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Shared mobility opporTunities And challenges foR European citieS

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The influence of socioeconomic factors in the diffusion of car sharing

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Acronyms

CS	Car Sharing	**MOP**	Das Deutsche Mobilitätspanel (Gemrna Mobility Panel)
EA	Environmental Awareness	**NTS**	National Travel Survey
ENA	Enquête Nationale sur l'Autopartage	**PBC**	Perceived Behaviour Control
ENTD	Enquête Nationale Transports et Déplacements	**PN**	Personal Norms
EU	Ease of Use	**PU**	Perceived Usefulness
FF	Free-floating	**RTSB**	Roundtrip Station-based
ICS	Iniziativa Car Sharing	**SN**	Subjective Norms
INSEE	Institut National de la Statistique et des Études Économiques	**SHS**	Scottish Household Survey
ISTAT	Istituto Nazionale di Statistica	**TAM**	Technology Acceptance Model
KiM	Kennisinstituut voor Mobiliteitsbeleid (Netherlands Institute for Transport Policy Analysis)	**TPB**	Theory of Planned Behaviour
LTDS	London Travel Demand Survey	**TRA**	Theory of Reasoned Action
MiD	Mobilität in Deutschland (Mobility in Germany)	**ZFER**	Zentrales Fahrerlaubnisregister (Central Register of Driving Licences)

SUMMARY

In order to put into relationship, the diffusion of car sharing practices and relevant individual sociodemographic and economic factors, the research started analysing the information in some of the national travel surveys administered throughout Europe. From this research, it emerged that in most of the cases information on the use of car sharing for daily mobility at a national level is of poor quality.

In particular, the characteristics of car sharing members such as gender, age, car ownership and travel behaviour have been compared with the characteristics of the population living in the same country or city, coming from the national (or city) travel survey.

Since there is an urgent demand to reduce the damaging impact of transportation on the environment (air pollution, noise pollution, reduced green areas, traffic accidents, etc.) in urban cities, we aim to answer the following question: What are the main behavioural, psychological and social factors influencing people's choice to use car sharing?

This main question can be operationalized in more specific sub questions: do users and non-users of car sharing differ, regarding transport choices? Are there differences among ages and genders for specific services and demands? What are the main motives for using car sharing for users and non-users? Are the social, behavioural and psychological aspects influencing people's intention to use car sharing? If so, to which extent does it occur?

In order to answer those questions, this report was structured in 5 main sections:

- Section 1: In this section multiple sources were exploited in order to give insights about the impact of car sharing on travel behaviours, among different kind of users and different countries/ cities.
- Section 2: Based on the model of Technology Acceptance Model (TAM) and the Theory of Planned Behaviour (TPB), the latent variables Attitudes, Perceived Behaviour Control (PBC), Perceived Usefulness (PU), Ease of Use (EU), Subjective Norms (SN), Trust, Personal Norms (PN) Environmental Awareness (EA) and Habit were tested in a linear regression model along with sociodemographic variables to predict behaviour intention to use car sharing. The data were collected by STARS partners along EU countries with users and non-users of car sharing.
- Section 3: In this case study, it is examined how car sharers in Flanders assess the services of different car sharing organisations. Focus was given on membership, car ownership, customer satisfaction, overall characteristics of the service, costs, flexibility and offer of cars with alternative fuels.

- Section 4: This second case study analysed and compared behavioural data from URBI during two months in Berlin, Milan, Turin and Madrid. Focus was given to patterns and hourly distribution of trips.
- Section 5: This case study analysed and compared behavioural data for users and non-users of car sharing in Germany. Focus was given to social demographic variables, the use of smartphones, attitudes towards different transport modes, incentives to use car sharing, support to implement car sharing, characterization of users of car sharing and relation to the characteristics of services.

1 Empirical evidence on car sharing use from existing travel surveys – EU countries

1.1 Introduction

In order to put into relationship the diffusion of car sharing practices and relevant individual sociodemographic and economic factors, the research started analysing the information contained in some of the national travel surveys administered throughout Europe. Unfortunately, from this research it emerged that in most of the cases information on the use of car sharing for daily mobility at a national level is of poor quality. This happens for many reasons, such as the fact that the most recent national travel survey in some countries was carried out before the wide diffusion of car sharing, or few car sharing members were identified in more recent surveys and consequently there is a lack of analysis. There is also a limited availability of publicly accessible raw data (only aggregate data analyses are shown in reports). This lack of car sharing information through national surveys is not only restricted to some country but it is observed in Europe as a whole.

On the contrary, some reports focusing on car sharing at national and city level are available for some European countries, together with a large number of specific studies on car sharing impacts. Although, given their specific focus, they tend to miss the overall picture of mobility behaviours of individuals. In the following, the attempt is to bridge such gap between travel survey lacking focus on car sharing and car sharing surveys missing the overall mobility picture. Such general overview based on the available data seemed a useful introduction to the study of the determinants of car sharing use and it is given in the first paragraph of this document.

1.2 Surveys included in overview

Since the lack of information about car sharing users in the main European national travel surveys, data related on car sharing members have been sought in national car sharing surveys (where available). However, also this kind of reports is not available in many countries. Therefore additional information on car sharing users is collected from studies that are accessible by the STARS partners, along with some city level's studies, in order to have an overview on a higher number of countries. Consequently, in this deliverable many sources are exploited in order to give insights about the impact of car sharing on travel behaviours, among different kind of users and different countries/ cities.

In particular, characteristics of car sharing members such as gender, age, car ownership and travel behaviour have been compared with characteristics of the population living in the same country or city, coming from the national (or city) travel survey.

The data are then presented in form of descriptive statistics, since raw data coming from the survey generally are not publicly and freely available (only reports were found).

The main data sources at the national level are reported in Table 1 below, while Table 2 lists the travel surveys at local level that were consulted. Detailed information about these surveys are reported in APPENDIX 3.

Country	Data sources	Sample size
United Kingdom	1. Carplus Annual Survey 2015/16 - England and Wales (Steer Davies Gleave, April 2016) 2. Carplus Annual Survey 2014/15 - England and Wales (only for Peer-to-peer car sharing data) (Steer Davies Gleave, April 2015) 3. Carplus Annual Survey 2016/17 – Scotland (Steer Davies Gleave, March 2017) 4. National Travel Survey 2016 (Department for Transport statistics, 2016) 5. SHS 2016 (Scottish Household Survey Project Team (Scottish Government), September 2017)	1. 2'583 roundtrip station-based members over 27'000 2. 84 peer-to-peer members of England, Scotland and Wales 3. 586 roundtrip station-based members over 11'500 4. 12'852 households 5. 10'500 households
France	1. Enquête Nationale sur l'Autopartage (ENA) 2016 (6t-bureau de recherche, Avril 2017) 2. Enquête Nationale Transports et Deplacements (ENTD) 2008	1. 2'420 car sharing members 2. 20'200 households
Germany	1. Ifmo 2016 – Car sharing 2025 – Niche or Mainstream? (Riegler, et al., September 2016) 2. Deutsches Mobilitätspanel (MOP) – Wissenschaftliche Begleitung und AuswertungenBericht 2016/2017: Alltagsmobilität und Fahrleistung (German mobility panel) (Karlsruhe Institute of Technology (KIT), 2018)	1. 8'638 car sharing users, 526 non-users from Berlin 2. 1'776 households, 3'643 individuals
Italy	1. ICS - Car Sharing – Conoscenza del servizio 2004 (Car Sharing – Service	1. 763 roundtrip station-based members over 2'003 interviewees

	knowledge) (Mastretta, et al., Giugno 2005) 2. ICS - Profilo dell'utenza beneficiaria degli incentivi alla rottamazione a supporto del Car Sharing (Profile of the user beneficiary of the scrappage incentives to support the Car Sharing) 2018 (Mastretta, et al., 2018) 3. ISFORT (Audimob) - La domanda di mobilità degli italiani 2015 (ISFORT, Fondazione BNC, 2015)	2. 2'809 roundtrip station-based members 3. 7'500 interviews
Netherlands	1. Car sharing in the Netherlands - Trends, user characteristics and mobility effects 2015 (partially based on TNS NIPO's data) (KiM | Netherlands Institute for Transport Policy Analysis, 2015) 2. Mobiliteitspanel Nederland 2013-2014 (Netherlands Mobility Panel)	1. 1'216 car sharing members (853 interviewed in TNS NIPO and 363 for this report) 2. 2'000 households

Table 1: Main national data sources used in the car sharing users' description

City	Data sources	Sample dimension
Berlin	1. Wirkung von E-Car Sharing Systemen auf Mobilität und Umwelt in urbanen Räumen (WiMobil) 2016 (BMUB, April 2016)	1. 4'182 FF members (On-Car Survey), 2'419 FF members + 315 RTSB members (Online Survey), 345 FF members + 58 RTSB members (Panel Survey)
London	1. Carplus Annual Survey 2016/17 – London (Steer Davies Gleave, April 2017) 2. London Travel Demand Survey 2015/2016 (Transport for London, 2016) 3. Travel in London 2016 (Transport for London, 2017)	1. 2'901 RTSB members and 1'122 free-floating members over 193'500 total members 2. 8'000 households 3. Report based on 8'000 households interviewed in the LTDS 2015/2016
Munich	1. Wirkung von E-Car Sharing Systemen auf Mobilität und Umwelt in urbanen Räumen (WiMobil) 2016 (BMUB, April 2016)	1. 4'182 FF members (On-Car Survey), 2'419 FF members + 315 RTSB members (Online Survey), 345 FF

	2. Evaluation Car-Sharing (EVA-CS) 2016 (team red, 2015)	members + 58 RTSB members (Panel Survey) 2. 1'655 car sharing users and 1'004 individuals
Turin	1. Travel survey (Demonstrate Project) 2016 – 2017 (Ceccato, et al., 2017) 2. Indagine sulla Mobilità delle Persone e sulla Qualità dei Trasporti (IMQ) 2013 (People Mobility and Transport Quality Survey) (Agenzia per la Mobilità Metropolitana e Regionale, 2015)	1. 138 car sharing members over 3'280 interviewees 2. 25'740 individuals

Table 2: Main local data sources used in the car sharing users' description

1.3 Results from previous studies

1.3.1 Car sharing variants

In identifying the various car sharing-variants, we follow the classification generated by the STARS project:

- **Free-floating car sharing with operational area:** The vehicles stand within a defined operational area distributed freely. Usually this area encompasses the extended center of a major city. Clients locate and book the vehicles with a smartphone. The vehicles have to be picked up at the location 15 to 20 minutes following the reservation, otherwise the booking becomes void. Long term reservations in advance are not possible. The end time of the booking need not be planned in advance. Within the business area clients can undertake one-way journeys.
- **Free-floating car sharing with stations:** The variant functions exactly like the free-floating car sharing with operational area. But the vehicles do not stand freely distributed in the street, but are parked by clients at special pool stations.
- **Roundtrip car sharing, station-based:** The vehicles stand in reserved parking spaces. There clients pick them up and return them after the drive. The vehicles are booked via smartphone, internet or telephone hotline. Start and finish of the booking period must be specified with the reservation. Reservations are also possible months in advance. Vehicles not pre-reserved can also be used immediately with a spontaneous reservation.
- **Roundtrip car sharing, home-zone-based:** This variant operates exactly like the stations-based roundtrip car sharing, however the vehicles are not made available in select parking

places. Instead, the vehicles stand anywhere within a narrow geographical area – usually a neighborhood or a parking space management zone. Since a vehicle is picked up there and needs also to be returned there, the usage patterns are quite similar to those of station-based roundtrip car sharing. However, providers of the home-zone model can decide whether they organize the bookings as with roundtrip car sharing or as with free-floating variants.

- **Combined car sharing:** With this option a car sharing enterprise offers clients roundtrip and free-floating vehicles from a single source. The possible uses are directed by the type of car clients book. The rates are usually adapted to those of roundtrip car sharing.
- **Peer-to-peer car sharing:** The vehicles are offered by private vehicle owners via an online platform made available by the service provider. Clients request a booking for a certain period and receive in turn from the vehicle owner a confirmation or refusal. Owing to the fact that the owner can also refuse any request for a vehicle, renting a really available vehicle is not always easy. The location of the vehicles is most commonly regulated according to the home zone model.

1.3.2 Car sharing user profiles

In this subhead the characteristics of the car sharing users in different countries and cities will be presented. Car sharing has been of particular interest to people being in life-stages characterized by strong flexibility and high incomes so far (Riegler, et al., September 2016). However, through the review of many studies reported below, it seems that the car sharing target group is becoming more heterogeneous, and car sharing itself is gaining in social acceptance. This will also lead to a growing interest in car sharing among persons who are more individualistic or property-oriented, as a useful extension of personal mobility. Clearly, this complementary way of considering car sharing has policy implications that could be very different from the original idea of car sharing as a way to decrease car use.

1.3.3 Characteristics of car sharing users based on country level data

Concerning car sharing user profiling, one of the countries where detailed information is available is the UK, where many different user profiles were shaped through a geodemographic profiling tool. The characteristics of car club members surveyed in the Carplus Annual Survey were in fact matched with the respondent postcodes using Mosaic1. Mosaic is a geodemographic profiling tool that classified residential postcodes into one of 66 profiles, based on demographics, attitudes and a wide range of other data from commercial and public statistics. Then percentages of car

[1] https://www.experian.co.uk/marketing-services/products/mosaic/mosaic-interactive-guide.html

sharing users falling in each profile are compared with those of the population living in the same area. A full breakdown of Mosaic profiles is reported in APPENDIX 4.

As reported in Carplus reports, in United Kingdom car sharing services are mainly based on roundtrip station-based scheme. A free-floating service, DriveNow, is only available in the inner London boroughs, while few accredited peer-to-peer schemes, mainly spread near London, were available in early 2016 (Steer Davies Gleave, April 2017).

Concerning the regional level, the highest percentage of England-Wales and Scotland roundtrip car sharing members belongs to a profile representative of youngsters, who are renting city centre flats in vibrant locations close to jobs and night life2 (11% and 23% respectively). Contrarily, only 1% of the population of England and Wales and the 3% of the Scotland population falls in this profile (called Central Pulse).

Other representative profiles of car sharing members are composed by:

- high status households owning elegant homes in accessible inner suburbs where they can enjoy city life in comfort (8% of members in England, Scotland and Wales);
- young professionals in their 20s and 30s renting expensive apartments in highly commutable areas of major cities (8% in England);
- older residents owning small inner suburban properties with good access to amenities (7% of members in England and 8% in Scotland).

Although Central Pulse profile is the largest group, it makes up only 11% of car sharing members in England. This means that car sharing market is enlarging its attractiveness moving beyond a typical demographic profile of initial adopters and this change, which is increasing year by year, is a sign of the maturing car sharing market (Steer Davies Gleave, April 2016).

Compared to the information found for the UK, a similar analysis is not available in other countries, where a synthetic description of a generic car sharing users profile is rather provided.

In 2016 car sharing users still represented a specific population in France, not only in relation to the French population as a whole, but also in relation to the population of the large cities where they mainly reside (6t-bureau de recherche, Avril 2017). Car sharing members in France remains a niche audience, with specific profile characteristics: on average 45 years old people, 70% living nearby a city centre (such as Strasbourg, Bordeaux, Paris, etc.), in households composed by a couple of adults with children. Members are generally well educated with high level working positions (senior

[2] According to the profile description reported in https://www.experian.co.uk/assets/marketing-services/brochures/mosaic_uk_brochure.pdf

management and higher intellectual professions) and a higher income compared to the average population (6t-bureau de recherche, Avril 2017).

In Italy the average station-based car sharing user's profile is constituted by men from the age of 36 to 55 mainly living single or in a two members' household (couple with no children) (Mastretta, et al., 2018). This represents a change from a previous research in 2005, where the typical profile was mainly constituted by younger men, from the age of 25 to 44 (Mastretta, et al., Giugno 2005), as a partial confirmation of the evidence from United Kingdom about car sharing market maturity. Furthermore, car sharing users are generally well instructed, most of them have a degree (47%) or at least a diploma (43%) and they are working as employee in a company. Over 90% of users live in an urban area and 20% in central areas with limited traffic zones or with parking restrictions; users are also characterized by the lack of available cars in the household: over one third of the interviewees declare to own no car, factor especially true for those living in a limited traffic area (45.9%) (Mastretta, et al., 2018).

In 2007, a user profiles characterisation based on a milieu affiliation (a social science concept) was carried out for German car sharing members (Loose, 2010). The milieu affiliation of surveyed car sharing members belonging to 10 German operators was established through a questionnaire with a set of 24 attitude items and a subsequent cluster analysis (Wuppertal Institute, 2007). The study's results showed that car sharing customers, who were surveyed in 2004, belonged predominantly to the upper milieus, while no car sharing participants came from the lower class milieus.

A more recent all-in-one study, which gives a German car sharing users' overview, is "Car sharing 2025 – Nische oder Mainstream?" (Riegler, et al., September 2016); the results showed in the report are based on surveys, administered to CS users and non-users, together with further information coming from other studies (BMUB, April 2016), (Loose, 2010). Two main synthetic profiles that differ according to the typology of car sharing service subscribed (roundtrip station-based or free-floating one) have been identified. Both profiles are mainly composed by young, well-educated men, living in urban areas with an above the average income (Riegler, et al., September 2016). Users belonging to the free-floating profile are younger: on average they have an age of 33 while station-based are 44 years old. Regarding education, 61% of the respondents belonging to the free-floating profile have a university degree, while station based users' fraction reaches 73%, well above the German average of 15% of adults (Federal Statistical Office, 2015). It is important to note that the higher proportion of graduates among station-based car sharing users is due to the widespread use of free-floating offers among students (Riegler, et al., September 2016).

Concerning the household composition, 33% of station-based users and 28% of the free-floating ones have underage children (over-representative of German households), which is partially in contrast with other studies (Schmöller, et al., 2015) where car sharing users live in two-member

households with no-children and double incomes. Station-based car sharing is used by a rather heterogeneous target group: families with older household members but also young two-person households both living in medium and large urban areas (Riegler, et al., September 2016).

In the Netherlands, the car sharing users' synthetic profile is again represented by young, well-educated urbanites (KiM | Netherlands Institute for Transport Policy Analysis, 2015). In particular, concerning the age, the 30–40 age group and to a slightly lesser extent the 40–50 age group make relatively high use of car sharing services. Nevertheless, the group from the age of 18 to 30 is also an important user group, which reflects the findings from other countries (see for example, United Kingdom's members). Moreover, considering the household composition, car sharing is particularly popular among young singles (18–40 age group) and two-person households (couples without children) in the 50–65 age group.

If a distinction is made by income and educational level, then the users of Dutch car sharing services are found mainly in the higher socio-economic classes. Not surprisingly, two-thirds of car sharers have at least a bachelor's or higher university degree. According to the classification commonly used in marketing studies in the Netherlands, in which population is divided into five segments, called "income groups" (Kotler, et al., 2013), most of the members fall in the A and Bb segment. The A segment is the wealthiest and includes directors of large companies, top civil servants and members of the liberal professions (about 10% of the population). The Bb segment is the upper middle class and includes directors of smaller companies, the upper segment of professional and tradespeople, higher level civil servants and senior managers (about 10% of the population). So car sharing users in the Netherlands seems to be represented have an above average to very high income.

Concerning the living area, car sharing members are overrepresented in the very high-density urban areas while they are underrepresented in rural areas. Indeed, more than 40% of car sharers come from high-density urban, whereas just 15% of the total population (over 18 and in possession of a driving licence) live in these areas (KiM | Netherlands Institute for Transport Policy Analysis, 2015).

1.3.4 Characteristics of car sharing users based on city level data

Regarding the city level, roundtrips as well as free-floating car sharing members of London were profiled according to Mosaic clusters. There are no significant differences between round trip members' profiles and free-floating's one: this could mean that different services are generally used for different purposes but by the same typology of users. In support of this argument, it is worth stressing that 35% of roundtrip members are also free-floating members.

More specifically, the highest percentage of car sharing member of both services falls in the "*Metro High-Flyers*" Mosaic's profile, which represents ambitious 20s and 30s renting expensive apartments in highly commutable areas in the inner boroughs of London (20% of roundtrip members and 23% of free-floating members).

Other representative profiles of car sharing members are composed by:

- high status households owning elegant homes in accessible inner suburbs where they can enjoy city life in comfort (14% of members of both services);
- multi-cultural households with children renting social flats in over-crowded conditions (9% of roundtrip members and 8% of free-floating members).
- self-starting young renters ready to move to follow worthwhile incomes in service sector (8% of roundtrip members and 10% of free-floating members).

According to the analysis reported in the "Carplus annual survey of car clubs – 2016/17 - London": "Car clubs are becoming more mainstream with a greater range of provision and a mix of operators appealing to a wide range of people ".

Once again a similar analysis is not available in other cities since a profiling tool is not available, but a synthetic description of the car sharing users profile is generally provided.

In the city of Turin (Italy), despite roundtrip station-based as well as free-floating car sharing services were available during the data collection process, no specific questions were asked about the service users were subscribed to. Thus, through the data is not possible identify relevant differences that might exist among different services' users. Nevertheless, two main car sharing user' profiles are detectable: one is represented by university students while the other one is composed by workers.

On one hand, student's profile group young men (74%), mainly from the age of 21 to 24 with a high education: 60% has a high school diploma and is getting a degree, while the 40% already has a degree and is still studying. They usually live in 4 members-households, where almost all have a driving licence but only 1 or 2 cars are available. The household income is generally lower than the average of the people living in the city. On the other hand, the workers' profile is mainly constituted by men from the age of 30 to 44 with higher educational level (the 54% has a degree). Most of them live in two-person household (couple without children), both holding a driving licence with a higher income than the average of the people living in the city.

Coming to Germany and using data coming from the "WiMobil" project (9/2012 – 10/2015), about a free-floating car sharing service (DriveNow) and roundtrip station-based (Flinkster), both operating in the city of Berlin and Munich, two synthetic car sharing user's profiles are identified (Giesel, et al., 2016). Summarising, regardless of the car sharing system and the city, the socio-

demographic profile of car sharing users consist to a large extent of young, highly educated men with high incomes in accordance with national profiles mentioned above.

Free-floating users are, on average, 36 years old men with a significantly higher proportion of students. Moreover, car sharing users are mostly highly educated and live in one or two-person households. The majority of customers are also employed full-time. Accordingly, the average net monthly equivalent income of over 2,500 € is also relatively high compared to the German's average income of 1,873 € (Giesel, et al., 2016). Concerning roundtrip station-based service, users are, on average, men with an age of 45, highly educated and live in one or two-person households. As in the case of free-floating users, the majority of customers are employed full-time, with a high average net monthly equivalent income. Between the cities Berlin und Munich there are only minor differences regarding socio-demographic characteristics. DriveNow customers in Munich have a significantly higher income than Berlin costumers (2,849 euros compared to 2,220 euros). This mainly reflects the higher income levels in Munich (Giesel, et al., 2016).

Most of car sharing users (about 60%) live in high density areas in the inner city. As the operating area of DriveNow and most of the Flinkster stations are located in the city centre, a residence outside the city is very rare. Regarding the number of cars in the households, there are relatively large differences between free-floating and station-based services: while 72% of the Flinkster customers live in a household without a private car, only 43% of the DriveNow respondents have no car in their household. It is worth stressing that there are not only differences between the car sharing providers but also between the cities in the case of DriveNow: 49% of users in Berlin and 39% in Munich have no car in the household. This is significantly lower. In line with the higher income level, more households in Munich are in possession of a car than in Berlin (Giesel, et al., 2016).

1.3.5 Gender and age comparisons of car sharing users versus driving license owners

Unlike the previous section, the current one focuses on how different social groups are differently affected by car sharing services; in particular, a gender and age comparison between car sharing users and driving licence owners belonging to the same area (country or city) is carried out.

In Figure 1, the gender profile of car sharing members compared with the national average in different EU countries is showed.

In general, we can observe that the highest percentage of driving licences is hold by men, except for the Netherlands where, contrary to the other countries, the women have the majority driving licences (51%). In terms of car sharing membership, according to the profiles presented in the paragraphs 1.3.3 and 1.3.4 above, Figure 1 shows us that men are more likely to join car sharing service than women.

It is worth stressing that the magnitude is different among countries: for example, in United Kingdom almost the 70% of car sharing members are men (Steer Davies Gleave, April 2016) (Steer Davies Gleave, March 2017) compared to the 54% of France (6t-bureau de recherche, Avril 2017) and Netherlands (KiM | Netherlands Institute for Transport Policy Analysis, 2015). In Germany, different services have different targets: many more male are free-floating users than station-based (Nehrke, 2018).

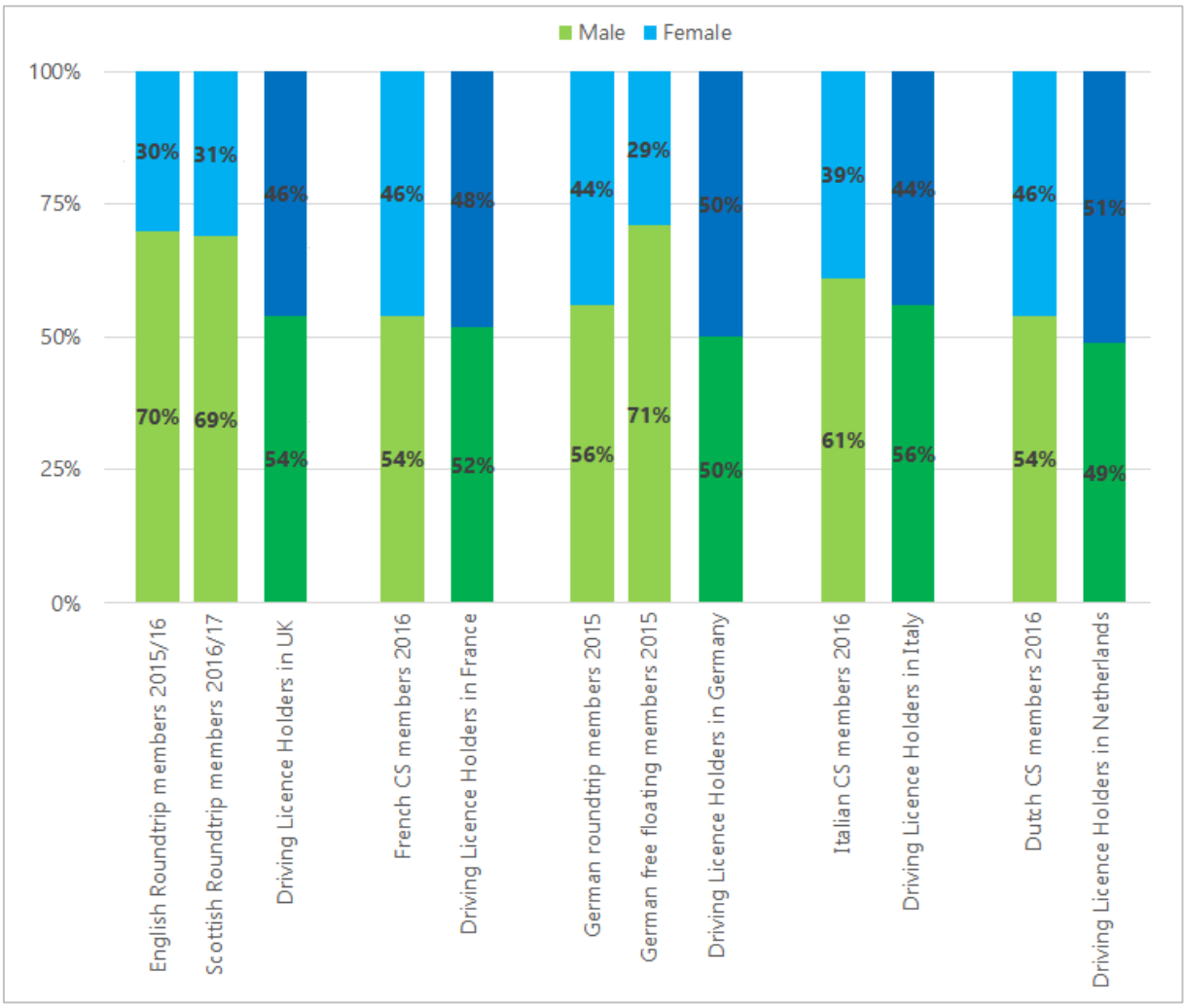

Figure 1: Gender profile of car sharing members compared with the national average in different EU countries (Source: own elaborations from data contained in Carplus Annual Survey 2015/16 – 2016/17, NTS 2016, ENA 2016, ENTD 2008, bcs 2018, ZFER 2018, ICS 2016, ISTAT 2010, KiM 2015)

Concerning the big city level, car sharing members' gender keep the same proportion of the national trend: in Turin most of driving licence is owned by men (52%) as well as the car sharing membership (54% of members are male). Like in the whole United Kingdom, in the city of London almost the 70% of car sharing members are men (Steer Davies Gleave, April 2017), even if different schemes are considered together. It seems there is no difference in gender profile between free-floating and station-based services.

Also in Berlin and Munich, men represent the 80% of car sharing members of a roundtrip station-based service (Flinkster) and the 74% of a free-floating service (DriveNow) (BMUB, April 2016). This is quite in contrast with the findings on national level in Germany. Two main explanations can be given: on one hand, consider only one operator such as Flinkster might be not reliable in describing station-based car sharing users, since its scheme is marketed very much to business people; on the other hand, it might be possible that in big cities station based services are more used by men but in medium and small cities, which are considered in the national statistic, this is less true.

Finally, age profile of car sharing members has been compared with the national average age profile of driving license owners in different European areas, just like it was done with the gender. In Table 3 data coming from different sources are summarised; a not uniform categorisation was done, so age brackets may differ among different countries.

Country		**Age profile**										
		18 to 20	**21 to 24**	**25 to 29**	**30 to 34**	**35 to 39**	**40 to 44**	**45 to 49**	**50 to 54**	**55 to 59**	**60 to 64**	**65+**
United Kingdom	Roundtrip station-based members in England and Wales 2015/16	0%	5%	18%	23%	31%		9%	6%	4%	4%	
	Roundtrip station-based members in Scotland 2016/17	3%	3%	9%	15%	28%		13%	10%	8%	11%	
	Driving Licence Holders in UK	3%	5%	7%	8%	20%		11%	10%	9%	27%	
France	French CS members 2016	10%			41%			34%			15%	
	Driving Licence Holders in France	7%		19%		20%		18%		8%	28%	
Germany	Roundtrip station-based members 2015	3%		24%		26%		28%		16%		4%
	Free-floating members 2015	13%		40%		25%		17%		5%		1%
	Driving Licence Holders in Germany	24%		64%				10%				3%
Italy	CS members 2016	1%		16%		33%		26%		15%		9%
	Driving Licence Holders in Italy 2017	8%		15%		19%		39%				19%

Country		Age profile										
		18 to 20	21 to 24	25 to 29	30 to 34	35 to 39	40 to 44	45 to 49	50 to 54	55 to 59	60 to 64	65+
Netherlands	CS members 2016	17%			28%		23%		18%		15%	
	Driving Licence Holders in Netherlands	14%			13%		18%		22%		34%	

Table 3: Age profile of car sharing members compared with the national average in different European countries (Source: own elaborations from data contained in Carplus Annual Survey 2015/16 - 2016/17, NTS 2016, ENA 2016, ENTD 2008, ifmo 2016, ZFER 2018, ICS 2016, ISTAT 2010, KiM 2015)

It is interesting to note that car sharing users of different countries are mostly in the age of 35 to 44, where no service distinction is considered. When is possible to split the user age's distribution in terms of service typology, as for the German case, it is clear that round trip station-based services have older customers, most of them from 45 and 54 years old. Moreover, the percentage of round trip CS members seems more uniformly distributed among different age.

In addition, one may consider that car sharing services affect younger population compared the age of the driving licence holders in different countries (excluding the German case). The same results emerge considering the car sharing users in big cities such as Berlin, London, Munich and Turin (the corresponding table is reported in Appendix 3).

1.3.6 Travel purposes related to car sharing

In this paragraph, car sharing trip purposes are analysed. A representation of car sharing trip purposes in different EU countries is reported the following figures. It is important to note that respondents could choose more than one trip purpose, therefore the sum of the percentages often overcome 100%. It is worth stressing that it is difficult to compare results coming from various sources, since the definition of each travel purpose might be different across surveys. Moreover, there is not a common and consolidated list of purposes, which slightly differs from country to country (see Table 113 in Appendix 3).

However, observing from Figure 2 to Figure 7 we can state that overall car sharing services are not generally used for commuting. Car sharing is used mostly often for recreational trips (leisure and shopping), regardless of the country and of the system. For example in Italy (Figure 4) leisure and shopping together account for 58% of uses (Mastretta, et al., 2018). In United Kingdom (Figure 7), personal business, visiting friends and leisure together reach the 71% of the car sharing purposes (30%, 21% and 20% respectively) (Steer Davies Gleave, April 2016). In France and in the Netherlands the situation is similar except for personal business purposes, which is substituted with the visiting friends and family.

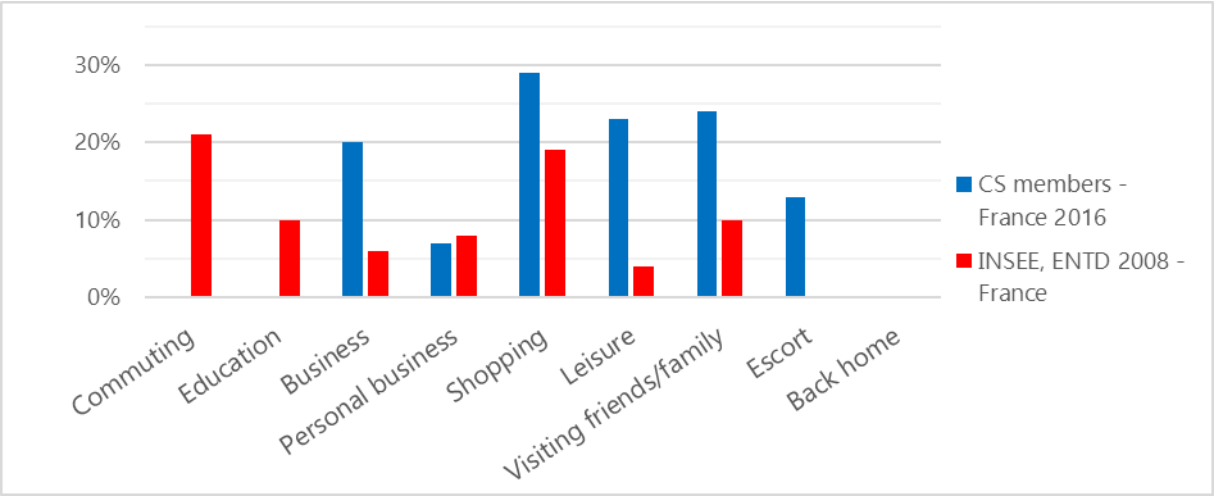

Figure 2: Car sharing trip purposes (blue bars) compared with all mode trip purposes (red bars) in France (Source: own elaborations from data contained in ENA 2016, INSEE, ENTD 2008)

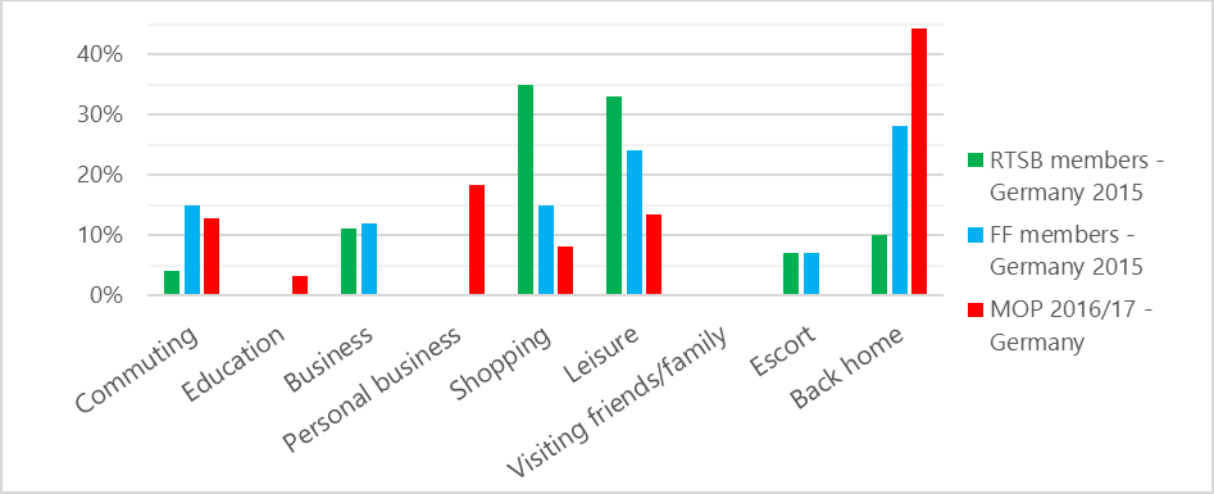

Figure 3: Car sharing trip purposes compared with all mode trip purposes (red bars) in Germany (Source: own elaborations from data contained in ifmo 2016, MOP 2016/17)

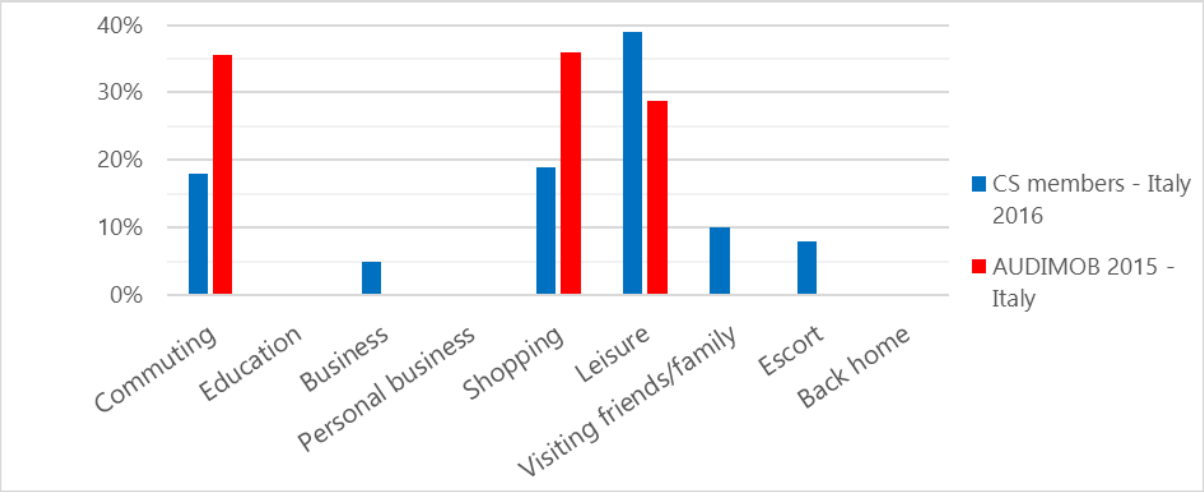

Figure 4: Car sharing trip purposes (blue bars) compared with all mode trip purposes (red bars) in Italy (Source: own elaborations from data contained in ICS 2016, ISFORT 2015)

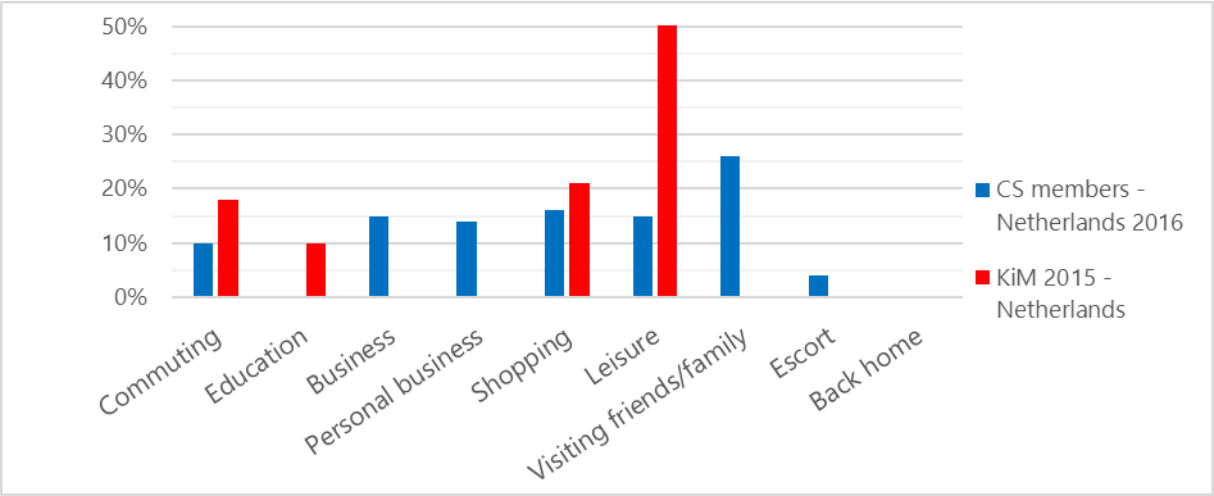

Figure 5: Car sharing trip purposes (blue bars) compared with all mode trip purposes (red bars) in the Netherlands (Source: own elaborations from data contained in KiM 2015)

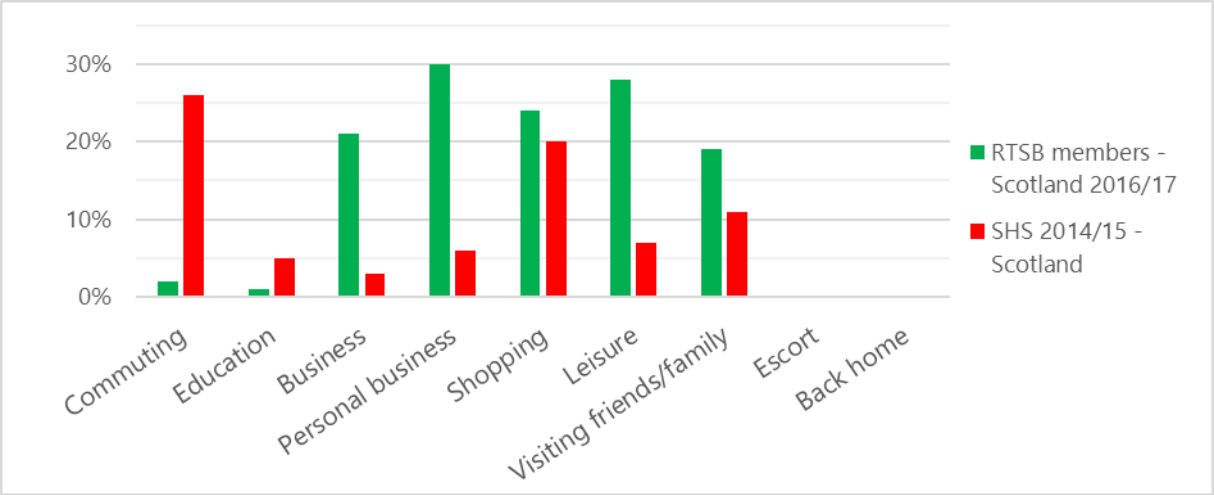

Figure 6: RTSB CS trip purposes (green bars) compared with all mode trip purposes (red bars) in Scotland (Source: own elaborations from data contained in Carplus Annual Survey 2016/17, SHS 2017)

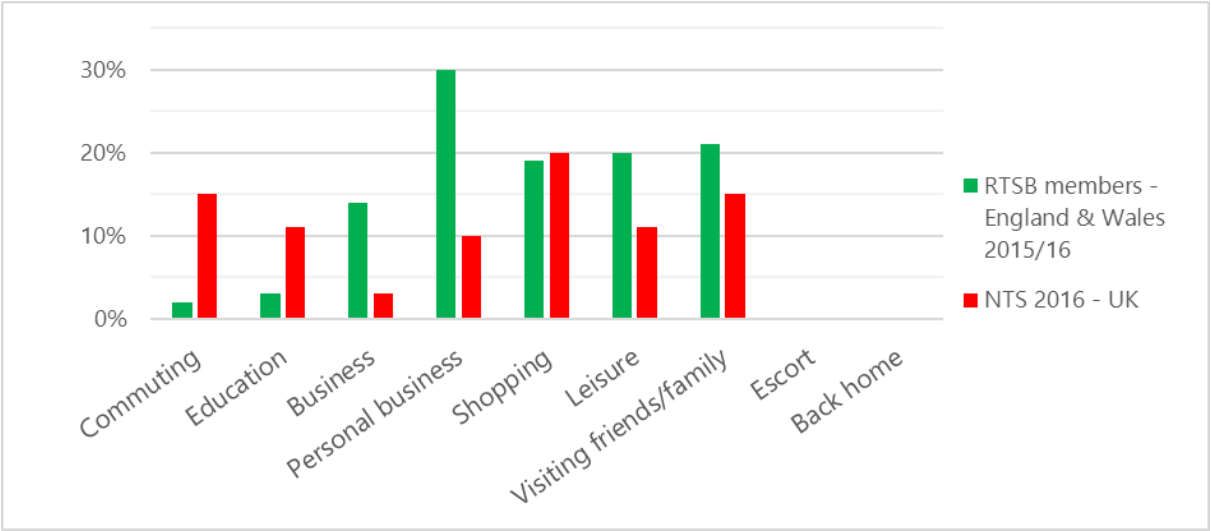

Figure 7: RTSB CS trip purposes (green bars) compared with all mode trip purposes (red bars) in England (excluding London) and Wales (Source: own elaborations from data contained in Carplus Annual Survey 2015/16, NTS 2016)

Compared to journey purposes reported in the main national travel surveys, clearly fewer car sharing trips are made for commuting and education purposes. Indeed, especially for roundtrip services it is not cost-effective: members pay by the hour and would therefore be paying for the whole period of hire including the time spent at work/education when the car is not in use (Steer Davies Gleave, April 2016). In accordance with this, the presence of commuting trips among German free-floating users could be explained (15% of the respondents use a free-floating service for commuting reasons as showed in in Figure 3). In fact, this typology of car sharing allows one-way trips, where the rent can be terminated nearby the working place and so, without keep paying during the working time. Probably this is also behind the presence in Italy (Figure 4) of 18% of commuting trips done by car sharing, since 80% of the market belongs to free-floating operators (Burlando, 2015).

Germany is the only country where station-based and free-floating services are analysed separately, concerning the trip purpose. The car sharing use "going back home" is available only in the trip purposes list of German studies (Riegler, et al., September 2016) (Karlsruhe Institute of Technology (KIT), 2018). The main limitation is that there is not a unique activity where CS users come back from: it could occur after a working day as well as a leisure activity or shopping. However, it is noticeable a big difference when driving back home concerning the operational characteristics of the two systems: by definition, in a round trip service a single trip from/to home is not possible; it occurs just in case the user's house is close to a car sharing station. This might be the reason why less than 10% of the respondents use round trip station-based car sharing for driving home, while almost 30% of the free-floating users has indicated this as a way-out.

The observed purposes for using car sharing in big cities, such as Berlin, Munich and London (reported in Figure 8 and Figure 9) confirm the previous assumptions. The focus at city level shows how different typology of services are used in different cities: it is worth stressing that for German cities only two operators, namely DriveNow (free-floating operator) and Flinkster (roundtrip station-based) are considered, which might have specific users target, so what is showed in the picture could be not completely representative.

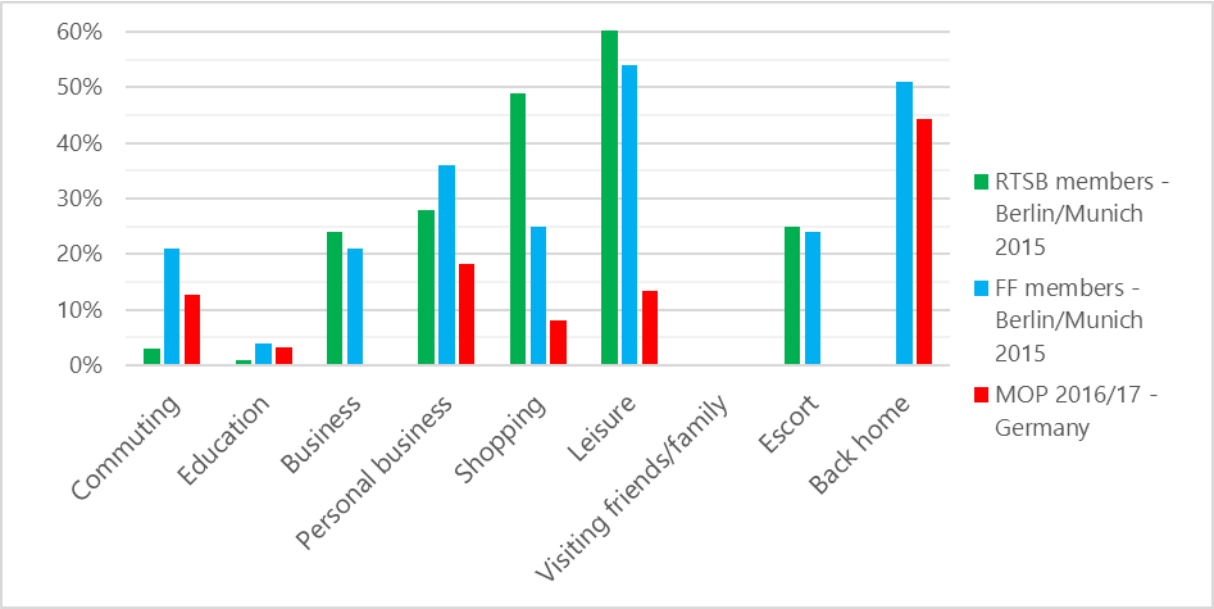

Figure 8: Car sharing trip purposes (light blue bars for FF and green bars for RTSB) compared with all mode trip purposes (red bars) Berlin and Munich (Source: own elaborations from data contained in WiMobil 2015, MOP 2016/17)

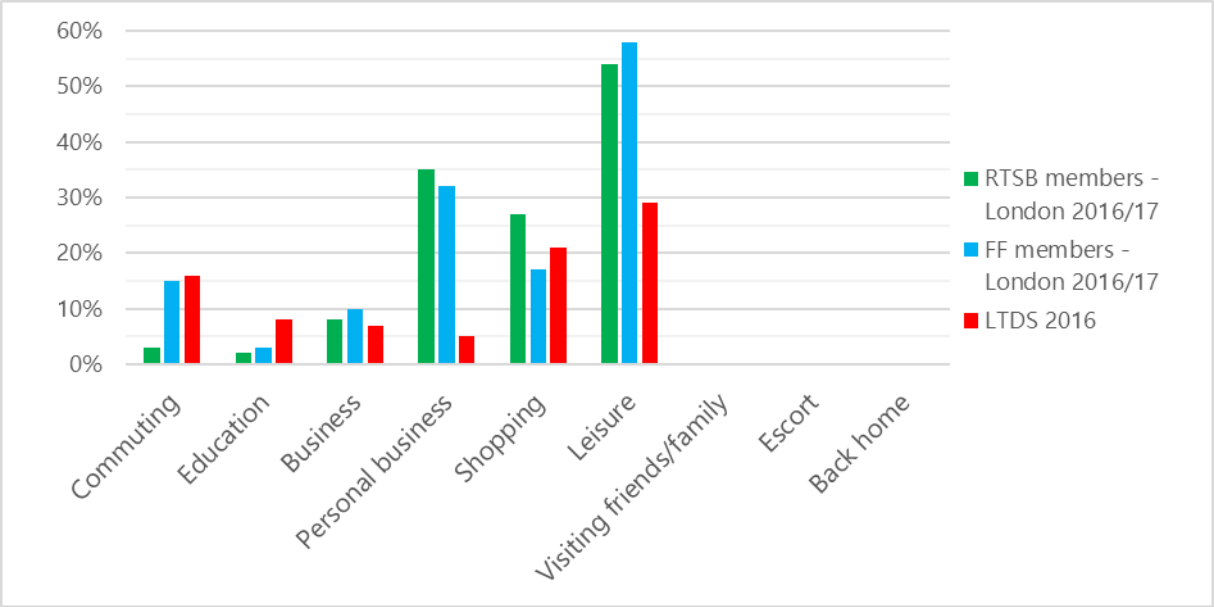

Figure 9: Car sharing trip purposes (light blue bars for FF and green bars for RTSB) compared with all mode trip purposes (red bars) in London (Source: own elaborations from data contained in Carplus Annual Survey 2016/17, LTDS 2016)

However, it is remarkable that car sharing use going back home is the second main motivation after the usage in leisure activity in the cities of Berlin and Munich. On the contrary, in London leisure activities are the main reason for using car sharing. Concerning shopping activities, in Figure 9 station-based services seem more suitable option to perform this kind of trips; a recent study in the city of Bremen confirm this evidence (Schreier, et al., 2018).

1.3.7 The use of different travel means by car sharing members

Here the mobility behaviour of car sharing users in comparison with the one of the overall population living in the same area is analysed. More specifically, the comparison will consider the frequency of usage of various mode of transport (Public transport, private car, bike and so on).

Similarly to the previous analyses, the data collected is not always available in the same scale/range, so it has been chosen the best way to represent it. Concerning the frequency of usage of travel modes, different frequency ranges are available: the most common frequency found is "at least once a week" that is therefore used to build Figure 10 and Figure 11.

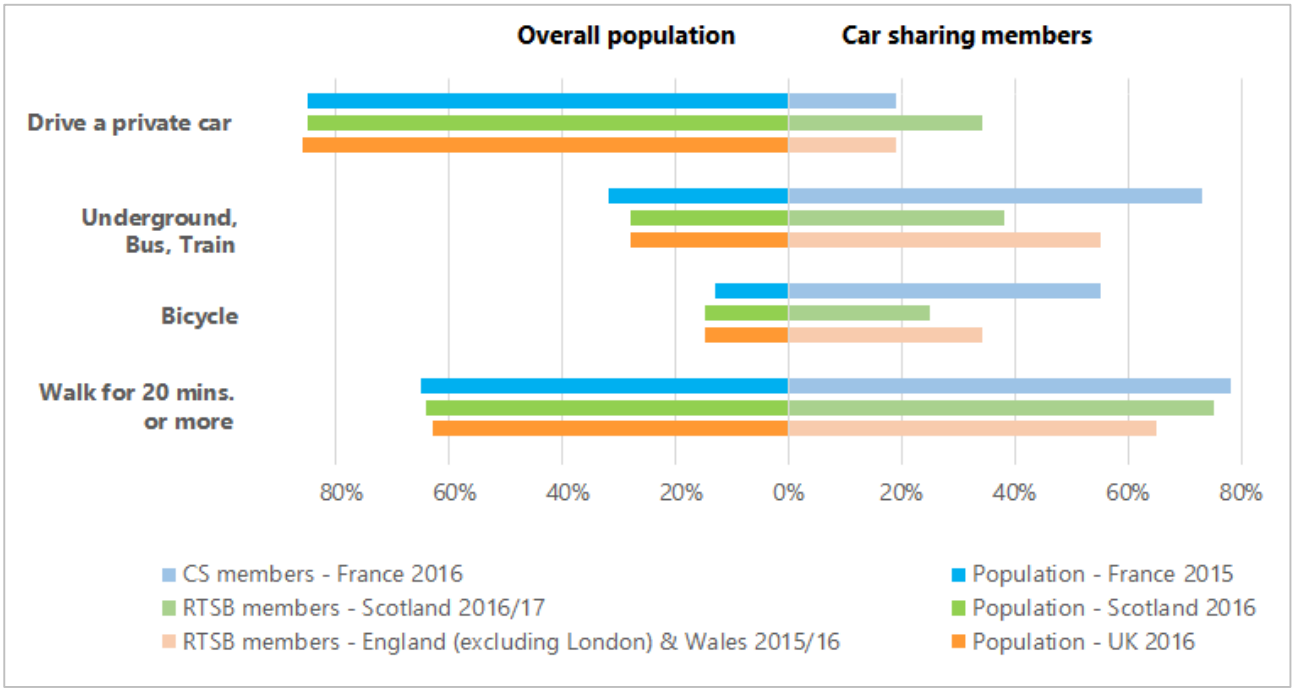

Figure 10: Percentage of car sharing members using transport modes at least once a week compared with the national average in different EU countries (Source: own elaborations from data contained in Carplus Annual Survey 2015/16 – 2016/17, NTS 2016, SHS 2017, ENA 2016, INSEE, Statista 2015[3] [4])

Despite the frequency of usage of various transport modes is similar between the overall population of France, England and Scotland, the situation is quite different for car sharing users as reported in Figure 10. In fact, on one hand we can observe similar usage percentages for all modes among the overall population while, on the other hand, the percentages for car sharing uses are more variable from country to country. Regardless the country where car sharing is operating in, we can state that car sharing members are more multimodal, they use more frequently public transport (bcs, 2017), (Nehrke, 2018) and soft modes compared to the non-users (Schreier, et al., 2018). This is

[3] https://www.statista.com/statistics/465723/share-of-people-using-buses-in-france-by-frequency/
[4] https://www.statista.com/statistics/465695/number-of-people-using-the-train-in-france-by-frequency-of-use/

also confirmed by the higher percentage of public transport seasonal ticket hold by car sharing users (bcs, 2017), (Schreier, et al., 2018).

It is noticeable the case of Scotland, where car sharing members use more private cars and less public transport and bike compared to English and French members: this could be due to a different quality and capillarity of the public transport as well as of cycle paths network. This assumption cannot find clear evidence through the data collected here.

The same kind of information was collected at city level, where also the distinction among different service typologies occurs, and it is reported Figure 11 below.

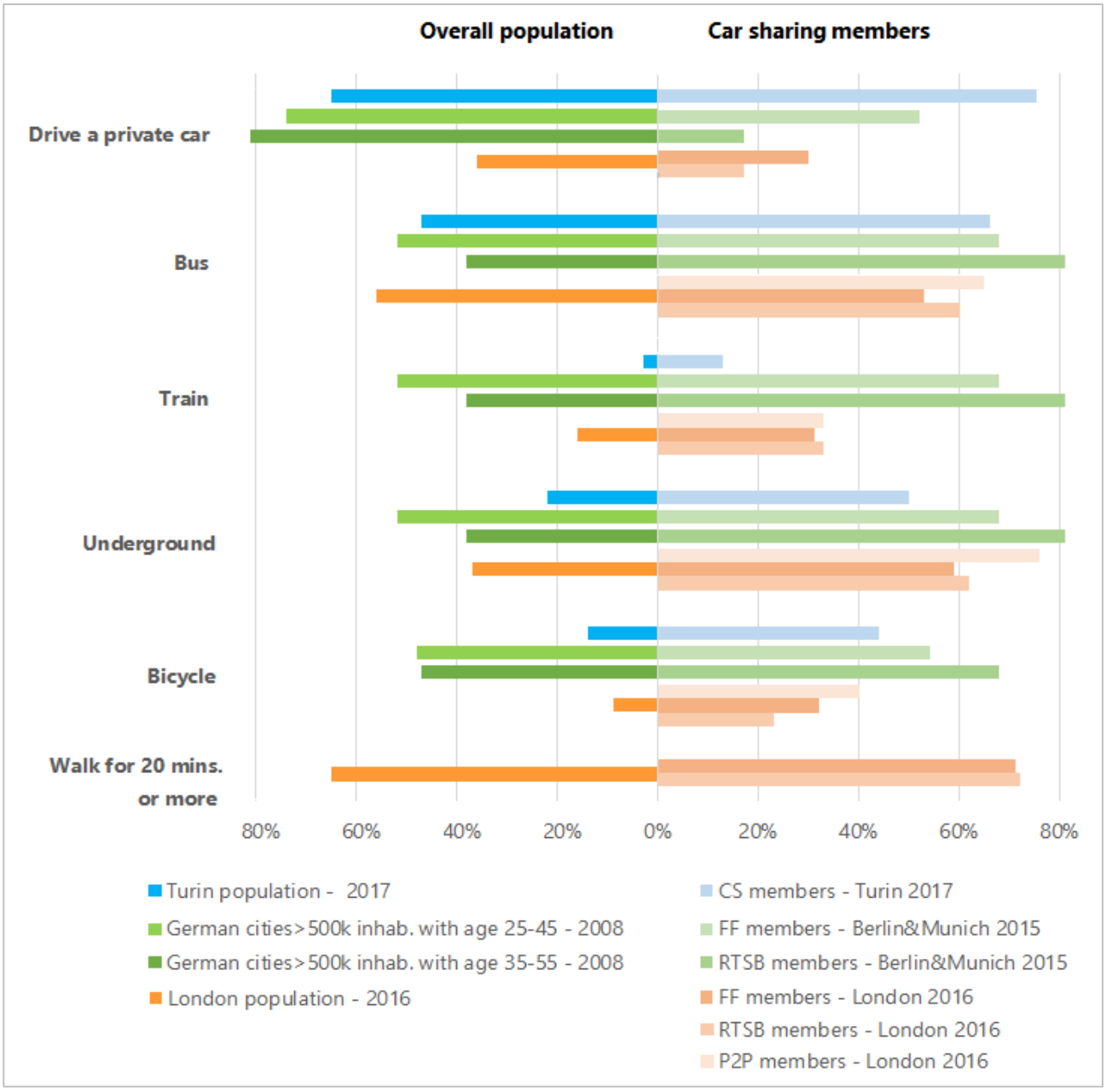

Figure 11: Percentage of car sharing members using modes at least once a week compared with the average in different EU cities (Source: own elaborations from data contained in Carplus Annual Survey 2016/17, LTDS 2016, WiMobil 2015, MiD 2008, DEMONSTRATE 2017)

It is important to note that German data, both for users and non-users, do not consider each public transport system individually, but underground, bus and train are aggregated under the hat "public transport". Thus, in order to keep comparable information for London and Turin, the percentages are equally reported three times. Moreover, contrary to what has been done so far, where the latest information is considered, here the data of the population comes from the study "Mobility in Germany 2008" (MiD) (Infas GmbH & DLR, 2010). As motivated in the WiMobil project report (BMUB, April 2016), both DriveNow and Flinkster core groups were determined[5] and compared to the corresponding group in the MiD (all men with driver's license in the appropriate age group, living in all cities with more than 500'000 inhabitants).

The results reported in Figure 11 are generally in line with those found at country level: **car sharing members make more use of sustainable modes of transport and less use of private cars than the average population living in the city**. The only exception comes from the Turin study, where the 75% of car sharing members use a car at least once a week compared to the 66% of the Turin population. This is probably due to the fact that a larger proportion of car sharing subscribers in Italy is not active, given the fact that subscriptions are (almost) free, as noted in *Deliverable 2.2 - Key technology and social innovation drivers for car sharing* (STARS, 2018).

Considering the mobility behaviour of members belonging to different service typologies, free-floating members in Berlin, Munich and London use more the private car and less public transport compared to the roundtrip station-based users. On the contrary, Londoner free-floating members use more frequently the bike: this could be due to the fact that the free-floating service is available in the inner London boroughs, where people are closer to all amenities and so more willing to use a bike. Peer to peer members, mainly surveyed in London, seems to be even more sustainable than the others, with the highest percentages of use of public transport and bicycle.

As a result of this comparison on frequency of usage of different transport modes and in line with many other studies in literature (Nobis, 2006), (Martin, et al., 2011), (Becker, et al., 2017), car sharing members use sustainable transport more often and use cars less often than the average city/country population.

1.3.8 Car ownership levels among car sharing members

Concerning car ownership, there are differences between free-floating car sharing members and roundtrip station-based ones, but both rates are much lower compared to the averages of the respective cities, as shown in Figure 12 below.

[5] For DriveNow, men in the 25- to 45-year-old age while for Flinkster men with an age from 35 to 55.

A lower number of owned cars is noticeable among members of roundtrip car sharing compared to the free-floating ones: in London, 77% of RTSB members has no car in the household and only 18% has got one, while percentages for free-floating members are 61 and 30 respectively. Similar results are found in Berlin and Munich. Regarding peer-to-peer members, they belong to household with the lowest number of cars owned.

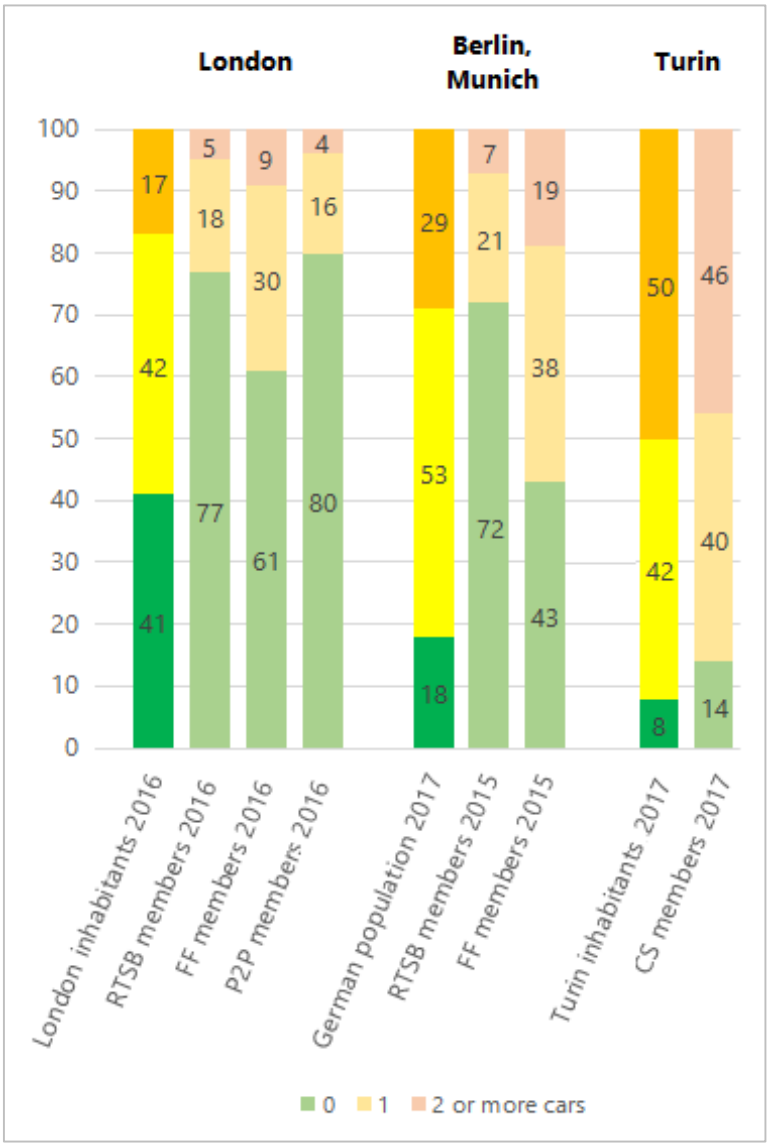

Figure 12: Car ownership percentages after joining car sharing services in different EU cities (Source: own elaborations from data contained in Carplus Annual Survey 2016/17, LTDS 2016, WiMobil 2015, Statista 2017[6], DEMONSTRATE 2017)

Comparable results are obtained at national level, especially in France where 77% of car sharing members does not have a car in the household compared to the 19% on national average (Figure 58 reported in Appendix 5).

[6] https://de.statista.com/statistik/daten/studie/172093/umfrage/anzahl-der-pkw-im-haushalt/

It is worth stressing that car sharing members usually belong to households with a lower number of cars owned compared to the average population, even before joining the service. Figure 13 reports the comparison of car ownership in the household before and after the service joining. This partially excludes the hypothesis of membership of users who need to replace the lack of car with a cheaper solution.

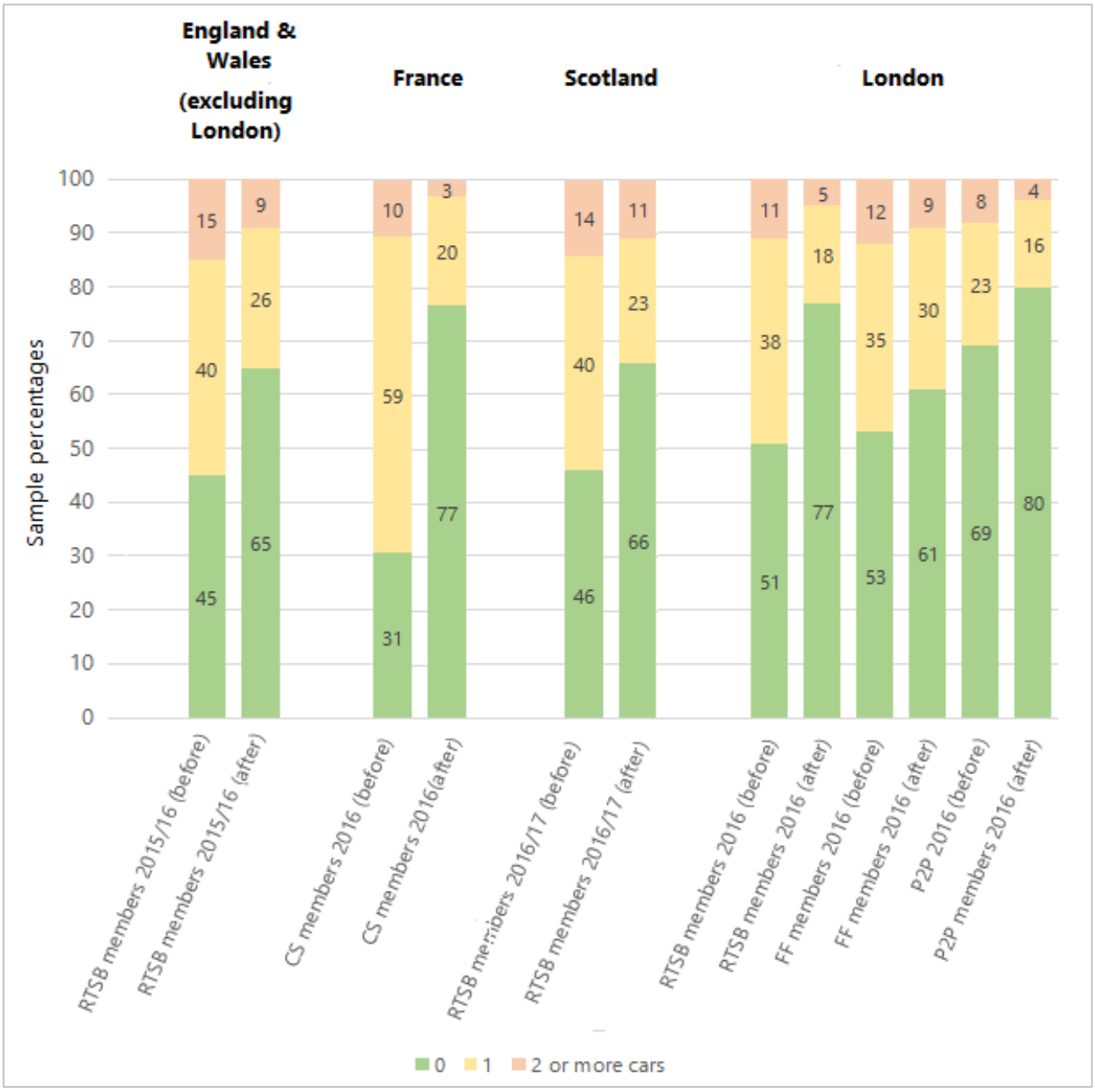

Figure 13: Car ownership percentages before and after joining car sharing services in different EU areas (Source: own elaborations from data contained in Carplus Annual Survey 2015/16 - 2016/17, NTS 2016, LTDS 2016, ENA 2016, INSEE 2014, SHS 2017)

More in general, it is important to note that the causal relationship between car sharing and environmentally sustainable travel behaviours concerning both the levels of use of different travel means and car ownership levels is not established in the scientific literature. Correlation measures

such as those presented in the latest two paragraphs might in fact be well due to a sample self-selection bias. This is in general not really acknowledged by many stakeholders in the car sharing sector and decision makers. Very preliminary scientific evidence (Mishra, et al., 2017) shows that indeed many of the observed benefits of car sharing on individual mobility behaviours could be due to self-selection and simultaneity biases.

2 Behavioural determinants of car sharing usage – EU countries

Car sharing has the potential to contribute to be a truly disruptive shared mobility, going beyond the boundaries of services niches (Sprei, 2017). Its impact goes from changes on transport systems as well as on people's transport behaviour. However, even with the increase of the car sharing fleet in some urban areas, car sharing operators are still facing challenges in terms of regulation and profitability. Despite the fixed costs of the service, the misunderstanding of consumer's behaviour has compromised the estimation of revenues (de Luca & Di Pace, 2015).

Therefore, there is a demand for empirical investigation of sociodemographic and behavioural variables to predict individual choices regarding car sharing use (Prieto, Baltas, & Stan, 2017) (Schaefers, 2013). Despite the motives of value-seeking and convenience, we need to consider the psychological process involved in the transport decision making. Moreover, environmental concerns and social influence should be explored to understand the extent in which they influence consumer's acceptance and usage of car sharing.

Transport behaviour choices are done within physical and social contexts, therefore, not surprisingly, it's affected by the same. To some extent, the decision goes beyond merely going from A to B, it also takes in account symbolic, instrumental and affective aspects (Bergstad et al., 2011; Steg, 2005). For instance, driving a private car that is a latest model or that is an electric car may signal different subjective desirable aspects.

Conscious reasoning that thrives to maximize instrumental and symbolic goals are done under the most relevant and sporadic decisions (e.g. buying or not a car, subscribing or not for a car sharing service, to live close or further to the workplace). The continuous decisions under a routine context will be less cognitively careful, and trips may be triggered by specific situational needs without careful planning (Jakobsson, 2004).

In line with the description presented in the next subsection, people follow a set of personal norms to guide their behaviour. However, what people believe does not always match what they do and, people are not always aware of the main drivers behind their actions (Gatersleben, B. in Gärling, Ettema, & Friman, 2014). One may have positive attitudes towards car sharing but he/she may still drive a private car. It is necessary to have a more global perspective of transport mode choices, consider the interconnection of sociodemographic aspects, such as age and gender, as well as, the behavioural and psychological aspects.

In the context of an urgent demand to reduce pollution in urban cities and to reduce the damaging impact of transportation on the environment (air pollution, noise pollution, reduced green

areas, road traffic incidents, etc.), we aim to answer the following question: **What are the main behavioural, psychological and social factors influencing people's choice to use car sharing?**

This main question can be operationalized in more specific sub questions: Do users and non-users of car sharing differ, regarding transport choices? Are there differences among ages and gender for specific services and demands? What are the main motives for using car sharing for users and non-users? Do social, behavioural and psychological aspects influence people's intention to use car sharing? If so, to which extent does it occur?

2.1 Theoretical model

In order to answer to the previous mentioned research questions, this research follows the rationale proposed by the Technology Acceptance Model (TAM), which has foundations on the psychological Theory of Reasoned Action (TRA) (Ajzen, 2012). Adaptations of TAM to investigate acceptance of vehicle automation and similar technologies have shown it to be a satisfactory framework across times and settings, indicating strong validity (Madigan, Louw, Wilbrink, Schieben, & Merat, 2017; Yousafzai, Foxall, & Pallister, 2007a, 2007b).

The following is a discussion of the main concepts involved in these models and how they relate to each other and to transport mode choices.

★ Attitudes

Individuals may form attitudes directly or indirectly to a given object (these can be abstract or concrete like a service, a travel mode or a vehicle). This process is automatic and inevitable, as we interact with an object, we evaluate its attribute and a link between attribute and object is formed (Ajzen, 2012). The attitudes towards car sharing may be formed based on cognitive and emotional evaluations of the service, its attributes and benefits, with no need to be a current user.

★ Perceived Behaviour Control (PBC)

Perceived behaviour control is a subjective valuation of the control and easiness to perform a certain behaviour (Ajzen, 1991). Moreover, in the theory of planed behaviour, this variable contributes to explain behaviour intention when some behaviours have limited volitional control (Bamberg, Ajzen, & Schmidt, 2003). For instance, one may want to use car sharing, however, he/she lives out of the car sharing operational areas.

★ Perceived Usefulness (PU) and Ease of Use (EU)

Perceived usefulness in the car sharing context is the degree to which a person believes that using car sharing would enhance his or her routine or accomplish with his or her activities. Ease of use is the perception that a person has of the degree of ease to use car sharing services and the process that it involves (eg.: booking a car online)(Venkatesh, Morris, Davis, & Davis, 2017).

★ Subjective Norms (SN)

Subjective norm is a belief that one has when evaluating what his/her peers (family, friends, parents, etc.) think about some behaviour. These perceptions may be of approval or disapproval and may have more or less impact on one's decisions (Ajzen, 1991).

★ Trust

Trust in the context of car sharing services is treated as the perception of risk and on how much one can rely on the trusting party. In this sense, it can be related to the concept of Perceived behaviour control on the theory of planned behaviour (Yousafzai, Pallister, & Foxall, 2009) and to the concepts of perceived usefulness and ease of use in TAM (Wu & Chen, 2005). The users expect that the operators will provide reliable services and that they will have access to the service under the terms previously stipulated.

★ Personal Norms and Environmental Awareness (PN) and (EA)

Personal norms form a system of moral obligation that guide behaviour and are activated by subjective norms and environmental awareness. Environmental awareness includes awareness of the need to protect the environment and to reduce destructive human impacts and, awareness of the consequences of human actions that are threatening the natural environment. The effects of personal norms on sustainable behaviour is expected to be mediated by behavioural intentions (Klöckner & Friedrichsmeier, 2011).

★ Habit

As habits become stronger by the repetition of the behaviour under similar circumstances, intentions will be less predictive of the behaviour. Individuals with strong habits tend to consider fewer alternative transport options. Following this rationale, habit becomes a strong predictor of transport mode choice if the circumstances are stable (Bamberg et al., 2003; Verplanken, Aarts, & Knippenberg, 1997).

Construct	Definition
Attitudes	Overall evaluation of a target object (service, object, behaviour, opinion).
Perceived Behaviour Control (PBC)	Subjective valuation of the control and ease to performing a certain behaviour.
Perceived usefulness (PU)	The degree to which using car sharing will provide benefits in the travel activities.
Ease of use (EU)	The perceived ease of using car sharing.
Subjective Norms (SN)	Belief of social approval or disapproval of some behaviour by their peers (family, friends, parents, etc.).
Trust	Perception of low risk and high trustworthiness.

Construct	Definition
Environmental awareness (EA)	Environmental concern or attitude towards it.
Personal norms (PN)	A moral obligation guiding the behaviour.
Habits	A script-based choice guiding decision making when the circumstances are constant.

Table 4: Main behavioural and psychological concepts definitions.

The research hypothesis is embedded in the following model (Figure 14). Attitudes, Perceived Behaviour Control, Social Norms, Personal Norms and Habits will have direct effects on Behaviour Intention. Habits will be predicted by SN and PN, while PN will be predicted by EA. PU, EU and Trust will predict Attitude, while Trust will also predict PBC and SN. These effects are expected to have a positive direction (positive attitudes towards car sharing will effect positively behaviour intention to use it), except for environmental awareness and personal norms.

Environmental awareness and personal norms measures have the environment as their object, while the other variables have car sharing services as then object of valuation. Therefore, the direction of the effects depends on how the participants see car sharing services in relation to the environment. If they believe that car sharing is some kind of threat to the environment (eg. because of the demand for parking areas), it is expected that EA and PN will have negative effect on BI. If they believe that car sharing may be a positive service for the environment (eg. because it may reduce private car use) it is expected that EA and PN will have a positive effect on BI.

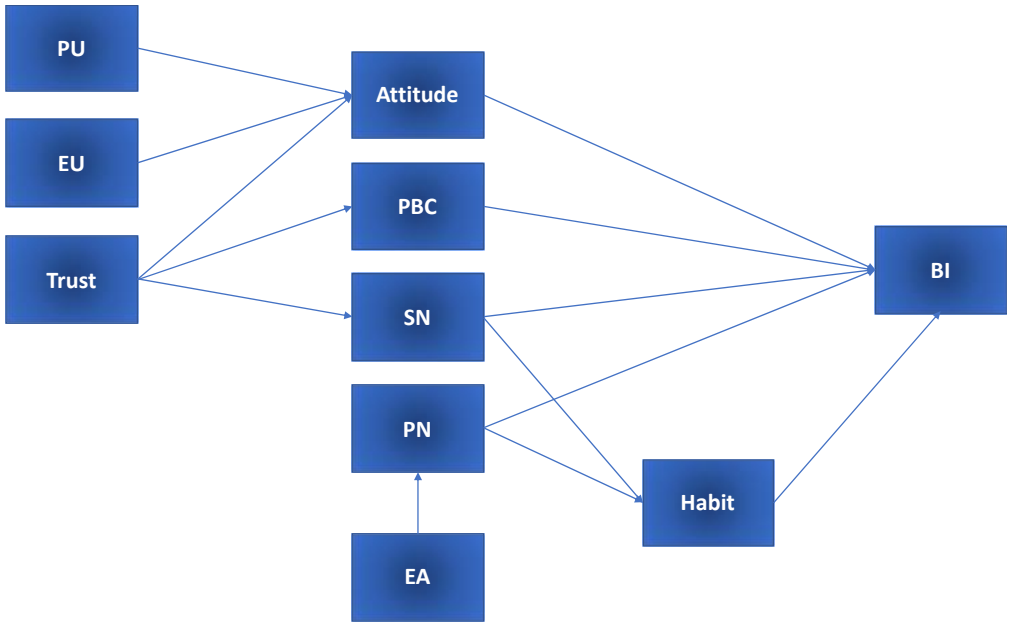

Figure 14: Theoretical model to predict behaviour intention to use car sharing.

2.2 Method

2.2.1 Model to predict travel behaviour change – EU level

This section describes the empirical model covering sociodemographic variables and behavioural determinants such as norms, values, car use habits, attitudes and behaviour intentions.

2.2.2 Overview

Data were collected by an online survey with car sharing users and non-users of European cities. The aim was to measure the latent variables described in the model (Figure 14) as age, gender, levels of education and income. In order to asses these latent variables, a set of questions were made to the respondents and indexes were estimated by statistical analysis. The validity of those variables was estimated conjunctly with the statistics procedures. The population targets were users and non-users of car sharing services in European cities where car sharing services are available.

2.2.3 Sample

The sample consisted of 6822 respondents living in European cities in Belgium, France, Germany, Italy, Spain and Sweden (Table 5). These countries were selected from previous tasks of the project in order to target cities for the future case studies (STARS Deliverable 2.1). It was also possible to reach respondents from non-target countries (Croatia, Greece, Hungary, Netherlands, Portugal, Slovenia and UK) but they were a small group (n=17). Therefore, these respondents will be included in the analysis but they will not be presented in separated descriptive analyses, mainly to guarantee privacy protection for the respondents.

Samples nationalities					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Belgium	73	1.1	1.1	1.1
	France	28	.4	.4	1.5
	Germany	86	1.3	1.3	2.7
	Italy	3696	54.2	54.2	56.9
	Spain	14	.2	.2	57.1
	Sweden	2889	42.3	42.3	99.5
	Other country	36	.5	.5	100.0
	Total	6822	100.0	100.0	

Table 5: Samples nationalities.

The respondents (55.7% men) were users (n = 2594) and non-users (n = 3695) of car sharing services. The mean age was between 40 and 49 years old, with 50% of the respondents having up to

2500 euros as monthly income and 69% of the respondents had university degree. Samples' descriptive analyses are given on the Figure 15 and Figure 16.

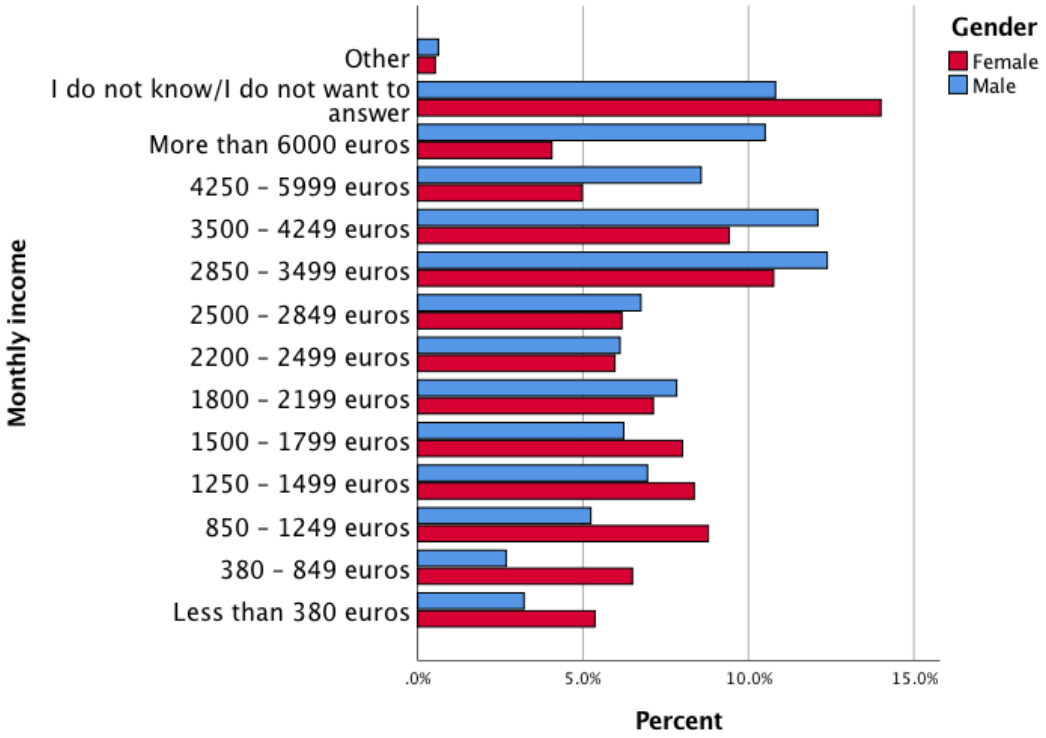

Figure 15: Monthly income before taxes by gender (all samples).

Because of the specificity of the German system of education, the education levels were classified in low, medium and high in order to systematize the education levels across samples. Low level of education includes not completed primary school and elementary school; medium level includes upper secondary school and post-secondary education and high level includes university and postgraduate degrees. There is no difference between men and women regarding education.

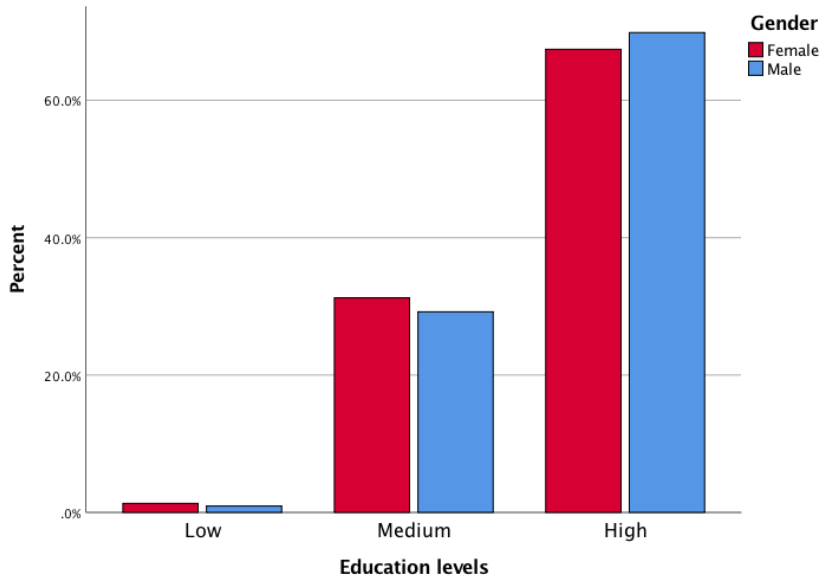

Figure 16: Education levels by gender (all samples).

2.2.3.1 Samples descriptions by country

All samples were characterized as follows: *"Car sharing current users", "Previous experience with car sharing"* and *"Non-users of car sharing".* For some of the following analyses, all samples will be compared between (under 50 years old) *"younger respondents"* and *"older respondents"* (over 50 years old) as well as gender. The respondents that affirmed not knowing the meaning of car sharing and those that skipped the question were classified as missing cases and the analysis treated missing data with listwise exclusion.

The Swedish sample was characterized as follows: *"Car sharing current users"* (n= 5645 *"Previous experience with car sharing"* (n=503) and *"Non-users of car sharing"* (n=1753), a total of 2821 valid cases. The sample has an older profile with only 5% of the respondents under 30 years old (Figure 17) and 60% were men.

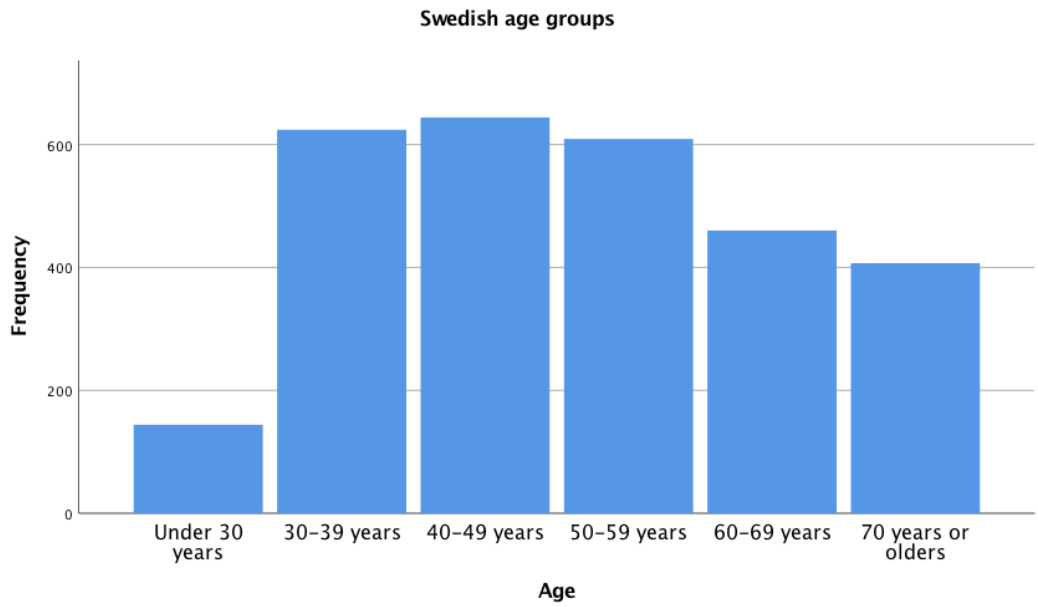

Figure 17: Age groups (Sweden).

Contrary to the Swedish sample, the Italian sample (52% men) had an younger profile, with 60% of the sample under 50 years old (Figure 18). The sample was characterized as follows: *"Car sharing current users"* (n= 823), *"Previous experience with car sharing"* (n=554) and *"Non-users of car sharing"* (n=1874), a total of 3251 valid cases.

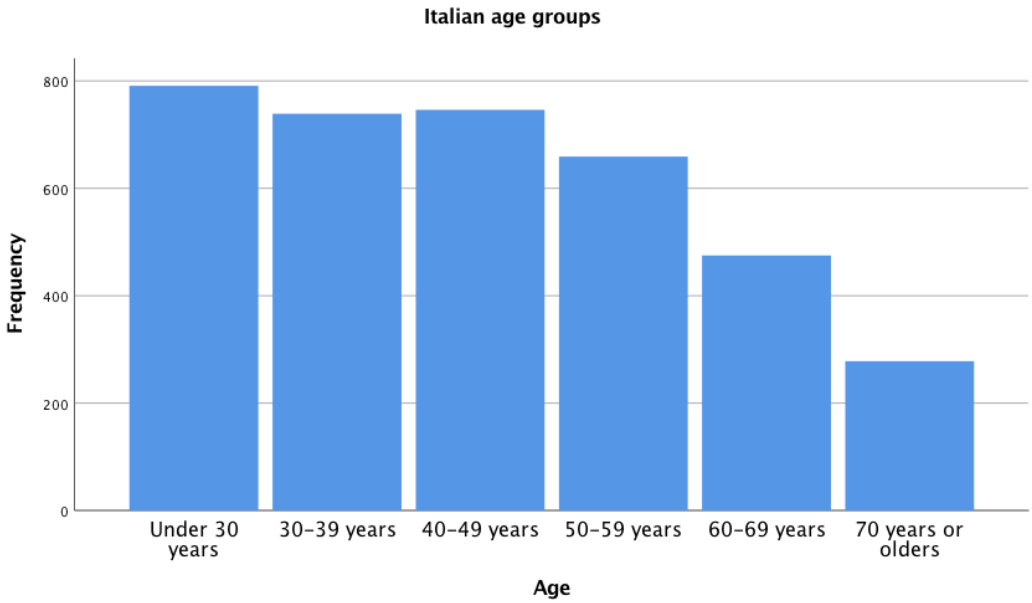

Figure 18: Age groups (Italy).

The German sample (66% men) was characterized as follows: "*Car sharing current users*" (n= 76), "*Previous experience with car sharing*" (n=3) and "*Non-users of car sharing*" (n=5), a total of 84 valid cases. The sample has a younger profile, with 74% of the respondents under 50 years old (Figure 19).

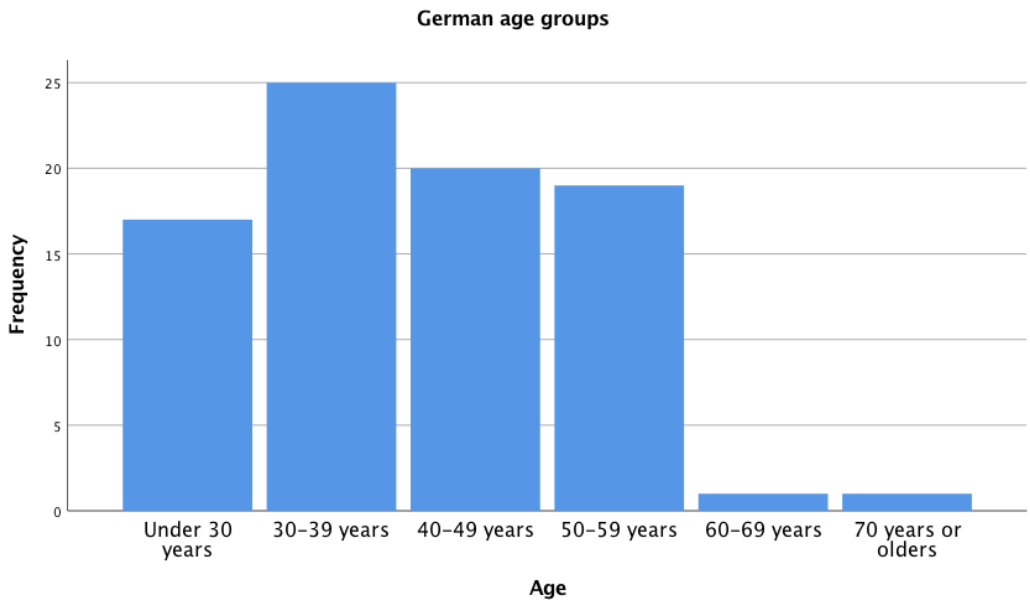

Figure 19: Age groups (Germany).

The Belgian sample (54% men) was characterized as follows: *"Car sharing current users"* (n= 37), *"Previous experience with car sharing"* (n=8) and *"Non-users of car sharing"* (n=28), a total of 73 valid cases. The sample has an younger profile, with 77% of the respondents under 50 years old (Figure 20).

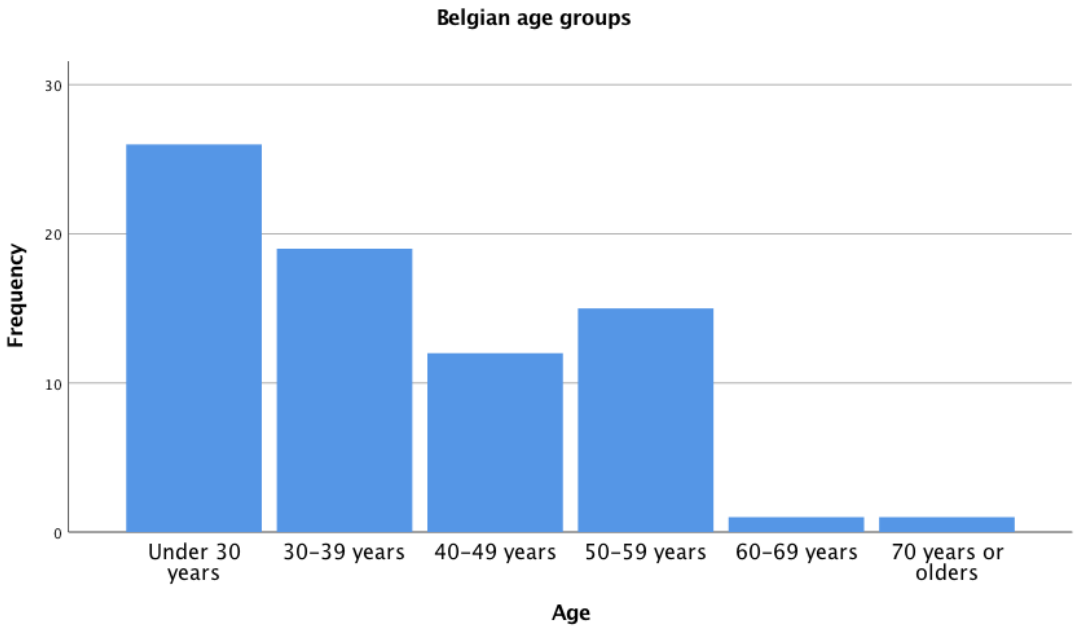

Figure 20: Age groups (Belgium).

The French sample was characterized as follows: *"Car sharing current users"* (n= 7), *"Previous experience with car sharing"* (n= 3) and *"Non-users of car sharing"* (n=16), a total of 26 valid cases. The sample has a younger profile, with only 4 respondents with 50 years or older (Table 6). The sample was gender balanced, with 15 men and 12 women participating.

French Age Groups					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Under 30 years	1	3.6	5.0	5.0
	30-39 years	3	10.7	15.0	20.0
	40-49 years	5	17.9	25.0	45.0
	50-59 years	10	35.7	50.0	95.0
	70 years or older	1	3.6	5.0	100.0
	Missing	8	28.6		
	Total	28	100.0	100.0	

Table 6: Age groups (France).

The Spanish sample was characterized as follows: *"Car sharing current users"* (n= 2), *"Previous experience with car sharing"* (n= 3) and *"Non-users of car sharing"* (n=7), a total of 12 valid cases. The sample has an younger profile, with only 3 respondents with 50 years or older (Table 7). The sample was gender balanced, with 9 men and 7 women participating.

Spanish Age Groups					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Under 30 years	4	28.6	28.6	28.6
	30-39 years	5	35.7	35.7	64.3
	40-49 years	2	14.3	14.3	78.6
	50-59 years	2	14.3	14.3	92.9
	60-69 years	1	7.1	7.1	100.0
	Total	14	100.0	100.0	

Table 7: Age groups (Spain).

2.2.4 Questionnaire and procedure

Seven online versions of the questionnaire were sent to the respondents in Swedish, Italian, German, Dutch, Spanish, French and English languages. The German, Dutch, Spanish and French surveys were distributed via link by the researchers involved on the project. The Swedish survey was distributed by the Laboratory of Opinion Research at the University of Gothenburg, targeting Stockholm, Gothenburg and Malmö cities.

The Italian survey distribution was done by an external poll firm from a representative panel of 3170 participants (2729 non-users and 442 users) living in cities where at least one car sharing service is available. The target cities were Bari, Bologna, Brescia, Cagliari, Catania, Florence, Genova, Milan, Modena, Naples, Padova, Palermo, Parma, Rome, Turin, Venice and Verona. Additionally, in order to get more information about car sharing users, two car sharing operators (BlueTorino and Enjoy) distributed the survey to their customers.

The Spanish and French surveys were announced in Barcelona, Madrid, Lyon and Paris. The survey was reached out through social networks (twitter and LinkedIn) and through a convenience sample of organizations. The distribution of the English survey was also done through social medias, such as the project's website or project's profile at LinkedIn.

Before starting to answer the questions, the participants were informed about the purpose of the project, the main institutions involved in the project, how long would take to answer the questionnaire (around 15 minutes) and to whom they could contact for questions. Moreover, they were informed that their answers would be made anonymously and stored encrypted in agreement with Regulation (EU) 2016/679 of the European Parliament on the protection of natural persons with regard to the processing of personal data.

It was presented to all respondents the following definition of car sharing: *"Car sharing is a membership service available to all qualified drivers in a community. No separate written agreement is required each time a member reserves and uses a vehicle. The car sharing companies offer to their members the access to a dispersed network of shared vehicles 24-hours, 7 days a week. It should be highlighted that the trips are not shared between drivers, only the vehicles are shared at different times by different drivers".* Following this definition, the participants were asked if they are/were users of car sharing, and they could also opt for the choice "*I am not familiar with the concept of car sharing*". The respondents that selected this option did not receive the specific questions regarding car sharing. The authors decided for this procedure in order to guarantee the validity of the response and to avoid inducing respondents to answer questions about topics that they are not familiar with.

The questionnaire consisted of 5 modules. Filters were applied in accordance with respondents' answers in order to avoid questions that did not apply for a respondent circumstance.

- ★ Module A – Habits measures
  1) Habit as frequency of past behaviour
     Ex.: *"How often do you use the following methods?" (private car as driver or passenger, car sharing, public transport, motorcycle or scooter, taxi, cycling, walking, other)*
  2) Habit as a cognitive overall evaluation
     Ex.: "*Which travel mode are you most likely to use to reach these activities?" (a set of activities and transport options were presented for the respondents)*
  3) Habit as a psychological measurement
     Ex.: *"I feel strange travelling without a car" (to be answered based on a Likert scale from 1 to 7, where 1 – strongly disagree and 7 – strongly agree).*

- ★ Module B – Self-efficacy measures
  4) Perceived Behavioural Control (PBC)
     Ex.: *"It is possible for me to use car sharing for my regular trips." (to be answered based on a Likert scale).*
  5) Ease of use (EU)
     Ex.: *"I find car sharing easy to use." (to be answered based on a Likert scale).*
  6) Perceived usefulness (PU)
     Ex.: *"Car sharing services is a useful mode of transport." (to be answered based on a Likert scale).*

- ★ Module C – Intentional and attitudinal measures
  7) Motives for using or future use of car sharing.
  8) Attitudes
     Ex.: *"My support for implementation of car sharing in society is…" (to be answered based on a Likert scale).*
  9) Trust
     Ex.: *"I think car sharing services are trustworthy." (to be answered based on a Likert scale).*

- Module D – Normative and environmental perception measures
  10) Subjective norms
  Ex.: *"People who are important to me would agree if I would use car sharing." (to be answered based on a Likert scale).*
  11) Personal norms
  Ex.: *"I feel morally obliged to reduce the environmental impact due to my travel patterns." (to be answered based on a Likert scale).*
  12) Environmental awareness
  Ex.: *"I believe that using the car causes many environmental problems." (to be answered based on a Likert scale).*

- Module E – Sociodemographic measures
  13) Country of residence and city of residence
  14) How many people, living in the household, number and age of children
  15) How many drivers / licensees were in the household
  16) How many cars are in the household
  17) The usage of car sharing (current user, previous user or non-user)
  18) The access to car sharing services
  19) Personal information: gender, age, income, education

2.3 Results

This section presents the categorization of usage *"Car sharing current users"*, *"Previous experience with car sharing"* and *"Non-users of car sharing"* by age and gender for all countries (see figures 21 to 28). Since the French and Spanish sample were small, with few current user of car sharing, they will be classified as *"Experience"*; for those with any experience with car sharing and *"No experience"*; for those that know the concept but haven't used it before.

2.3.1 Categorization by usage of car sharing, age and gender

For the four countries, **the frequency of male current users of car sharing are higher than female current users.** For the other two categories there is no big difference between the genders, except for the Swedish non-users, which has higher frequency of men (Figure 21).

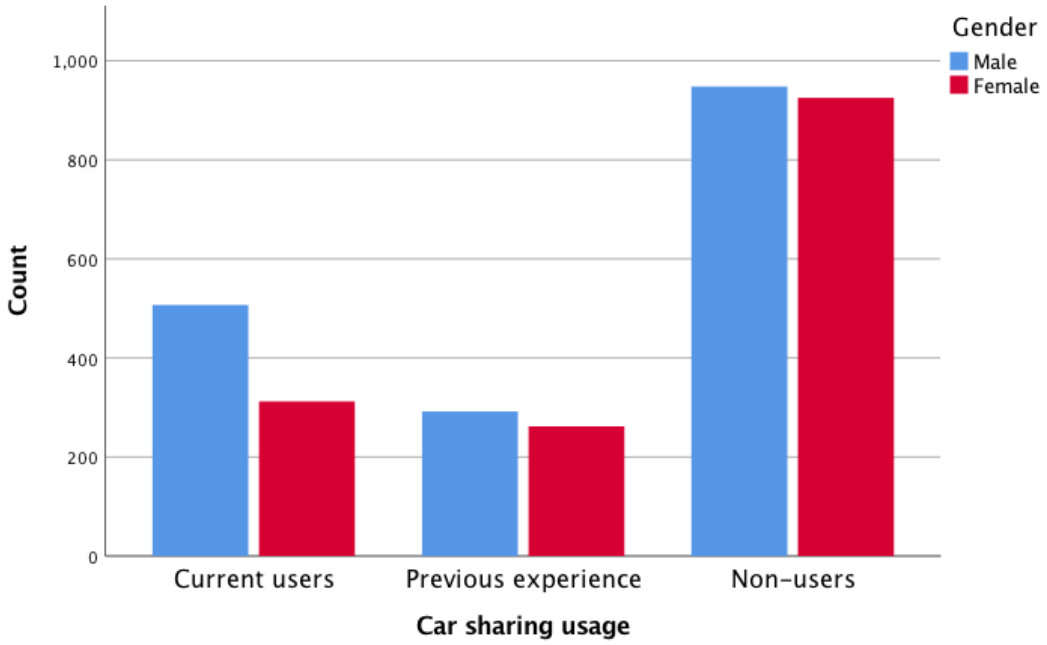

Figure 21: Car sharing usage by gender (Italy).

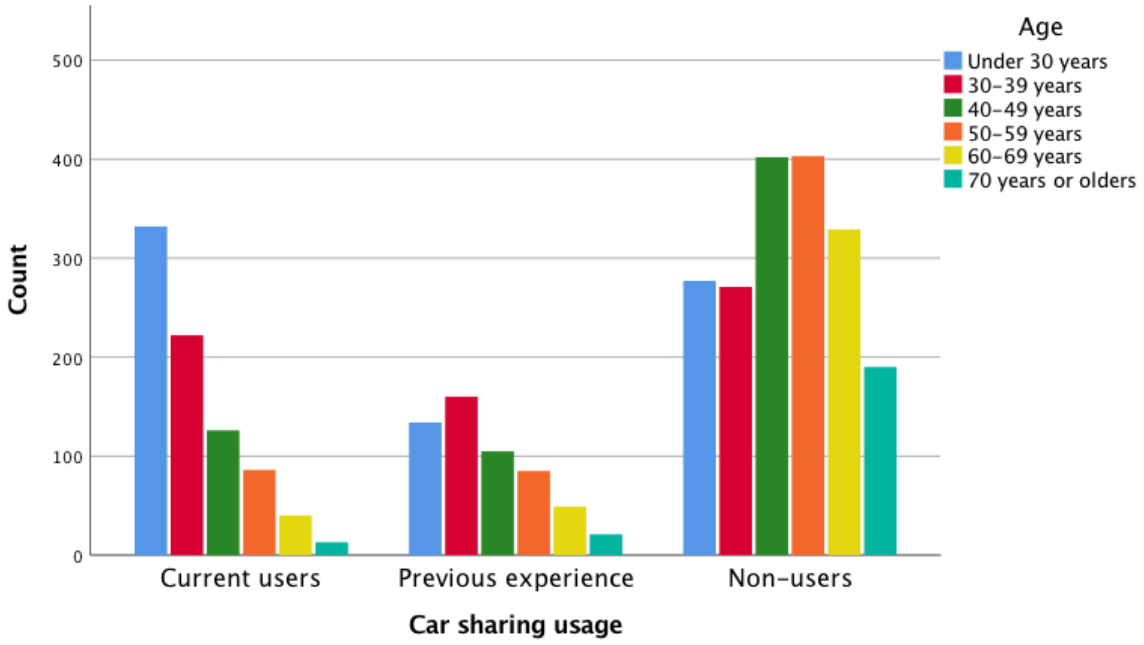

Figure 22: Car sharing usage by age (Italy).

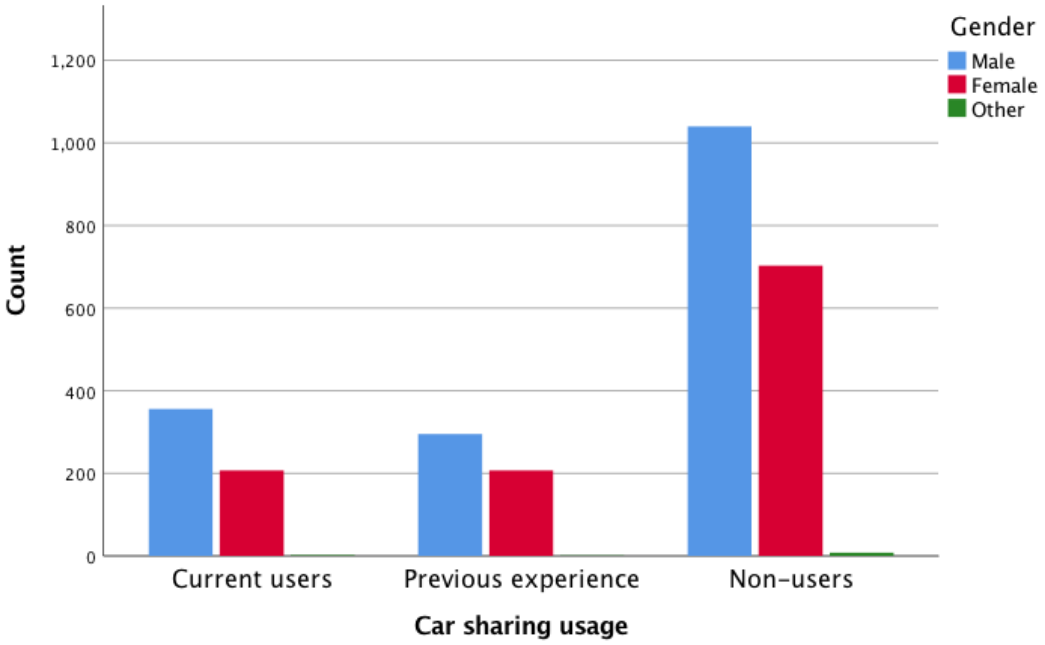

Figure 23: Car sharing usage by gender (Sweden).

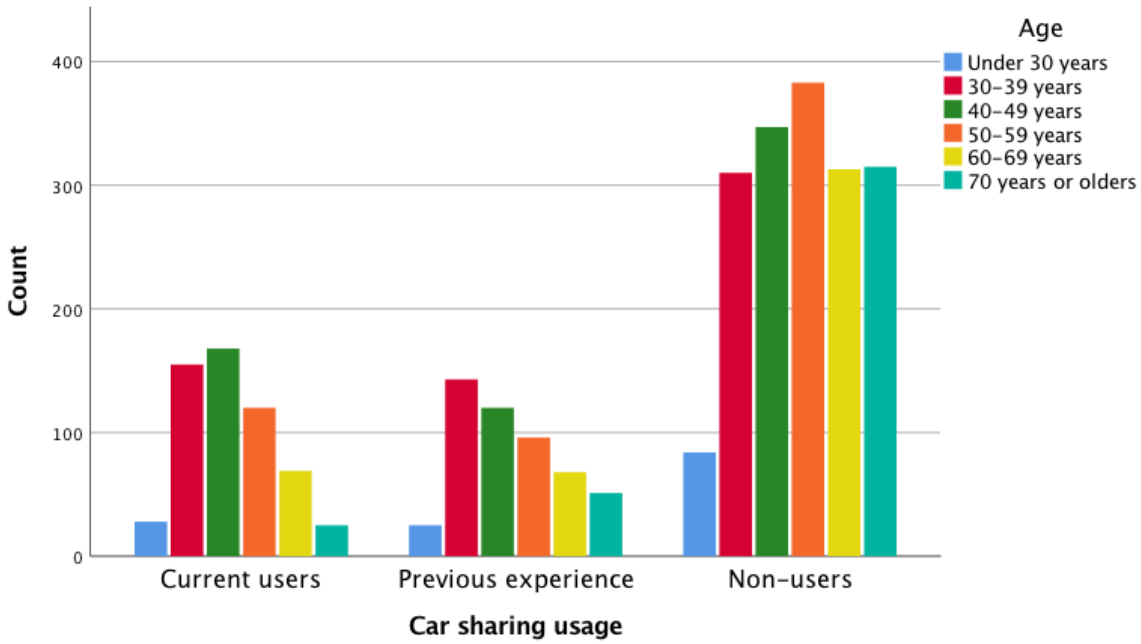

Figure 24: Car sharing usage by age (Sweden).

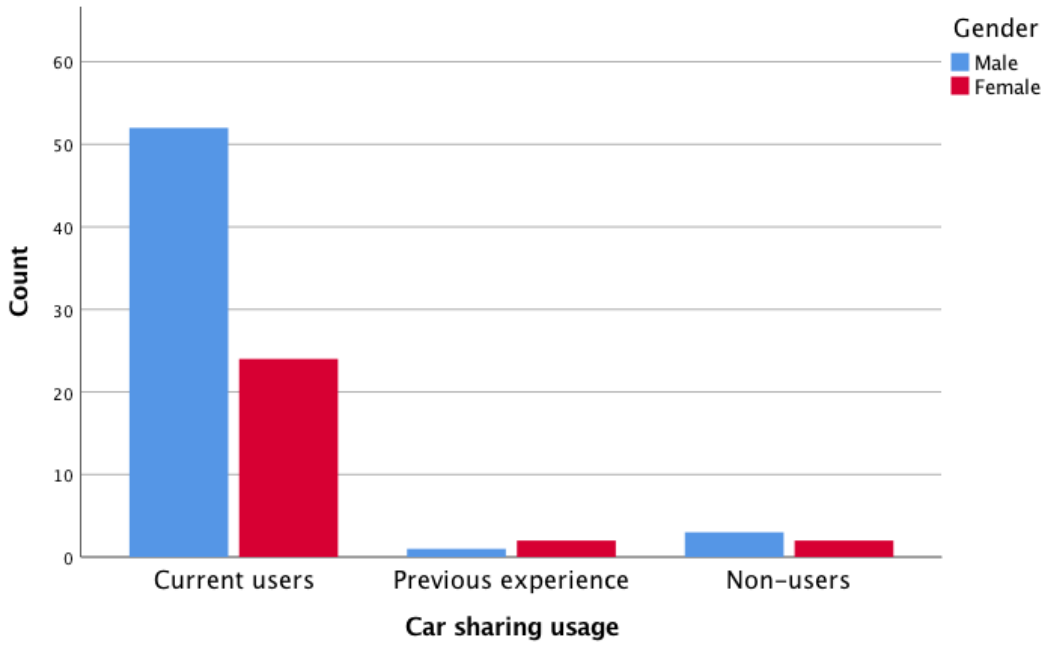

Figure 25: Car sharing usage by gender (Germany).

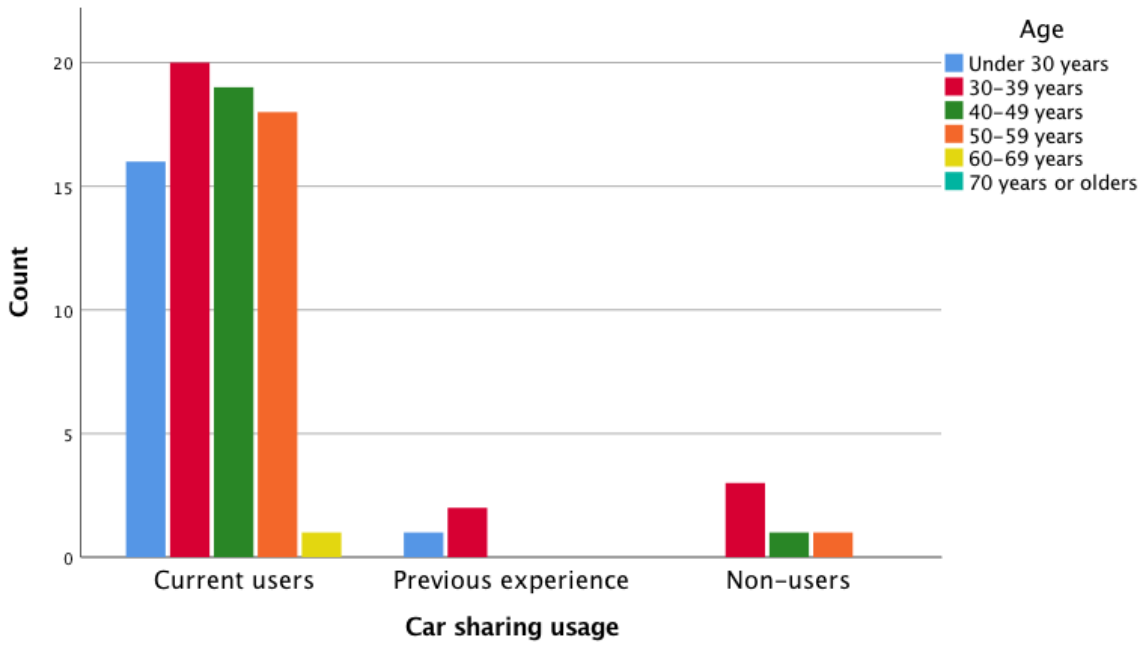

Figure 26: Car sharing usage by age (Germany).

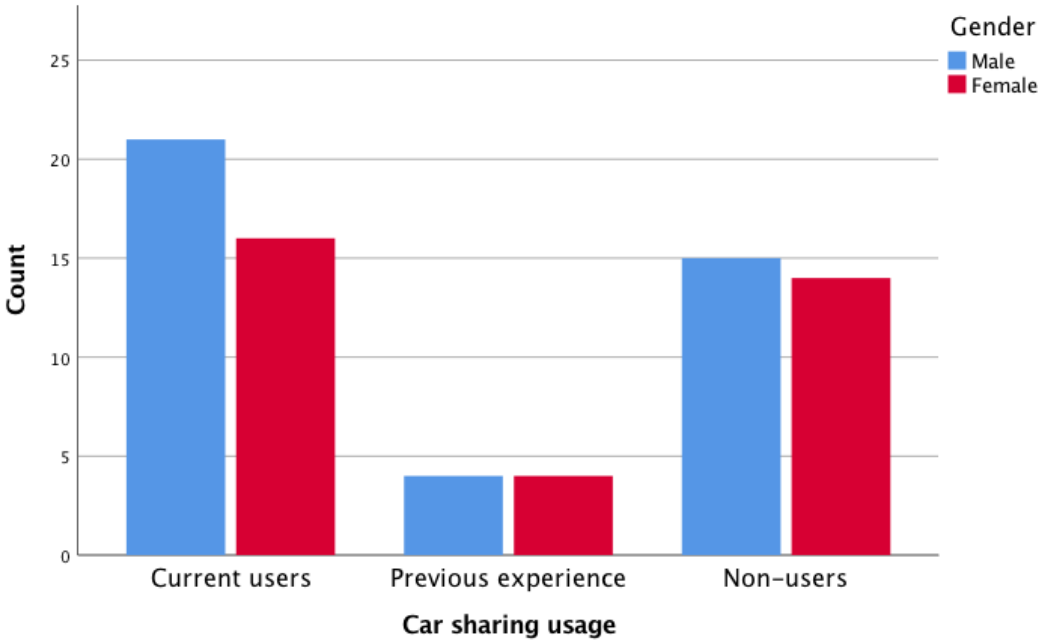

Figure 27: Car sharing usage by gender (Belgium).

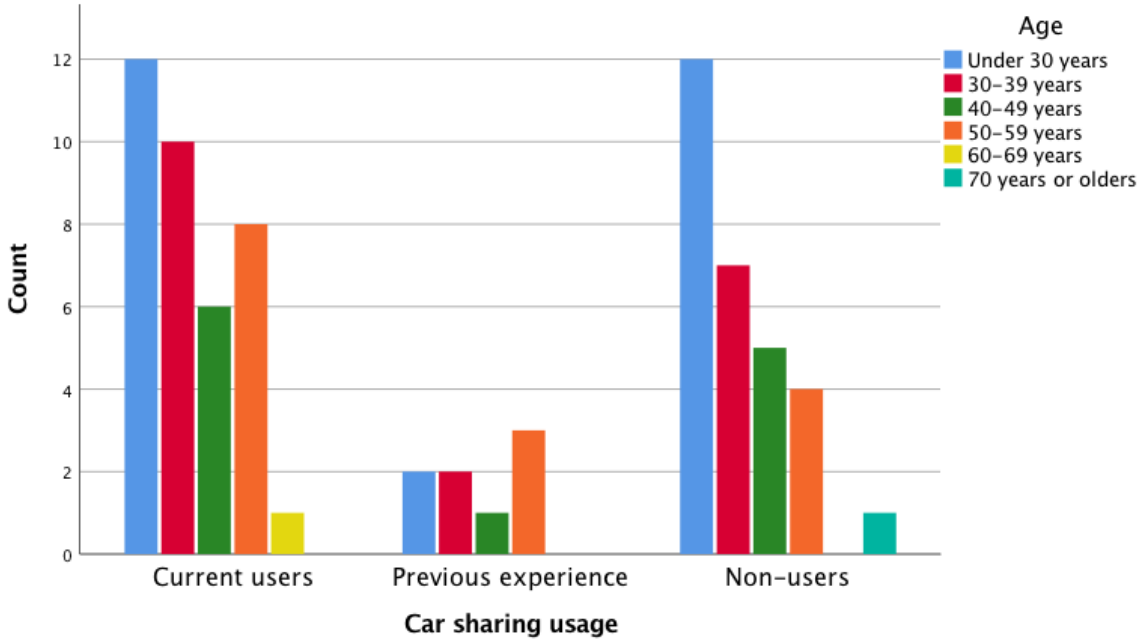

Figure 28: Car sharing usage by age (Belgium).

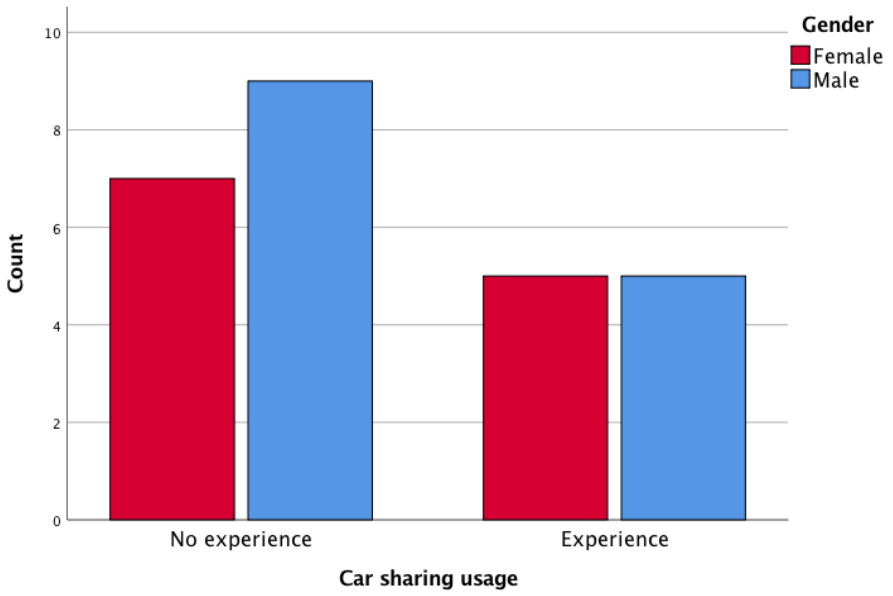

Figure 29: Car sharing usage by gender (France).

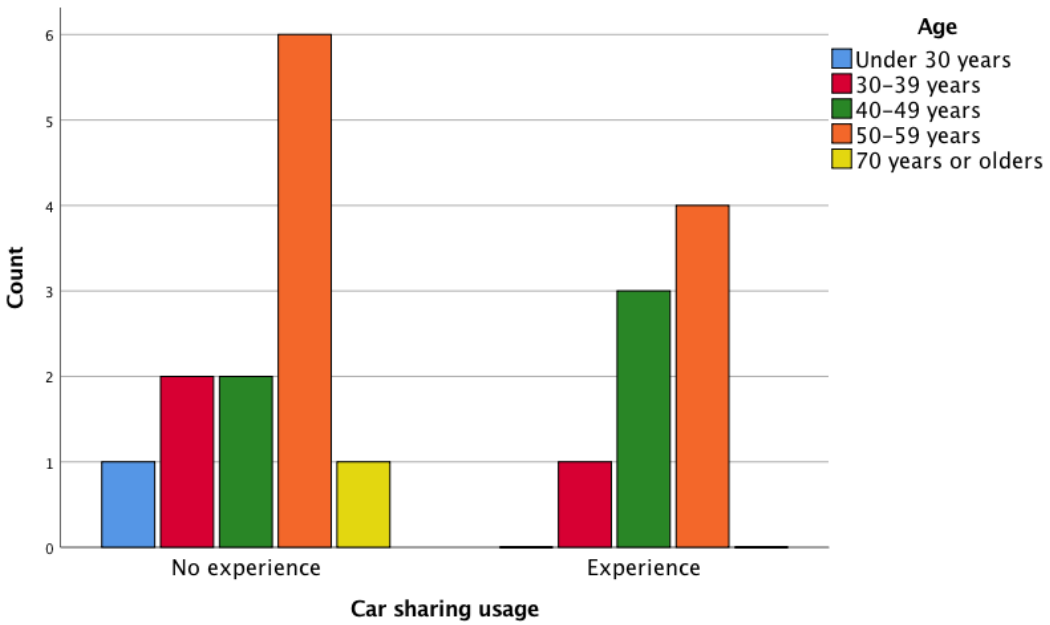

Figure 30: Car sharing usage by age (France).

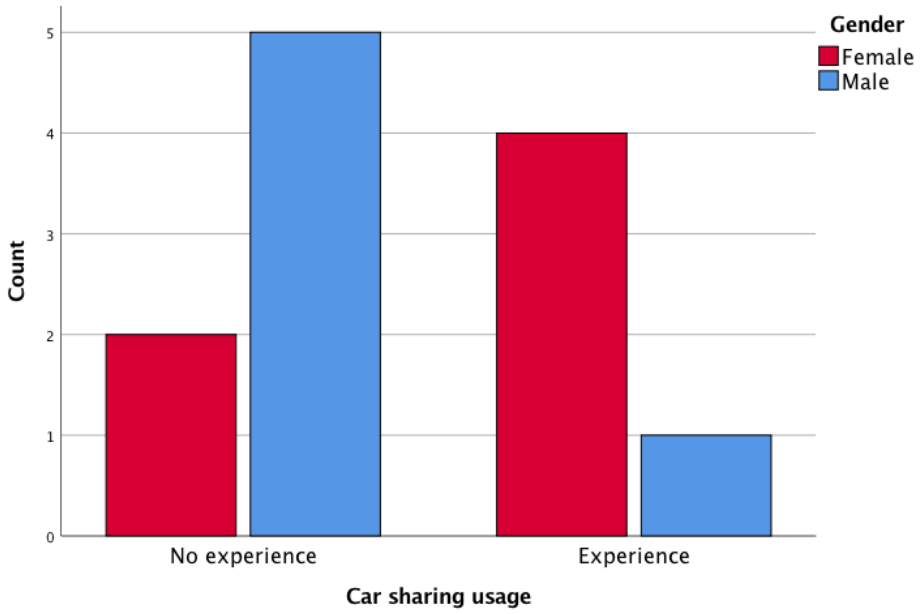

Figure 31: Car sharing usage by gender (Spain).

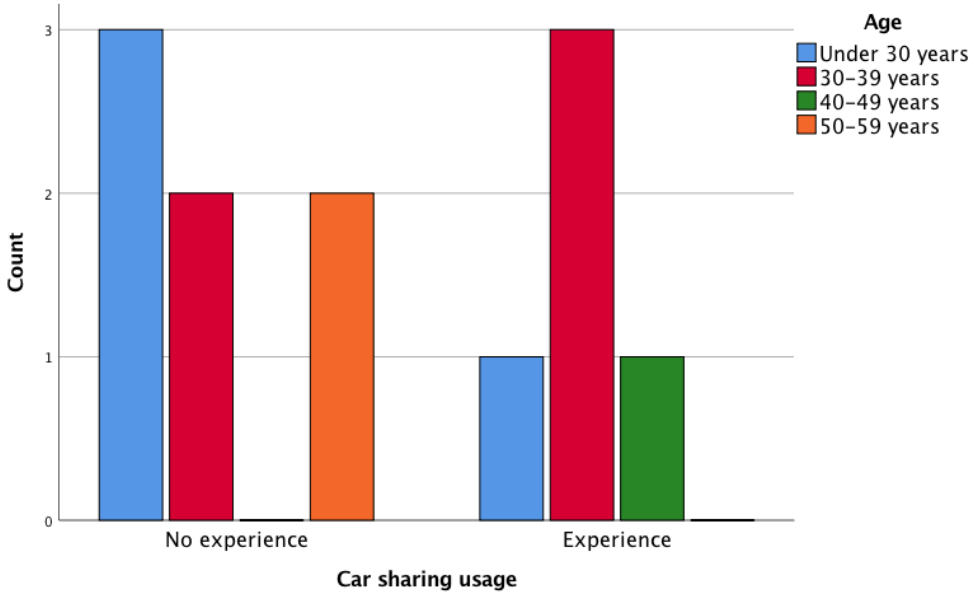

Figure 32: Car sharing usage by age (Spain).

2.3.2 Motives to use car sharing

The respondents were asked which are main incentives for them to use car sharing. They could choose multiple options among the following motives:

M1. The accessibility of car sharing pick up locations near my place / workplace

M2. To reduce expenses

M3. To travel more sustainably

M4. For more comfort when traveling

M5. The convenience of having a car only when I need it

M6. To avoid responsibilities with maintenance and repairs of my own car

M7. To avoid looking for parking spots

M8. Other motives

Non-users had higher frequency of reports (n=8646) than current users (n=5056) and people with previous experience (n=2912). The main motives for non-users and people with previous experience with car sharing were (M6) to avoid responsibilities with maintenance and repairs of the car, (M5) the convenience of having a car only when in need of it and (M2) to reduce expenses.

The current users reported mostly (M5) the convenience of having a car only when in need of it, (M6) to avoid responsibilities with maintenance and repairs of the car and (M7) to avoid looking for parking spots (see Figure 33).

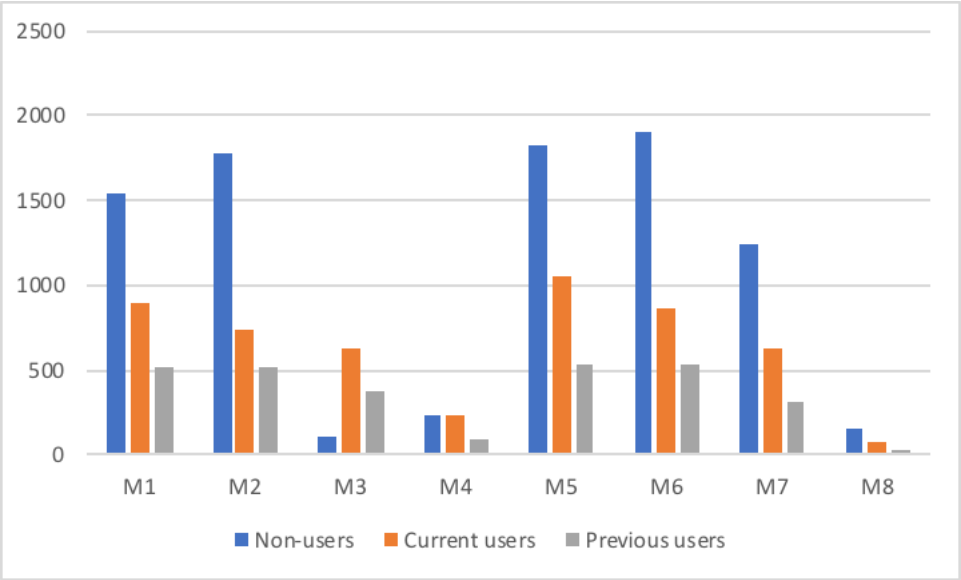

Figure 33: Frequencies of reports "motives for using car sharing".

Regarding gender, there were no substantial differences between women and men on motives for using car sharing services. It was only one motive (M3) "to travel more sustainable" which was stronger among females.

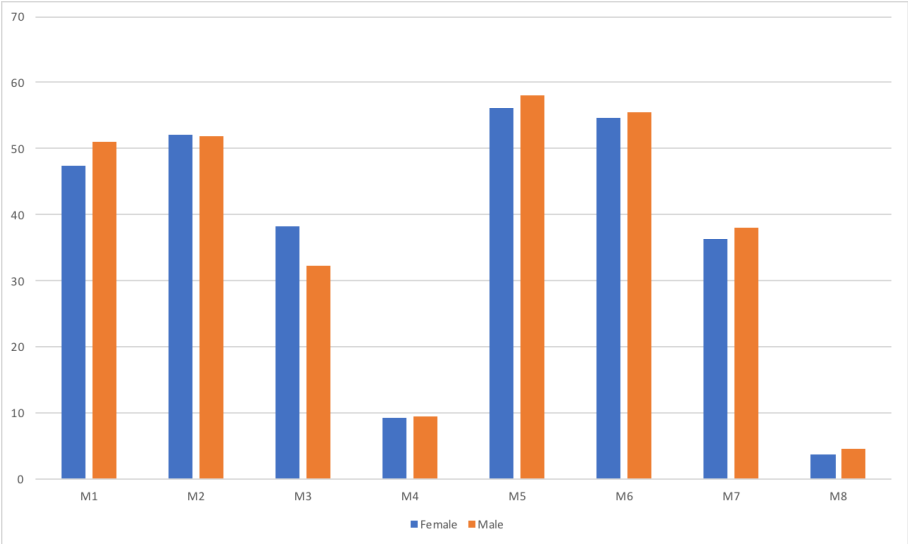

Figure 34: Percentage of reports "motives for using car sharing" (by gender).

2.3.3 Users profiles categorization by operators

Current users were asked to report which car sharing company they are using now and respondents with previous experience were asked to report which car sharing operators they had experienced with before. The user profiles followed the classification of the car sharing operators defined in the previous Deliverable 2.1. In the following, the definitions of each profile are briefly presented, for more details see STARS Deliverable 2.1.

Profile 1 – Free-floating car sharing systems: This profile represents the free-floating operational schemes which are mainly composed by a large public fleet.

Profile 2 – Free-floating car sharing systems with pool stations: This profile mainly differs from the previous profile for its operational characteristic. Unlike the first profile, the reservation time in advance is a bit longer. It has a public fleet with medium fleet dimension.

Profile 3 – Peer-to-peer car sharing systems: This profile is characterized by companies with only private shareholders with operational characteristic of roundtrip home zone-based (peer-to-peer).

Profile 4 – Privately owned roundtrip station based car sharing systems: This profile is representative of the roundtrip station-based car sharing systems with roundtrip station based car sharing systems.

Profile 5 – Publicly owned car sharing systems: This category is the only representing companies/corporations with public shareholders. Publicly-owned car sharing services are not very different in their characteristics from those listed in Profile 4.

Profile 6 – Association-based car sharing systems: This profile represents a small category of car sharing operators. Contrarily to the other profiles, it is the only one having associations as organization form. It is a Roundtrip Station Based Car sharing System, with public fleet and small fleet dimension.

Since this was an opened question, it was possible to identify some particularities such as small and local car sharing operators that were not identified before by the Deliverable 2.1 and reports of use of car sharing at work. The respondents could also report all car sharing operators they had experience with, which indicated the variability of experiences within each profile.

The STARS classification was validated since it proved to very useful and we could successfully organize 90 % of the current users into the six profiles. The remaining 10% were also classified in three "other" categories referred to as profile 7, 8 and 9.

Profile 7 "Car sharing operators providing multiple operational characteristics": for this profile it is possible that one operator falls in more than one profile if one of its services share common characteristics with those identifying in the proposed profiles.

The *Profile 8 "Not previously identified"* are characterized by small fleet, in general, and they operate only in one city. The *Profile 9 "Car sharing at work"* is characterized by users that use car sharing provided by their workplace.

However, further research of the operators who doesn't easily fit into the profiles is needed before yet more profiles should be added to the original classification.

Operators characteristics	N (current users)	N (previous experience)
Profile 1	677	273
Profile 2	633	285
Profile 3	6	5
Profile 4	61	7
Profile 5	4	13
Profile 6	10	11
Profile 7 "Multiple characteristics"	54	37
Profile 8 "Not previously identified"	82	142
Profile 9 "Car sharing at work"	25	21
Total	1552	794

Table 8: Frequencies of operators reported per car sharing profiles.

The most reported Profiles for current users are: Profile 1 in Italy, Profile 2 in Sweden and Profile 4 in Germany. In general, men reported a higher number of car sharing operators and there was no special differences regarding gender and car sharing profiles preferences.

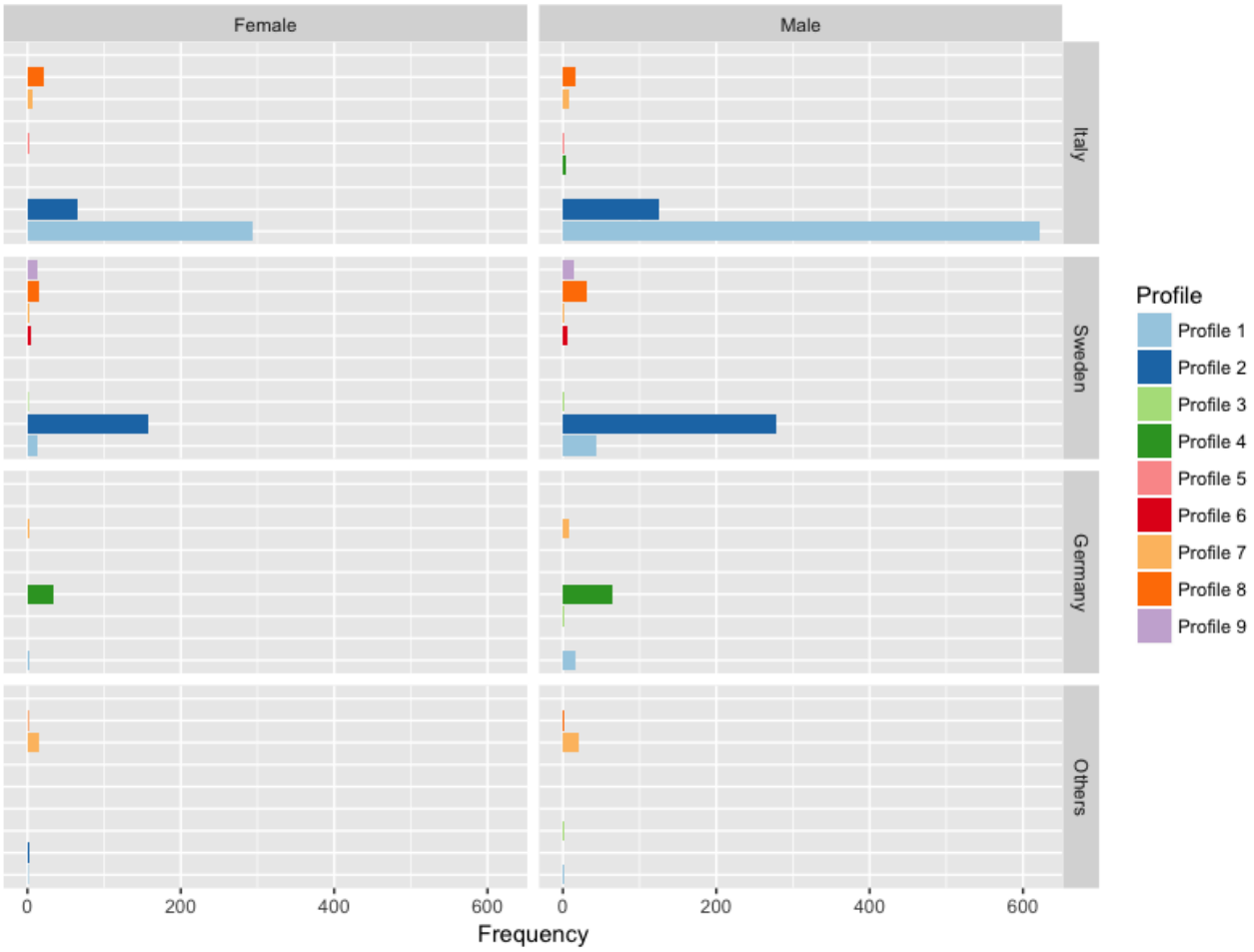

Figure 35: Profile frequencies per gender and country (current users).

The reports of previous experience for car sharing also shows higher frequencies for Profile 1 and 2, in Italy and Sweden respectively. However, if compared to current users, the reports also show a higher frequency of Profile 8 for both countries and higher frequency of Profile 7 for Italy. There is no difference between genders regarding preferences for specific profiles.

Because of the contributions of car sharing operators for the survey distribution in the Italian sample, it is not possible to infer that Profile 1 is the most chosen kind of operators among the Italian population. This result could be merely a sample bias.

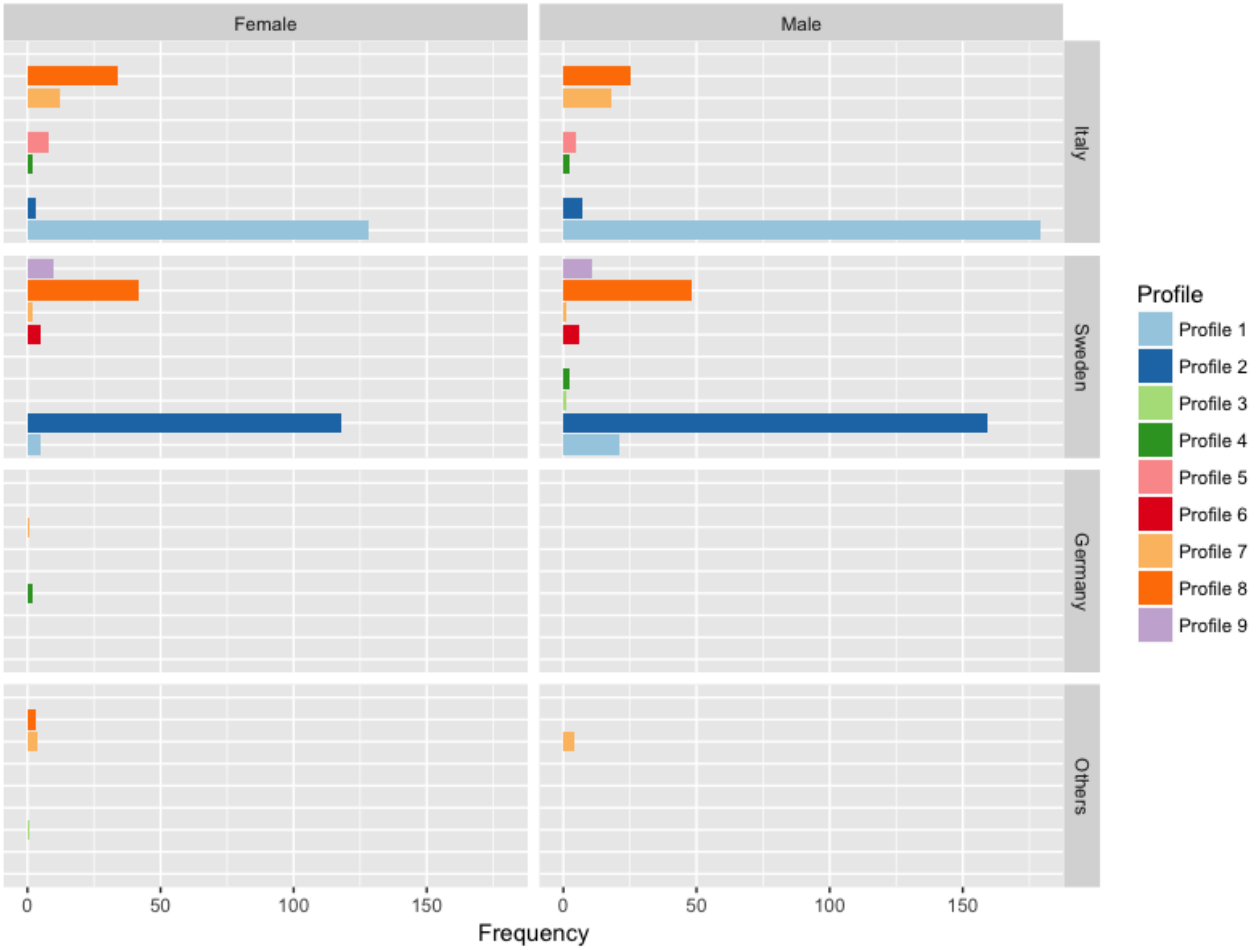

Figure 36: Profile frequencies per gender and country (previous users).

In order to have a more detailed picture of users of car sharing preferences, the Profiles we analysed by age. However, because of the differences among samples sizes, we present the data only for Sweden and Italy, since only these countries had a sufficient number of reports to divide among the age groups.

In Italy, the higher frequencies for Profile 1 is under 30 years old while, in Sweden, the higher frequencies for Profile 2 is from 30 to 49 years old for both users and previous users. The Profile 8 is stables across age groups for both countries.

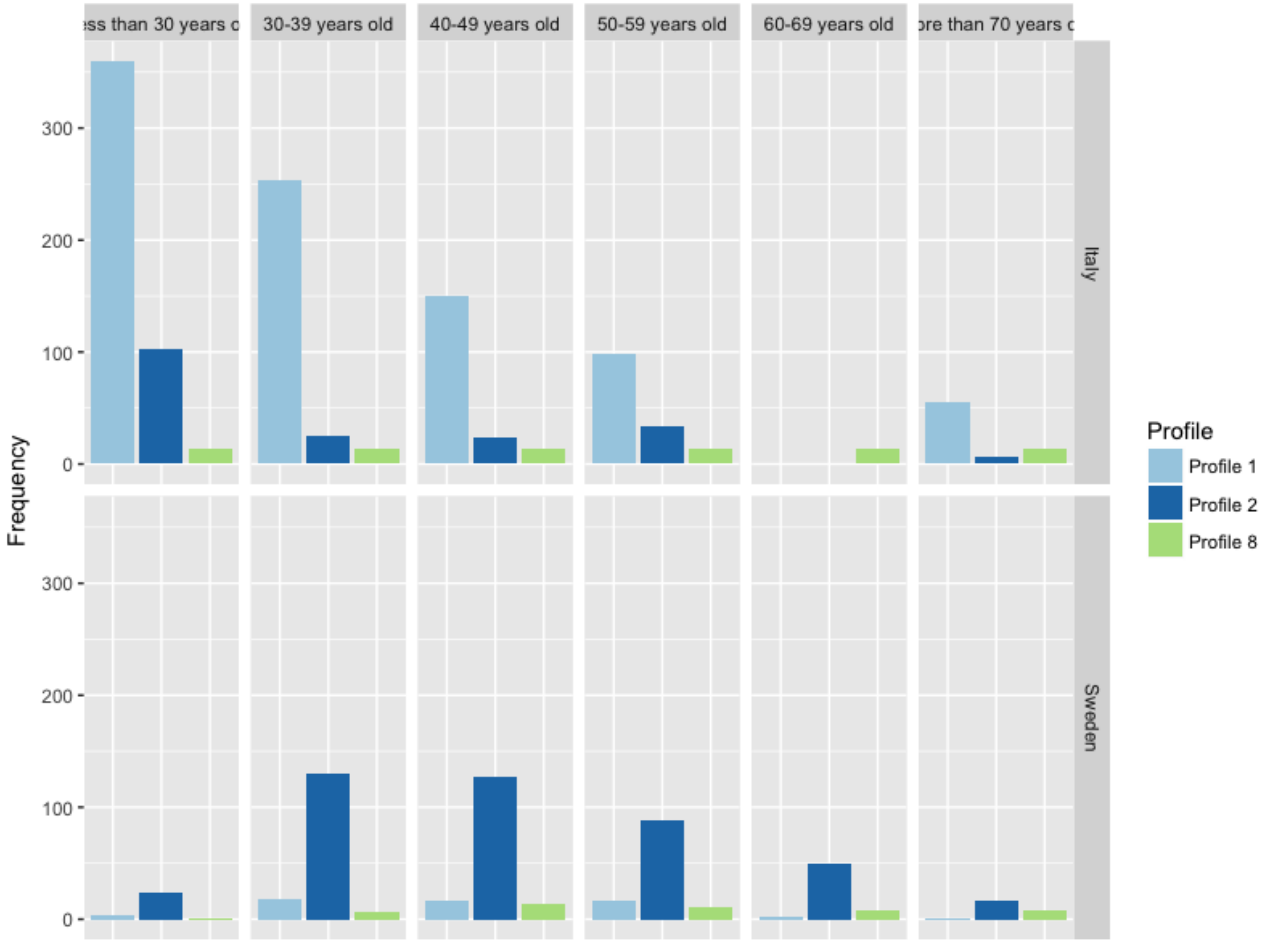

Figure 37: Profile frequencies per age and country (current users).

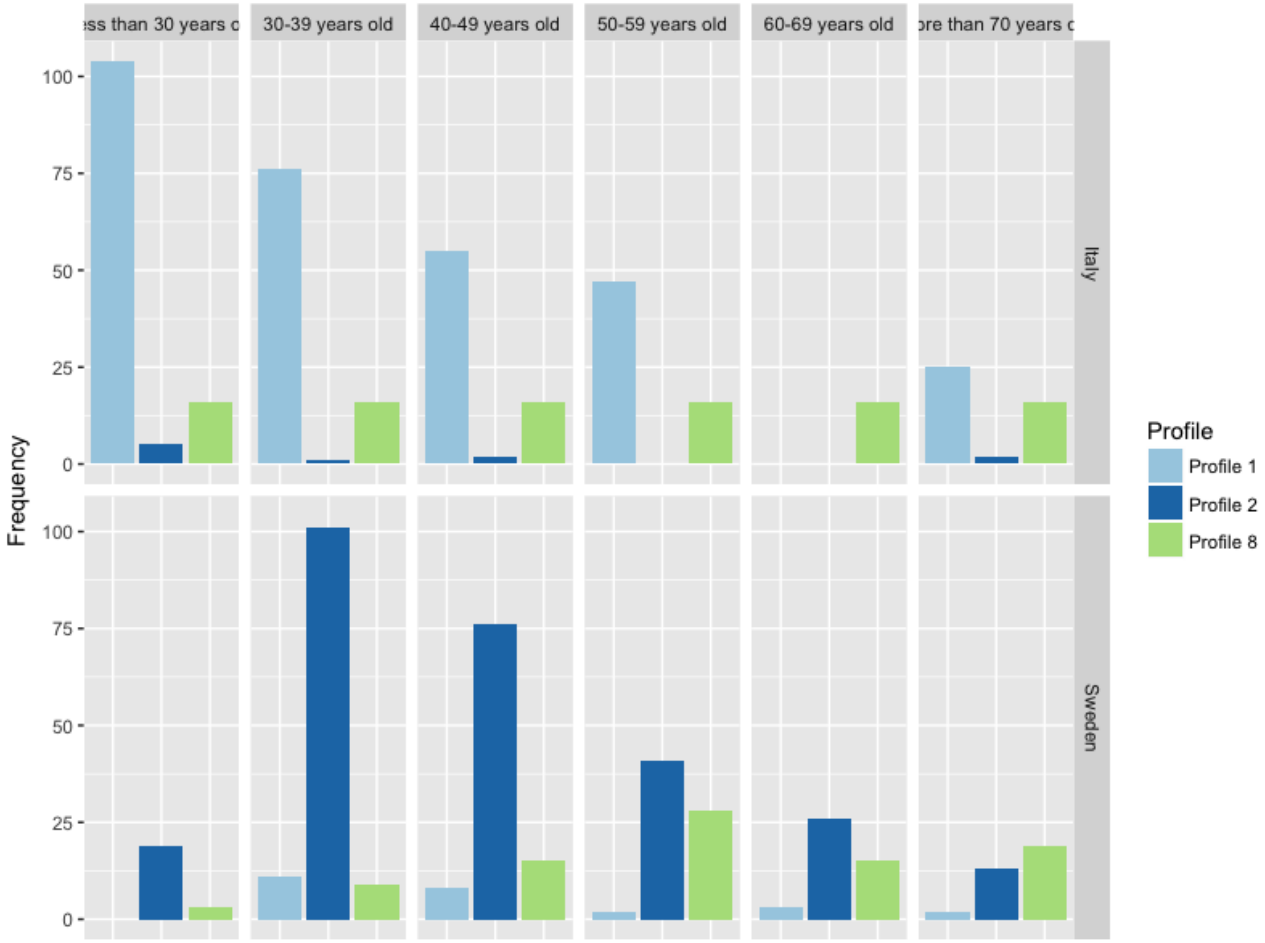

Figure 38: Profile frequencies per age and country (previous users).

2.3.4 Usage profiles categorization by household characteristics

In this section, the three categories of use profiles are described based on their household characteristics: Household size (Figure 39), number of cars (Figure 40) and location in relation to car sharing pick up stations or operational areas (Figure 41, Figure 42).

The most characteristic household size was with two persons across all categories of car sharing usage. Non-users have by far more cars in the household than current users and people with previous experience with car sharing. Current car sharing user was the category with more reports of not having a private car.

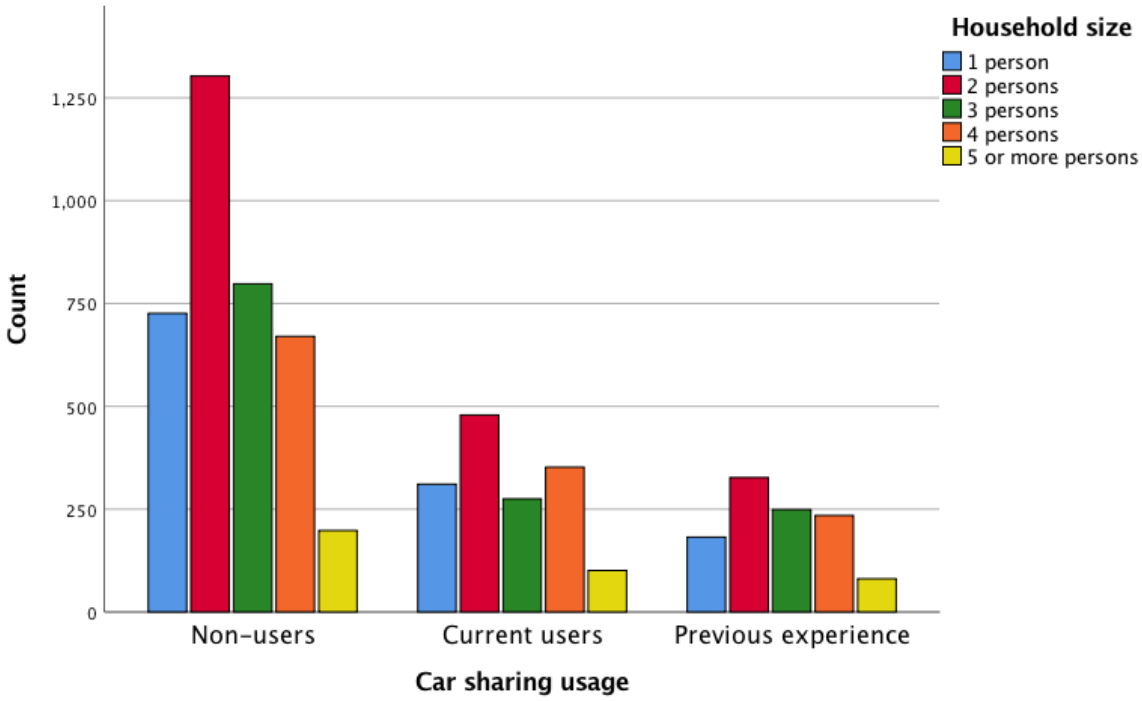

Figure 39: Household size by car sharing usage (all countries).

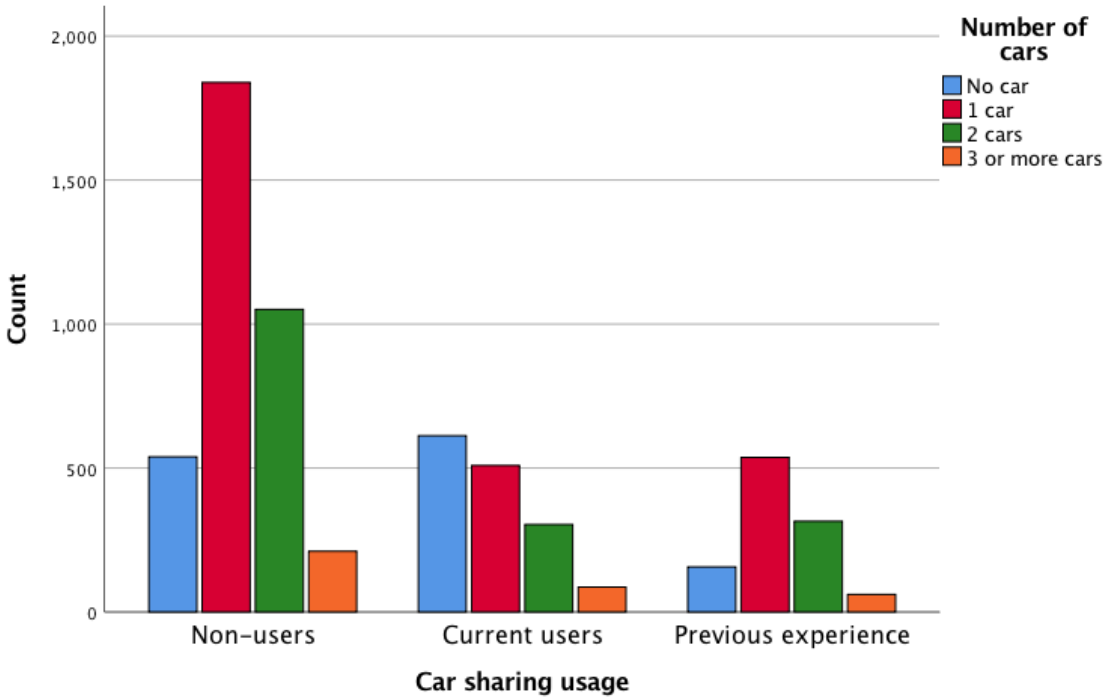

Figure 40: Number of cars in the household by usage profile (all countries).

Facilitating conditions to use car sharing were measured by two questions: *"Are there any car sharing pick up locations close to your home, or is your home within an operational area?"* and *"Are there any car sharing pick up locations close to your workplace/place where you study, or is your workplace/place where you study within an operational area?"*. Those questions measured the variables *"Facilitating condition (home)"* (see Figure 41) and *"Facilitating condition (work/study)"* (see Figure 42), respectively.

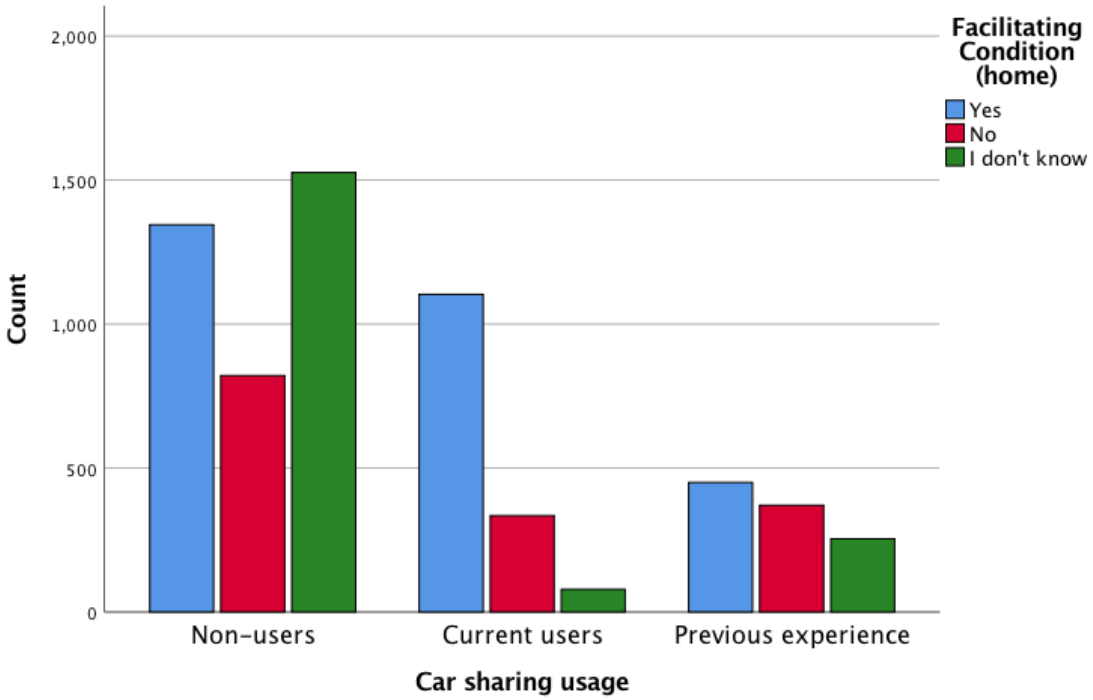

Figure 41: Facilitating condition (home) by car sharing usage (all countries).

Non-users is the group less aware of the availability of car sharing around their home or work/study place and they reported more frequently not having close access to the car sharing services (pick up locations and operational areas).

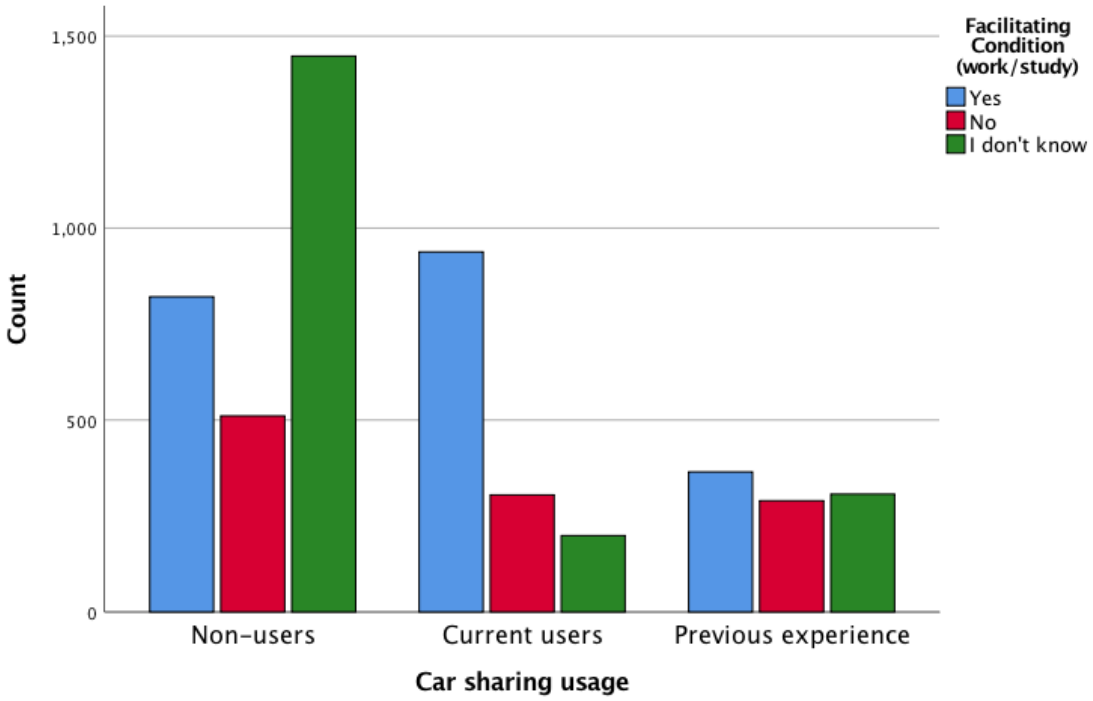

Figure 42: Facilitating condition (work/study) by car sharing usage (all countries).

2.3.5 Users profiles categorization by travel mode choices

The respondents were asked how often they use different kinds of transportation for their daily activities (for work, study, buying groceries, etc). The responses were based on the 6 points scale 0 – "Never", 1 – "Rarely", 2 – "Once/ a few times a month", 3 – "1-3 days/week", 4 – "4-6 days/week", 5– "Daily". The transport modes options were:

H9 "Private car as a driver",

H10 "Private car as a passenger",

H11 "Car sharing",

H12 "Public Transport",

H13 "Motorcycle/ scooter",

H14 "Taxi",

H15 "Cycling",

H16 "Walking".

Frequency of modes choices for daily activities										
Car sharing Usage			H9	H10	H11	H12	H13	H14	H15	H16
Non-Users	N	Valid	3672	3660	3652	3682	3651	3664	3674	3684
		Missing	23	35	43	13	44	31	21	11
	Mean		**2.62**	1.68	.13	**2.63**	.47	.74	1.48	**3.68**
	Std. Dev.		1.837	1.171	.497	1.533	1.197	.776	1.585	1.492
Current Users	N	Valid	1513	1507	1511	1512	1503	1504	1515	1514
		Missing	6	12	8	7	16	15	4	5
	Mean		1.87	1.52	1.91	**3.17**	.71	.93	2.44	**3.96**
	Std. Dev.		1.759	1.209	.976	1.410	1.371	1.020	1.783	1.315
Previous Experience	N	Valid	1069	1067	1067	1070	1066	1067	1067	1070
		Missing	6	8	8	5	9	8	8	5
	Mean		**2.66**	1.86	.85	**2.75**	.84	.99	2.07	**3.61**
	Std. Dev.		1.774	1.199	1.006	1.467	1.420	.952	1.640	1.427

Table 9: Travel mode choices for daily activities by car sharing usage (all countries).

The means for the modes of transport "Private car as a driver", "Public transport" and "Walking" were similar across categories of car sharing usage, with the mean level of "Walking" being the highest.

In order to explore this result, an ANOVA test was conducted to see if the means across car sharing usage differs statically from each other (Bonferroni post-hoc test) regarding walking behaviour.

Multiple comparisons between categories						
Group (I)	Group (J)	Mean Difference(I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
.00	1.00	-.284*	.044	.000	-.39	-.18
	2.00	.070	.050	.489	-.05	.19
1.00	.00	.284*	.044	.000	.18	.39
	2.00	.354*	.058	.000	.22	.49
2.00	.00	-.070	.050	.489	-.19	.05
	1.00	-.354*	.058	.000	-.49	-.22

*. The mean difference is significant at the 0.05 level.
Dependent variable: H16 "Walking"
Groups: Non-users (.00), Current Users (1.00) and Previous Experience (2.00).

Table 10: Multiple comparisons among groups for walking behaviour.

The result shows that there is an statically difference between Current Users (M = 3.96, SD = 1.31) and Non-users (M = 3.68, SD = 1.49) and between Current users and people with Previous Experience (M = 3.73, SD = 1.44), F(2, 6265) = 25.803, p = .000.

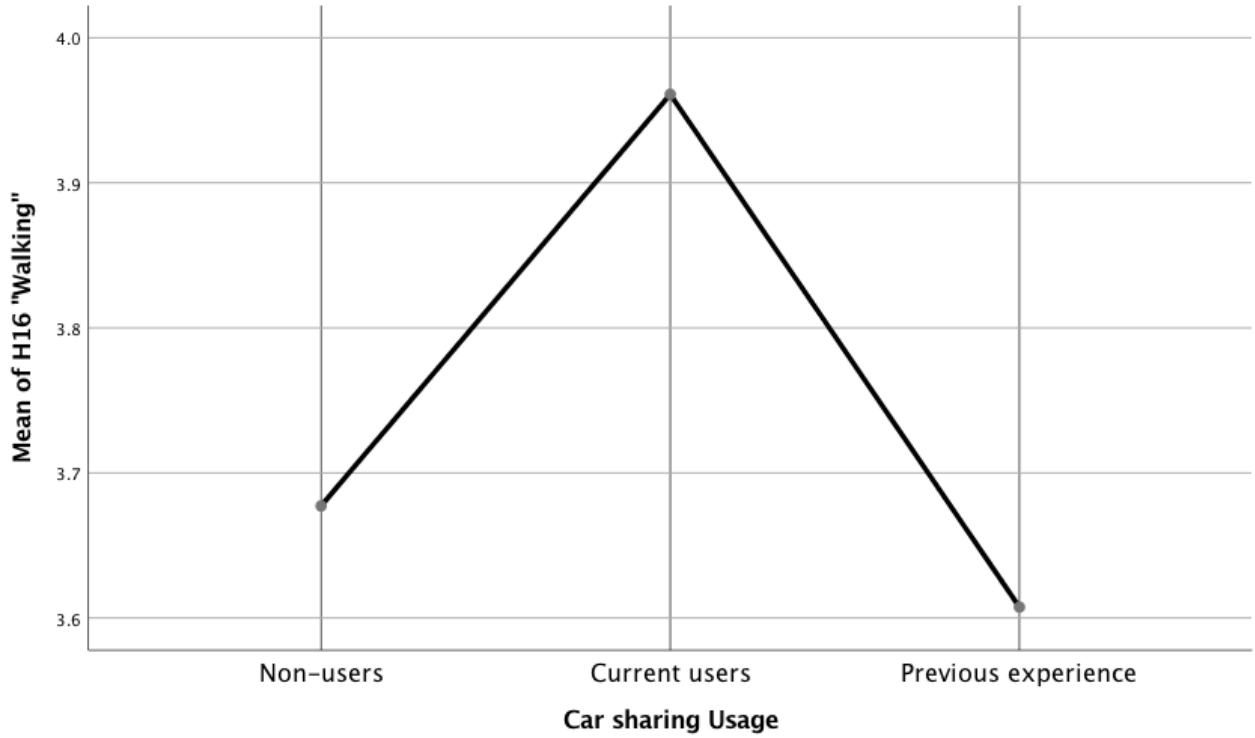

Figure 43: Mean differences for walking by car sharing usage categories (all countries).

As visualized by the Figure 43, current users reported walking more than non-users and people with previous experience with car sharing. On the following section, the use of car sharing will be explored regarding the latent variables described on the model. Descriptive data will be taken in account as well as people's perceptions of their own behaviour and perceptions of their social environment.

2.4 A behavioural and psychological model to predict car sharing use.

In order to statistically test the proposed model, a set of questions were computed as the sum of means for each scale.

In the previous section, transport mode choices were reported based on frequencies of use of each kind of transportation. In this section, car driving habits were measured by a set of statements aiming to assess the psychological and behavioural aspects of driving a car. The respondents selected on a Likert scale (*1 – Strongly disagree 7- Strongly agree*) to what extent they agree with the

statements. There were 8 statements such as *"I use the car without planning ahead"*, *"Driving a car saves time"*, *"I use the car without planning ahead"*.

A factor was computed from these 8 items to represent *"Car driving habit"*. The Scale presented an alpha (.905), showing strong validity. The KMO (Kaiser-Meyer-Olkin test) was also good .902, showing sampling adequacy. Using the method of Principal Component Analysis, one factor was extracted based on the Eigenvalues. The factor explains 60% of the variance and the items loadings on the factor are presented on the Table 11: Items loading on the Factor Car Driving Habit (CDH).

The factor *"Car driving habit"* was computed based om samples from all countries.

Component Matrix[a]	
	Component
	1
H3. It would require an effort for me not to use a car.	.861
H4. Using a car is part of my daily routine.	.849
H5. Using a car is something that I do automatically.	.792
H7. Driving a car saves time.	.785
H1. I feel strange travelling without a car.	.777
H6. I have been using a car for a long time.	.744
H8. Driving a car makes life easier.	.715
H2. I use the car without planning ahead	.687
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

Table 11: Items loading on the Factor Car Driving Habit (CDH).

The model showed statistical significance to explain behavioural intention to use car sharing. The R-squared for model 1 (only with control variables) was .061, while the model with behavioural and psychological variables (model 2) had the value of .468. R-square shows how much of the variance in Y (the dependent variable) is accounted by the model derived from the sample. It ranges from 0 to 1 and it is a measure of linearity that can be used to compare models. In this case, the full model (model 2) explain 46,8% of the variance in behavioural intention to use car sharing.

		age	sex	medium_ edu	high_ edu	low_in	high_ in	PBC	PU	SN	EU	Trust	EA	PN	Attitu de	CDH
Pearson Correlation	BI	-.210	-.007	.046	-.035	.113	-.121	.516	.596	.536	.316	.418	.216	.312	.439	-.105
	age		.032	.151	-.168	-.130	.053	-.146	-.153	-.186	-.155	-.066	-.100	-.114	-.131	.083
	sex			-.022	.026	-.146	.137	.000	-.040	-.017	.048	-.061	-.133	-.100	-.100	.057
	medium_ edu				-.974	.204	-.272	.024	.006	-.088	-.106	-.047	-.069	-.008	-.100	.140
	high_edu					-.210	.282	-.020	.006	.099	.120	.053	.082	.021	.113	-.148
	low_in						-.505	.053	.074	-.011	-.031	-.033	.039	.055	-.047	.028
	high_in							-.041	-.063	.037	.091	.050	-.035	-.071	.091	-.056
	PBC								.624	.489	.333	.372	.183	.236	.430	-.117
	PU									.552	.495	.514	.322	.344	.592	-.158
	SN										.385	.456	.296	.343	.594	-.150
	EU											.473	.274	.228	.499	-.186
	Trust												.361	.321	.656	-.124
	EU													.646	.444	-.289
	PN														.391	-.141
	Attitude															-.228
	CDH															1.00

Table 12: Correlation matrix for predictors and dependent variable.

In order to facilitate the interpretation of the regression model, the variables were dummy coded and mean centred. In doing so, "Age" can be interpreted in two levels (younger or older, with younger as the constant). "Sex" is also dichotomous (male or female, with female as the constant). "Education" was dummy coded in three levels (low, medium and high, with the low education as constant). "Income" was also dummy coded in three levels (low, medium and high, with medium as the constant).

All the other behavioural and psychological variables (PBC, PU, SN, EU, Trust, EA, PN, Attitude, CDH) were mean centred. In doing so, the standardized coefficients can be interpreted at mean levels. The coefficients give the amount of change in Y if there is a change in one unit in X, holding all the other variables at constant mean levels, $p < .05$. For example, in this model, one unit increased in Perceived Usefulness (PU) will account for 29.9% of increase in Behavioural intention to use car sharing (BI), holding all the other variables constant.

Model		Standardized Coefficients Beta	Sig.	95.0% Confidence Interval for B	
				Lower Bound	Upper Bound
1	(Constant)		.000	2.178	3.254
	Age	-.205	.000	-.898	-.670
	Sex	.017	.261	-.048	.175
	Medium edu.	.187	.004	.241	1.303

Model		Standardized Coefficients Beta	Sig.	95.0% Confidence Interval for B	
				Lower Bound	Upper Bound
1	High education	.144	.030	.058	1.117
	Low income	.039	.023	.023	.311
	High income	-.082	.000	-.447	-.183
2	(Constant)		.000	2.510	3.321
	Age	-.091	.000	-.435	-.260
	Sex	.035	.002	.048	.220
	Medium education	.083	.095	-.060	.741
	High education	.037	.465	-.251	.549
	Low income	.032	.013	.029	.246
	High income	-.074	.000	-.386	-.185
	Perceived Behaviour Control	.155	.000	.131	.191
	Perceived Usefulness	.299	.000	.287	.359
	Subjective Norm	.237	.000	.234	.300
	Ease of Use	-.033	.018	-.081	-.008
	Trust	.118	.000	.128	.217
	Environmental Awareness	-.084	.000	-.133	-.062
	Personal Norm	.102	.000	.079	.142
	Attitude	-.008	.642	-.062	.038
	Car Driving Habit	-.013	.289	-.068	.020

Table 13: Linear regression model to predict Behavioural Intention to use car sharing.

The following interpretations explain the effects of the predictors on the behavioural intention to use car sharing, holding all the other variables constant, with 95% confidence (p <.05):

- **Positive predictors**

Perceived Usefulness predicts positively the BI, increasing BI in 29.9%.

Subjective Norms predicts positively the BI, increasing BI in 23.7%.

Perceived Behaviour Control predicts positively the BI, increasing BI in 15.5%.

Trust predicts positively the BI, increasing BI in 11.8%.

Personal Norms predicts positively the BI, increasing BI in 10.2%.

Being male predicts positively the BI, increasing BI in 3.5%.

Low income predicts positively the BI, increasing BI in 3.2%.

Based on this model, we may affirm that for this sample, people's perception of self-efficacy and subjective norms are the main predictors of car sharing usage. Firstly, how people perceive the usefulness of car sharing services for their routines is the best predictor of intention to use it. The second strongest predictor is the perception of a social network which also approves and has positive attitudes towards car sharing. Perceived behaviour control, which means how much people perceive themselves under control to decide or having the ability to behave in a certain way, is the third main predictor.

- **Negative predictors**

  Being older predicts negatively the BI, decreasing BI in 9.1%.

  High income predicts negatively the BI, decreasing BI in 7.4%.

These two interpretations of the model may seem, at first sight, contradictory of what have been shown in the profiles from the Section 2.3.1. However, what the profiles are showing is the overall characteristics of users of car sharing. Here, in this model, it is possible to isolate the true effect of each variable when all the others are constant. It means that social bias are controlled and it is possible to measure the effect of each variable controlling for the others.

For example, being male, older, with high income, living in a certain area and showing a certain life status may positively predict car sharing use. However, only with the descriptive analysis, it is not possible to measure how much those variables are correlated to each other neither to which extent each of them explain choices regarding car sharing and transport behaviours.

With the linear regression model, it is possible to explain the extent of influence that each variable has on behaviour intention. Moreover, it is possible to explore the effects of psychological and behavioural variables that interact with the main demographical measures (age, gender, income and education).

- **Medium and high education, as well as Car Driving Habit are not predictors of BI.**

Once again, similarly to age, education by itself may not necessarily be a predictor of behaviour. Education is correlated, on average, with other social aspects as well, for instance, income, housing and number of children. The habit of driving is not a predictor of behavioural intention to use car sharing.

- **Special discussion should be given to the variables Attitudes, Environmental awareness and Ease of use.**

As one may see on the Table 12, while those variables had positive correlations with BI, they also had strong correlations with other variables, such as PU and Trust. When performed the regression, Attitudes, Environmental awareness (EA) and Ease of use (EU) presented a reverted direction and reduced effects on the BI. This is a case of statistical net suppression, which means that

the Xs variables are supressing the error variance on other predictors instead of correlating with the variance in Y (Friedman & Wall, 2005).

3 Case study in Flanders

The questionnaire for users and non-users of car sharing was distributed in a good number of European countries, and was discussed earlier in this deliverable. Specifically for the Flemish region, the northern, Dutch speaking part of Belgium, a number of extra questions were added to the general questionnaire (see APPENDIX 2). These additional questions should enable us to examine how car sharers in Flanders assess the services of different car sharing organisations.

Although a large number of car sharing organisations helped spread this survey, and Autodelen.net launched several calls via their newsletter and social media, the response for this online questionnaire was not overwhelming. However, the results provide interesting insights in the car ownership of car sharers and their evaluation of the service(s) they use.

3.1 Membership

More than four out of ten respondents indicate that they are member of Cambio (44%). Furthermore, respectively almost one quarter and one eighth are affiliated with Cozycar and Dégage. Partago is the fourth best represented organisation with 6 percent of the respondents being a member of the cooperative. The proportion of members of Bolides, Caramigo, Drivy, Poppy and Stapp.in is relatively small, varying between 2 and 3 percent, and the absolute number of respondents is also very low. This makes it difficult to make statements about these organisations. We will show figures in the tables and the answers of these respondents are included in the overall means, but we will not discuss them separately here. More information on the category of these car sharing organisations can be found in APPENDIX 2

Seven other organisations, most of them only active in Brussels and the southern part of Belgium (Wallonia), were not mentioned by respondents. Both regions were not part of the scope of this research, which explains the absence of their members in this sample.

It is interesting to see that a lot of respondents are member of several organisations at the same time. Almost half of the respondents reporting to be a customer of Cambio are also member of one or more other car sharing services. For Dégage, the rate is even higher. Slightly less than two thirds of their members are also affiliated to other organisations. For Cozycar, another organisation supporting small private car sharing groups, it's the other way round. Two thirds of their members only fall back on Cozycar for their journeys with a shared car.

3.2 Start of membership

Respondents who are customers of Cambio on average started their contract in 2013 (see Table 14). A more detailed look at the data shows there were peaks in the number of new memberships

between 2010 and 2012 (25% of all members), between 2014 and 2015 (21%) and especially between 2017 and 2018 (36%). More than one third of the respondents only became a Cambio-customer in the last two years.

	Bolides	Cambio	Caramigo	Cozycar	Dégage	Drivy	Partago	Poppy	Stapp.in
Average starting year of membership	2016	2013	2015	2014	2012	2018	2018	2018	2016

Table 14: Average starting year of membership (Flanders case study).

Respondents linked to Dégage and Cozycar respectively started their membership in 2012 and 2014. Together with the customers of Cambio, they have on average the longest 'track record'. Organisations that started operating more recently logically have on average less long memberships among their respondents.

3.3 Car ownership

We asked the respondents whether they own fewer cars since they started car sharing. On average, **almost two thirds of the respondents do not own fewer cars since they started car sharing.** Cambio has the highest percentage of customers who got rid of a car. Almost four out of ten owns fewer cars since they started using shared cars of Cambio.

On average one third and one fourth of the members of Cozycar and Dégage have less cars in their household than before their membership. It is important to notice both organisations support the sharing of private cars among individuals, so some of them still own one or more cars, but they might share them with neighbours, friends or family.

	Bolides	Cambio	Caramigo	Cozycar	Dégage	Drivy	Partago	Poppy	Stapp.in
Percentage of participants	0%	43%	0%	33%	25%	0%	0%	0%	0%

Table 15: Percentage of participants owning less cars since membership (Flanders case study).

It is not possible to make statements about the underrepresented car sharing organisations but all of these respondents answered that they retained their car(s).

The number of cars disappearing from the road due to car sharing is an important measure for governments in their policy regarding car sharing. The figures from this research in Flanders show that some of the respondents own fewer cars since they started car sharing.

Respondents were asked to indicate whether they got rid of a car since they started car sharing, but we don't know if they have refrained from purchasing an extra car after they have started car sharing. That would also be a very interesting indicator to measure the impact of car sharing. Further research will have to provide more insight into this.

3.4 Customer satisfaction

Once the respondents indicated to which car sharing service(s) they are linked, we asked them to evaluate these organisations on different aspects.

3.4.1 Overall service

On a scale between 1 (strongly dissatisfied) and 7 (strongly satisfied), the average satisfaction with the overall service of the car sharing organisations is 5.95. Nine out of ten respondents think the service they receive from the car sharing operator is above average.

Cambio and Dégage get the highest ratings (6.25). Almost all of their customers or members are (very) satisfied. The means for Cozycar and Partago are a bit lower, but still both organisations are evaluated predominantly positive.

	Bolides	Cambio	Caramigo	Cozycar	Dégage	Drivy	Partago	Poppy	Stapp.in	Total
Mean	5.00	6.25	4.00	5.60	6.25	6.00	5.25	6.00	6.50	5.95
>= 5	50%	96%	0%	87%	100%	100%	75%	100%	100%	90%

Table 16: Satisfaction with the overall service (Flanders case study).

3.4.2 Proximity of the cars

Three-fourths of the respondents are quite or very satisfied with the proximity of the shared cars. The differences between the organisations are bigger than in the previous aspect. Half of the members of Partago, for instance, are happy with the proximity of the cars, whereas the satisfaction level among customers of Cambio and members of Cozycar is around 90%. Dégage lies in between with a satisfaction of six out of ten members. A clear explanation for this difference in appreciation is hard to find but one can imagine the fact Partago just started and doesn't own a big fleet yet, might be a reason distances to shared cars are sometimes further away.

	Bolides	Cambio	Caramigo	Cozycar	Dégage	Drivy	Partago	Poppy	Stapp.in	Total
Mean	3.50	5.89	2.00	5.60	5.38	4.00	4.75	4.50	6.50	5.49
>= 5	0%	88%	0%	87%	62%	0%	50%	50%	100%	76%

Table 17: Satisfaction with proximity of the cars (Flanders case study).

3.4.3 Ease of use of the cars

The satisfaction about the ease of use of the cars is high. More than 80% of the respondents indicate that they are (very) satisfied. The differences between the organisations are not that big, and can't be explained by the category to which the organisations belong.

	Bolides	Cambio	Caramigo	Cozycar	Dégage	Drivy	Partago	Poppy	Stapp.in	Total
Mean	4.00	6.14	1.00	5.47	5.50	3.00	5.50	5.50	6.50	5.65
>= 5	50%	96%	0%	80%	74%	0%	75%	100%	100%	84%

Table 18: Satisfaction with ease of use of the cars (Flanders case study).

3.4.4 Cost price of the service

Almost seven out of ten respondents are quite or very satisfied about the cost price of their car sharing provider. A clear distinction can be found between two groups of organisations. Dégage and Cozycar, offering private car sharing in closed community groups, get the highest scores. Both systems only use a price per kilometer that is purely based on real costs. The rates for Cambio and Partago are (slightly) lower, probably partly due to the time aspect that plays a role in their pricing model.

	Bolides	Cambio	Caramigo	Cozycar	Dégage	Drivy	Partago	Poppy	Stapp.in	Total
Mean	3.50	5.14	2.00	5.80	6.63	2.00	4.50	4.00	4.50	5.24
>= 5	0%	72%	0%	80%	100%	0%	50%	0%	50%	68%

Table 19: Satisfaction with cost price of the service (Flanders case study).

3.4.5 Flexibility of the service

Services are all evaluated (very) positively when it comes to the flexibility of their service. More than eight out of ten respondents are satisfied with the way in which the car sharing schemes deal flexibly with (unexpected) situations.

	Bolides	Cambio	Caramigo	Cozycar	Dégage	Drivy	Partago	Poppy	Stapp.in	Total
Mean	3.00	5.68	2.00	5.60	5.13	6.00	5.50	6.50	5.50	5.46
>= 5	0%	89%	0%	87%	74%	100%	75%	100%	100%	83%

Table 20: Satisfaction with flexibility of the service (Flanders case study).

3.4.6 Offer of cars with alternative fuels

Finally, the satisfaction with the offer of cars with alternative fuels is not unanimous. On average less than half of the respondents are satisfied with the level of the shared cars with alternative fuels. On the one hand, members of Partago are unanimously very satisfied, presumably related to the fact the scheme only has fully electric cars. On the other hand, members of Cambio and Dégage are indicating neither to be satisfied nor to be dissatisfied with the offer. The members of Cozycar, finally, are least enthusiastic about the ecological impact of the cars they share. Only 14% is satisfied.

	Bolides	Cambio	Caramigo	Cozycar	Dégage	Drivy	Partago	Poppy	Stapp.in	Total
Mean	3.50	4.39	1.00	3.29	4.25	4.00	7.00	6.50	3.00	4.23
> = 5	0%	50%	0%	14%	50%	0%	100%	100%	50%	44%

Table 21: Satisfaction with the offer of cars with alternative fuels (Flanders case study).

To conclude, the Flemish car sharers are most satisfied with the general service of the operator, the ease of use of the cars and the flexibility of the service provider. When the offer of more cars with alternative fuels increases in different systems, the level of satisfaction could still increase.

4 Case study from URBI data in Berlin, Milan, Turin and Madrid

4.1 Introduction

The following section is focused on understanding behavioural patterns of car sharing users in 4 main European cities. Based on URBI data (STARS H2020 advisor member), we had the possibility to analyse and compare two months of anonymized data from different car sharing operators. Considering previous users profiles classification, users of this analysis are mainly under *Profile 1*: free-floating car sharing system.

This section has the following two aims:

- To verify the length of CS rental, average trips per car,
- To verify if there are any trends in users' reservation (peak hours, differences between week days and weekends);

The 4 cities concerned in the evaluation are Berlin, Milan, Turin, and Madrid. All four cities have been selected for the in-depth research (Deliverables 2.1 and 2.2). A fifth city was Barcelona, but URBI could have shared data for scooter sharing users only -excluded from the current analysis for this reason. Finally, due to the nature of the data collected, the age and sex information were not available: it would have permitted a comparative analysis with section 2, 3 and 5 results in term of users' behaviours.

4.2 CS operators fleet sizes, and number of trips per city

The period of analysis covers the following two months: April and May 2018, while the car sharing operators involved in our discussion are listed in the table below:

City	Car Sharing Operators
Berlin	Car2Go, DriveNow, Driveby
Milan	Car2Go, DriveNow, Enjoy, Share 'n Go
Turin	Car2Go, Enjoy
Madrid	Car2Go, Emov, Zity

Table 22: List of car sharing operators per city (URBI case study).

Regarding car sharing operators, we verified the fleet size for each operator. The data provided by URBI are aggregated, without the possibility to clearly distinguish neither male/female trends in renting shared vehicles, nor electric fleet used for the cities of Berlin and Milan (cities in

which providers propose also pure electric vehicles among their fleets, or is 100% electric such as Share 'n go). The comparison in term of propulsion can be done only for Madrid: in the Spanish capital the selected providers propose only BEVs (e-smart for Car2Go, Citroen C-Zero for Emov, and Renault Zoe for Zity). In the table below, 100% electric fleets have been heighted in orange:

	Berlin	Milan	Turin	Madrid
Car2go	1100	800	400	500
DriveNow	1400	500		
Driveby	30			
Enjoy		650	250	
Share 'n Go		500		
Emov				600
Zity				500
TOT.	**2530**	**2450**	**650**	**1600**

Table 23: Fleet size by city and by car sharing operator (URBI case study).

Based on URBI data, the months of April and May 2018 registered the following records regarding the average fleet size, the total trips and the average duration of each trip:

	Average Fleet Size		Total Trips per month		Average Trip duration in Min	
	APRIL	**MAY**	**APRIL**	**MAY**	**APRIL**	**MAY**
Berlin	2.440	2.359	392.842	395.314	39,61	40,29
Milan	2.170	2.134	435.313	461.587	31,34	31,67
Turin	637	650	132.562	143.018	24,91	25,61
Madrid	1.453	1.456	361.240	364.889	35,48	34,99

Table 24: average Fleet sizes, total trips in April & May '18, and average duration of each trip in minutes (URBI case study).

From Table 24 it can be noticed that the biggest fleet size is in Berlin with an average of roughly 2.400 vehicles available in the city during the observed months. Berlin users are also driving for a longer duration in both months: almost 40 minutes per each rent, while only Madrid tries to close the gap with 35 minutes. If we compare the duration of free-floating schemes with a station-

based program, we can immediately see the huge difference among the two categories: in Flinkster, the average duration is 472.99 minutes (almost 8 hours). This huge difference is easily explicable by the high price and the limitations in operational area free-floating cars are nearly exclusively used for short inner-city trips. On the other hand, station-based cars are also used for longer trips and out-of-town journeys.

Another element to be underlined is that Milan showed the highest total trips in both months even though the average fleet size is smaller than Berlin. **On the other hand, if we put in relation fleet sizes and total trips per each city, we discover that every vehicle available in Madrid is rented 8 times a day (as showed in Table 25 below): 3 rentals more than Berlin – with the lowest score among the four cities.**

	Av. Trip per car/day	
	APRIL	**MAY**
Berlin	5,37	5,41
Milan	6,69	6,98
Turin	6,94	7,10
Madrid	8,29	8,08

Table 25: Average trips per car per day (URBI case study).

Car2Go declared in a press release dated January 11th, 2018 the following information: the "greatest rentals growth rates [in 2017] were achieved in Milan (plus 678,000 rentals), Berlin (plus 622,000 rentals) and Hamburg (plus 454,000 rentals)" (Car2Go, 2018). Considering the declared Car2Go fleet in Milan and Berlin, every Car2Go vehicle was booked only 2,32 time per day on 2017; in Berlin even less: just 1,55 times per day. A very low score compared to the aggregate data retrieved from URBI during April and May 2018[7].

4.3 Reservation distributions and peaks' hours

Focusing now on users' reservation trends, we verified if users prefer driving during week days or during weekends & holidays. It is interesting to notice that in Berlin, users prefer renting shared vehicles during their weekends (and/or holidays) with a difference of even 3'000 trips less (on

[7] From a CS operator point of view, the average trip per day and average time of each trip can provide the saturation. All 4 cities show a higher saturation compared to the average saturation of a private car as underlined in previous deliverables (around 5-10% for a private car). Madrid recorded the highest score -with a saturation of 20% in April and 19.5% in May 2018. Berlin, Milan and Turin scored 14.5%, 14.7%, 12% (April '18), and 14.8%, 15.4% and 12.6% (May '18) respectively.

average) than during week days. At the opposite Madrid showed a more intensive use of its full electric fleet during week days. Details are presented in the tables below:

APRIL	Av. Trips per day			Av Trips per day per car	
	Trips	Week Days	W-E / holydays	Week Days	W-E / holydays
Berlin	392.842	11.386	14.358	5,06	5,88
Milan	435.313	15.015	13.500	6,83	6,42
Turin	132.562	4.771	3.714	7,42	5,92
Madrid	361.240	13.020	9.971	8,97	6,90

Table 26: Average trips per car per day during week day and weekends in April 2018 (URBI case study).

MAY	Av. Trips per day			Av Trips per day per car	
	Trips	Week Days	W-E / holydays	Week Days	W-E / holydays
Berlin	395.314	12.051	14.465	5,02	6,43
Milan	461.587	15.028	14.553	6,99	7,11
Turin	143.018	4.857	4.017	7,38	6,40
Madrid	364.889	12.640	9.646	8,65	6,67

Table 27: Average trips per car per day during week day and weekends in May 2018 (URBI case study).

Finally, we can also verify the peak hours for each city. The hourly distribution is similar on all selected cities (see Figure 46, Figure 47, Figure 48, and Figure 49): around 6am and 7 am users start reserving and renting CS vehicles. **Madrid a Turin stand out with a first "morning peak" in term of rental distribution compared to Berlin and Milan.**

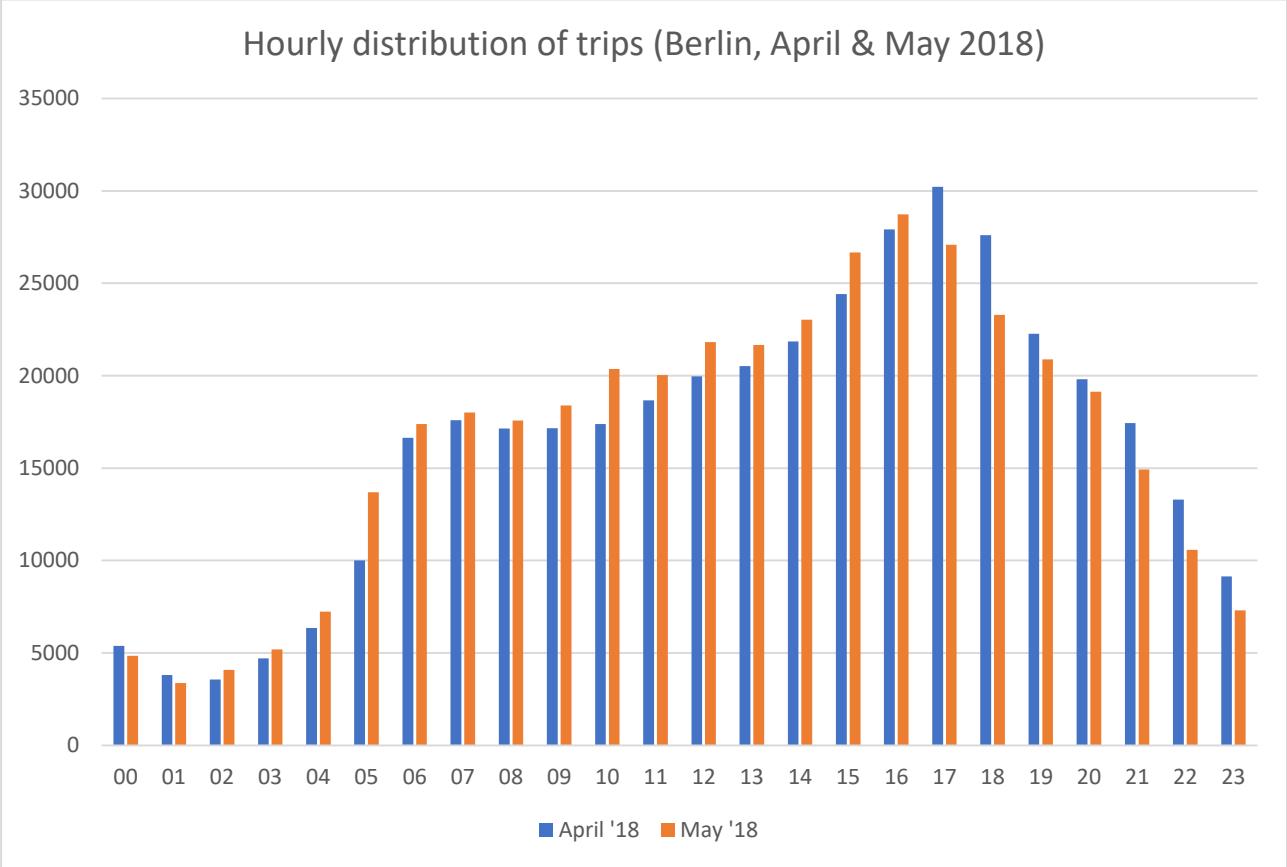

Figure 44: Hourly distribution of trips, Berlin, April & May 2018.

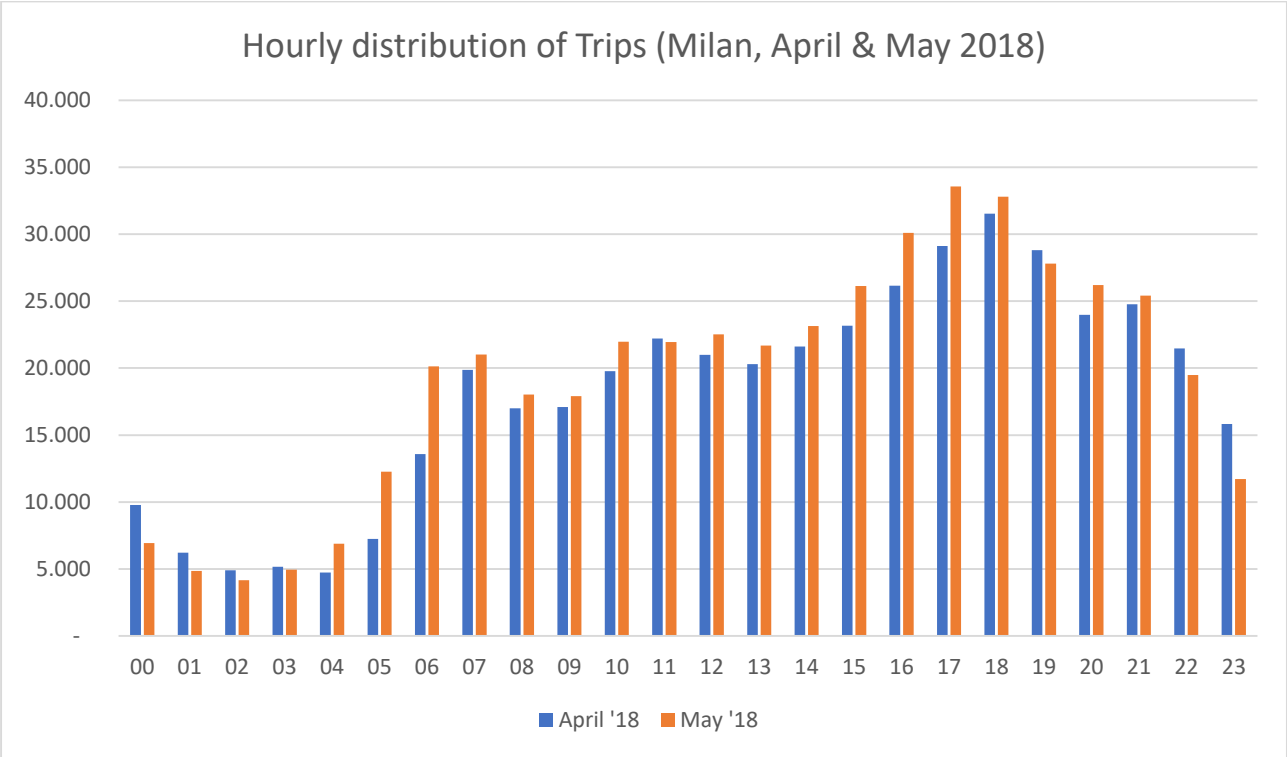

Figure 47: Hourly distribution of trips, Milan, April & May, 2018.

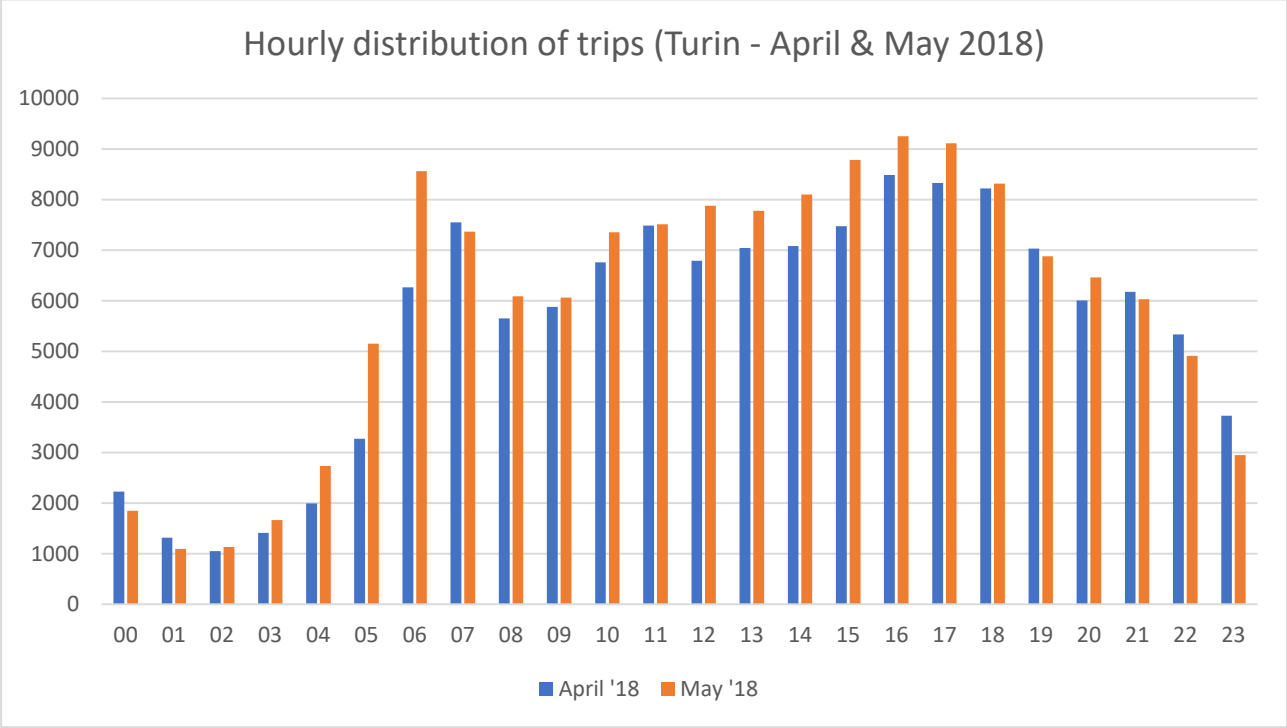

Figure 45: Hourly distribution of trips, Turin, April & May, 2018.

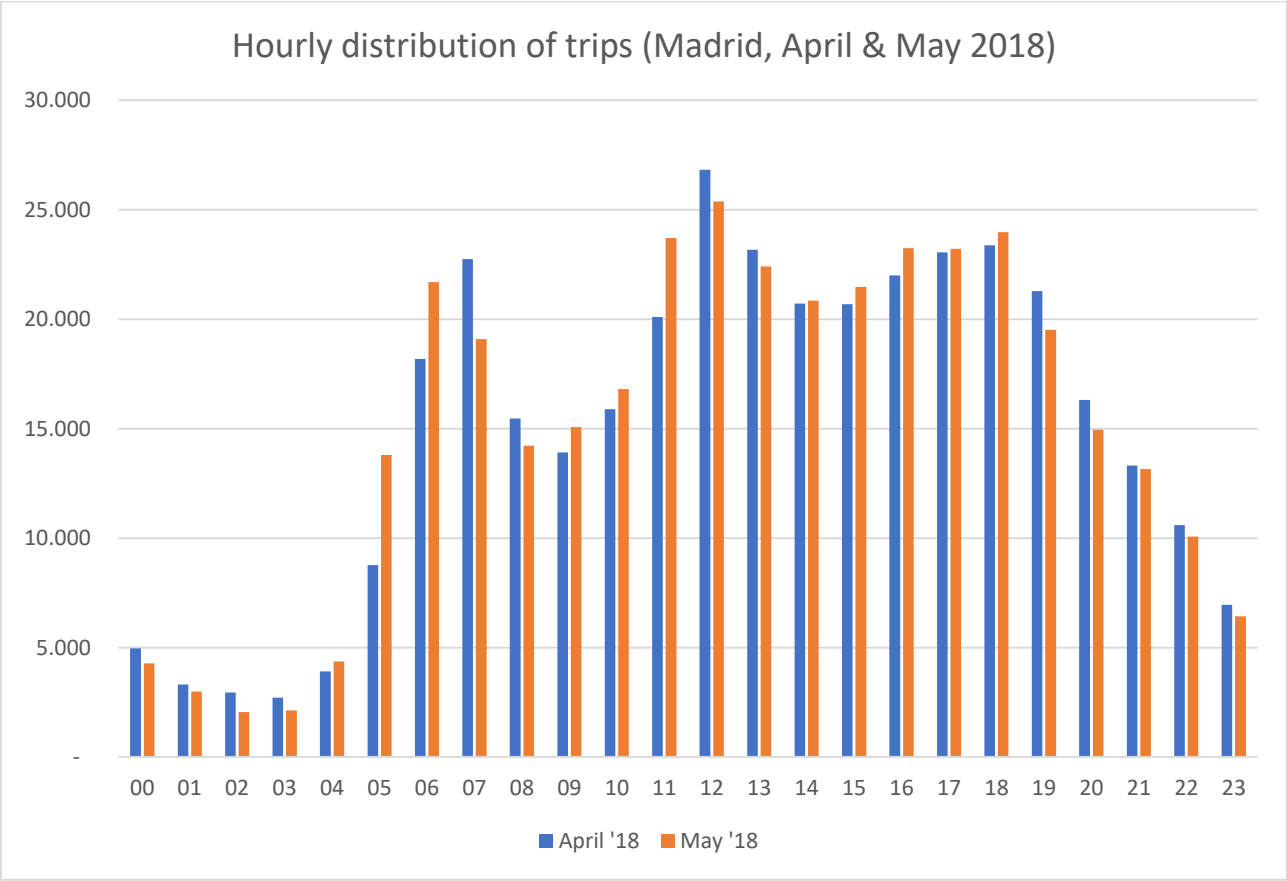

Figure 46: Hourly distribution of trips, Madrid, April & May, 2018.

We also aggregated the hourly average reservation peaks of both months to better compare the 4 cities. The tendency showed in Figure 49 below is characterized by a slow reservation growth from 6-7am until the peaks at the end of the afternoon (from 5am to 6pm where normally traffic congestion is at its maximum), before a more accelerated decline. Only Madrid has a different trend with its highest peak at midday.

During the night (from 1am to 4am), all cities recorded low reservations and trips: this phenomenon is explicable by fleet management operations such as cleaning, refuelling (and/or recharging), and fleet replacement. On average, the fleet available during nights in all 4 cities may decrease up to 70-75% of the overall fleet.

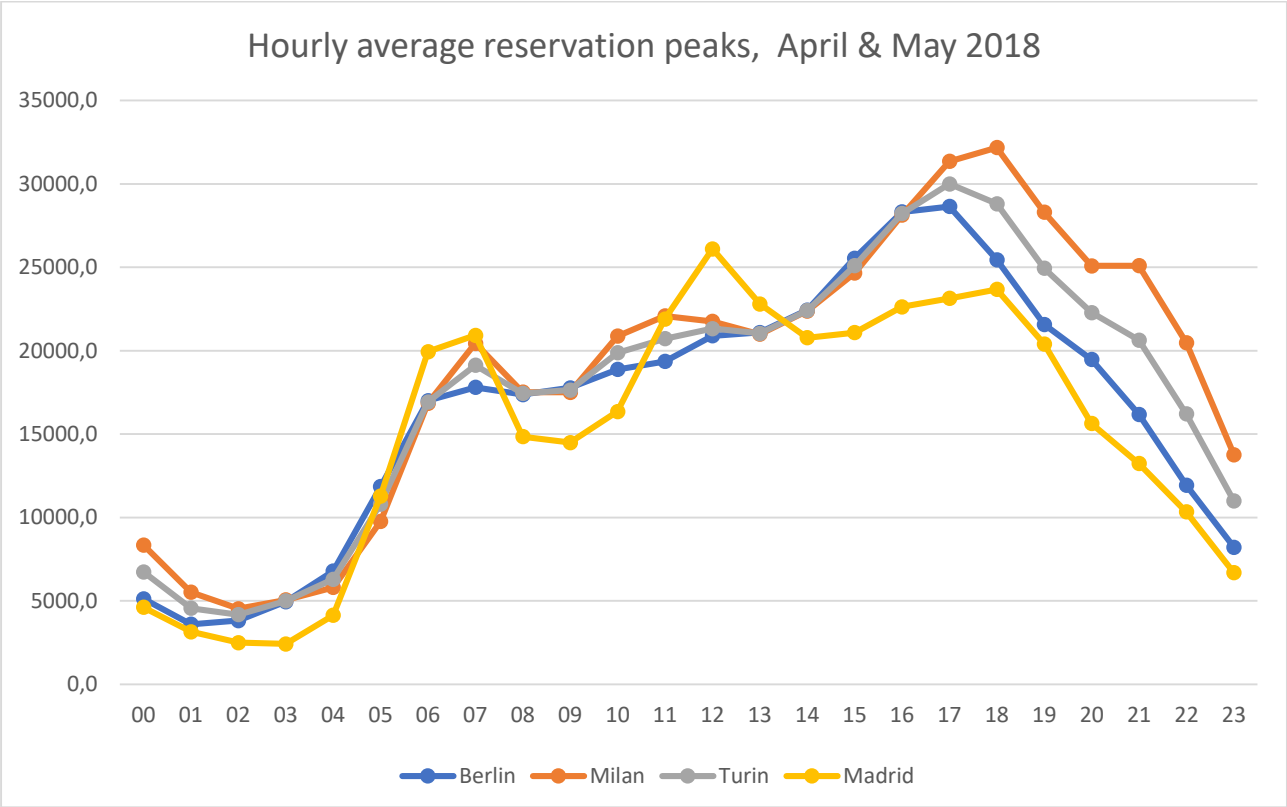

Figure 47: Hourly average reservation peaks; all cities in April/May, 2018.

4.4 Conclusion

The analysis based on URBI data provides some information on how (mainly) free-floating users behave in the selected 4 cities.

A first result provided by the analysis (even though URBI data did not cover the entire CS offer in all cities), is that users' in Madrid enjoy driving full electric vehicles. **Users' in Madrid tend to rent more frequently electric CS vehicles than their peers in Berlin, Milan and Turin**. Further analysis may try to demonstrate if users choose an electric shared vehicle based on their personal ecological convictions or for a pure commercial offer.

Another output concerns the success of CS proposals in those cities. Although URBI data was not granular enough to determine the age of CS users and that not all CS providers have been included in their analysis (such as BlueTorino, Respiro, or Ubeeqo), both months recorded roughly 1.35 million trips. Further studies and analysis may confirm CS growth in major European cities, and if it may have (disruptive) impacts on public transport.

5 Case study in Germany

5.1 Approach and aim of the case study

The case study has two aims:

a. It should enable a better understanding of how different car sharing-variants[8] are used, which target groups they appeal to, and which effects they have on mobility behaviour.

b. It should illuminate differences evident between current users and non-users of car sharing.

As regards (a.), the result of the study is a characterization of car sharing users, based on different car sharing-variants. As regards (b.), the result is a characterization of the differences between car sharing users and non-users, and an assessment of the importance of these differences for the explanation of participation or non-participation in car sharing. In both cases the study takes into account sociodemographic features, use of transportation modes, attitude towards various modes, attitude towards the theme "environment and car" and political attitude quite generally. With regard to car sharing users, closer consideration is also given to the effects of car sharing upon the use of transportation modes and the satisfaction with car sharing.

A distinct feature of this case study is that it relates to select city neighborhoods in three German metropoles. This limitation was set for two reasons:

- Car sharing is – although enjoying considerable media attention at the moment – still a niche market. Even in individual cities the supply with car sharing offers is not uniform and car sharing-variants are not equally available everywhere. A comparative analysis conducted in a city area all too large would be severely distorted by this circumstance, for the respondents would very likely not have equal access to all the car sharing-variants.
- For mobility behaviour it makes a great difference, in what kind of urban space each respondent lives and which prerequisites for the use of different transportation modes are to be found there. That also plays an important role for the use of car sharing. Because car sharing is a service which, supplementing other modes, is used in the framework of multimodal traffic behaviour. The less homogenous the examined area is with regard to these boundary conditions, the more difficult it is to interpret statements about the use of car sharing correctly.

For these reasons the following study is limited to a homogenous subsection of urban space: residential areas near city centers which enjoy a very good provision of all the car sharing-variants, a very good provision of public transport, have a high building densification and a mixture of

residential and commercial use. Within these controllable parameters, both the differences between car sharing users and the differences with the non-users can be best understood.

5.2 Description of the areas under investigation

The investigation areas lie in the cities of Frankfurt on the Main, Cologne and Stuttgart. They were - together with areas in nine other German cities – already identified in 2015 along with the car sharing providers operating there. The aim was to spot the city areas with the best provision of car sharing, the highest density of car sharing clients and an optimally developed offer of public transport. The precise delimitation of each area was made on the basis of postal delivery areas. Three areas of investigation were sorted out for the present study:

- Frankfurt: postcodes 60385, 60316, 60318
- Cologne: postcodes 50937, 50539
- Stuttgart: postcodes 70176, 70193, 70197

These are all inner city areas with an above average population density and an urban, multi-use structure (with housing, shopping and workplaces all in the same quarter). The districts are characterized by diverse mobility options. Besides car sharing, there are bus, tram and subway stations which are accessible to residents at a short distance. The offer is partially complemented by bike- and scooter-sharing. In the urban quarters there is a high competition for street space. This is true for both, parking and flowing traffic.

Concerning the car sharing offer, the areas under study represent the optimal existing situation today. The results of this study have to be understood accordingly: They show how car sharing users and non-users behave under the best-case conditions for multimodal mobility. That pertains especially to all the results relating to the use of transportation modes and car sharing.

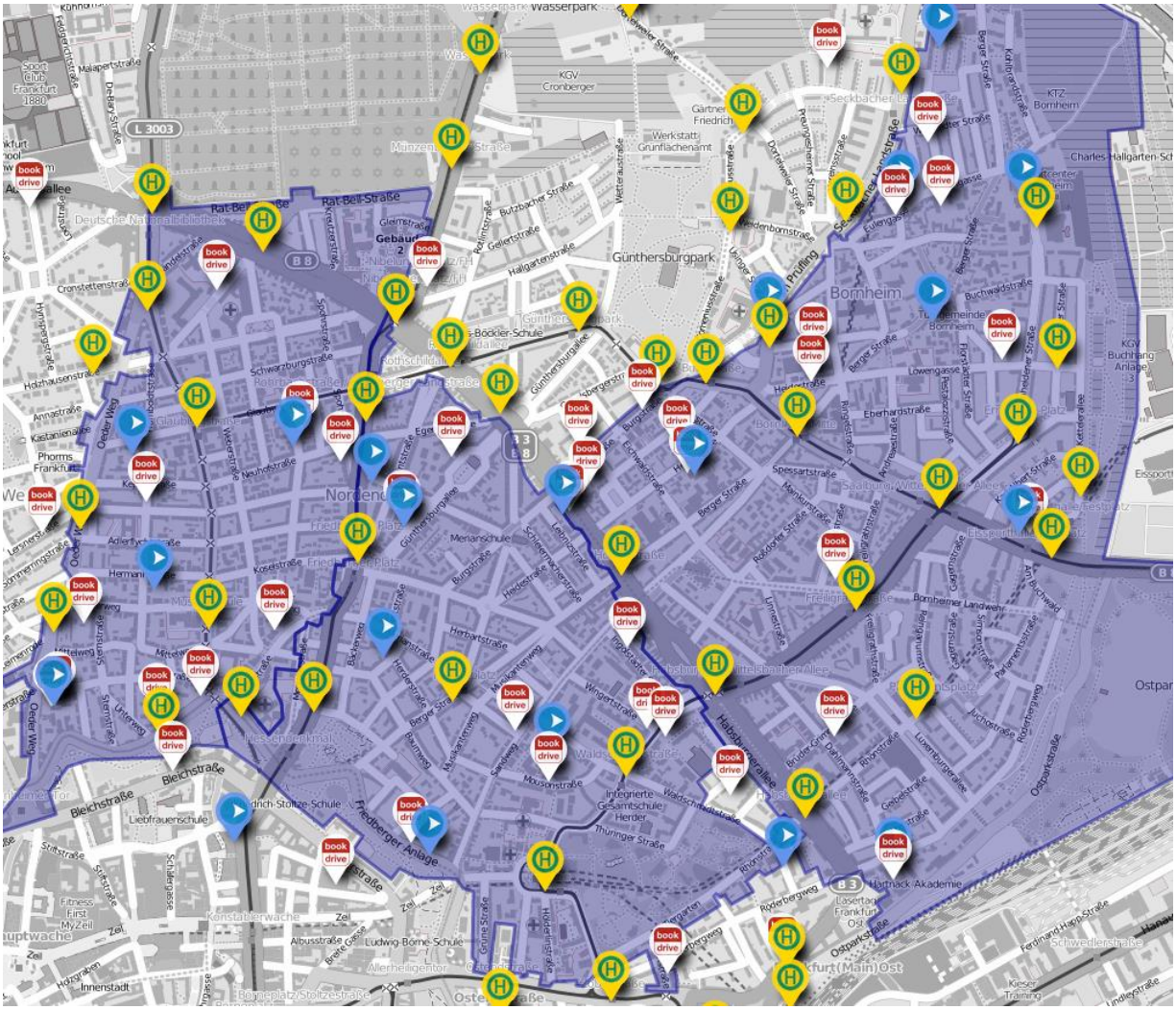

Figure 48: Example area of analysis Frankfurt on the Main: Car sharing stations and public transport stops

Figure 49: Example area of analysis Frankfurt on the Main: High use competition, high parking pressure

5.3 Description of the survey

The data of the study was gathered with the help of an online-survey. In the course of this, car sharing users were asked separately from non-users. Car sharing users from the predetermined postal code districts were invited to take part in the survey by a car sharing provider, of whom they were a client at the time of the survey. The following car sharing providers invited their clients to the survey:

Operator	Car sharing variant	Town
cambio	Roundtrip car sharing, station-based	Cologne
stadtmobil	Roundtrip car sharing, station-based	Frankfurt, Stuttgart
car2go	Free-floating car sharing with operational area	Frankfurt, Cologne, Stuttgart
book-n-drive	Combined car sharing (Roundtrip, station-based + free-floating with operational area and pool stations)	Frankfurt
Drivy	Peer-to-peer car sharing	Frankfurt, Cologne, Stuttgart

Table 28: Car sharing operators who took part in the German case study

Other providers also operating in some of the study areas, such as Flinkster (roundtrip, station-based), Scouter (roundtrip, station-based), DriveNow (free-floating with operational area) and SnappCar (peer-to-peer), did not take part in the study.

Identification of clients residing in the areas of study was done by car sharing providers. The providers were asked not to include users who were clearly identifiable as entirely commercial customers or company employees. The aim was to focus exclusively on private households.

Peer-to-peer providers were asked, additionally, to contact only those clients who themselves do not offer their private cars via the online platform. In this way those households were kept out of the survey data which in reality do not represent car sharing clients, but rather private car sharing providers.

Altogether some 14,858 clients of the car sharing-variants roundtrip, combined, free-floating and peer-to-peer were contacted in the areas of the study. The survey was answered by 1,122 clients. 822 questionnaires were filled out completely.

The number of peer-to-peer car sharing clients to be contacted in the areas examined was 208, and thus relatively low. Only 11 clients answered the questionnaire. To generate a higher number of responses, another 11,124 clients of the provider were contacted in a second wave on a nationwide level. Here 191 clients answered the survey. Thereby a sufficient quantity of answers was generated.

In the interpretation of the corresponding results it needs to be taken into consideration that these survey data do not primarily stem from the defined areas of study or from comparable urban spaces.

Car sharing non-users were contacted with the help of an address data record which contained the postal addresses of 7,844 private households from the defined areas of study. These households received a white mail invitation from the Bundesverband Car sharing e.V. (bcs) to take part in the survey. The data set contained no persons less than 18 years of age, so that only potential car sharing clients would be involved.

In the questionnaire for non-clients two filter questions were placed at the outset. Persons who indicated here that they possessed no driver's license and/ or were already registered with a car sharing provider, were not admitted to participate in the survey. Some 185 non-users answered the survey. 182 questionnaires were filled out completely.

5.3.1 Data analysis and statistical significance

In the analysis of the survey data we partly rely on mean values of approval or disapproval to statements and questions presented to car sharing users and non-users. If we report differences between mean values of different groups in the text, an ANOVA test has been performed to check for statistical significance. The results of all ANOVA tests are presented in Appendix 6.

5.4 Results: Users and mobility behaviour in different car sharing variants

5.4.1 Structure of user groups

For the analysis of car sharing user groups, a distinction was first drawn between users who are only registered with one car sharing-variant and users who are registered with multiple variants. Then within the latter group various combinations of car sharing-variants were differentiated. This resulted in the following car sharing user groups:

Users of one car sharing variant	**Only roundtrip**
	Only free-floating
	Only peer-to-peer
	Only combined
Users of two car sharing variants	Roundtrip + free-floating
	Roundtrip + peer-to-peer
	Free-floating + peer-to-peer
	Combined + roundtrip
	Combined + free-floating

	Combined + peer-to-peer
Users of three car sharing variants	Roundtrip + free-floating + peer-to-peer
	Combined + roundtrip + free-floating

Table 29: Car sharing user groups (German case study).

Of the respondents some 66.6 % are registered with only one car sharing-variant. One third of the respondents (33.4 %) are registered parallel with two or more variants. Among multiply registered users, particularly the combination "roundtrip + free-floating" stands out (14 %). All the other combinations of car sharing services appear in only a small number of cases.

The users of combined car sharing systems, which have one provider for roundtrip and free-floating vehicles, and the users registered with many different car sharing-variants have to be distinguished. Although both user groups combine car sharing-variants, our evaluation shows that they differ from one another quite clearly. In the following we speak of users of "combined car sharing" on the one hand and on the other hand of "multiple users" or "parallel users."

Car sharing users, main groups	number of respondents	% of respondents
Only roundtrip	269	24.0 %
Only free-floating	190	16.9 %
Only peer-to-peer	131	11.7 %
Only combined	157	14.0 %
total	747	66.6 %
Roundtrip + free-floating	159	14.2 %
Roundtrip + peer-to-peer	15	1.3 %
Free-floating + peer-to-peer	64	5.7 %
Combined + roundtrip	38	3.4 %
Combined + free-floating	33	2.9 %
Combined + peer-to-peer	2	0.2 %
total	311	27.7 %
Roundtrip + free-floating + peer-to-peer	30	2.7 %
Combined + roundtrip + free-floating	34	3.0 %
total	64	5.7 %

Table 30: Classification of the respondents in car sharing user groups (German case study).

This study undertakes the more precise identification of the differences between the users of various car sharing-variants. When we take into account the case figures in each group, this is quite possible for all users registered with one car sharing-variant. It is also possible for users who are

registered in parallel with roundtrip and free-floating car sharing. For other car sharing users registered with multiple variants, differences in the survey can be regarded merely as indications, for here the number of cases is in part quite small. The combination of variants "combined + peer-to-peer" and "roundtrip + peer-to-peer" was not analysed any further for the very small number of cases in this groups.

5.4.2 Social demographics of car sharing users

5.4.2.1 Age and gender

The average age of all car sharing users is 46 years. Considering the individual user groups, clients of combined and of roundtrip car sharing-variants have the highest average age (50 and 49 years). Users of free-floating car sharing are on average ten years younger (39 years). This could well be attributable to the comparatively higher proportion of students in this group. Users of peer-to-peer car sharing with an average age of 45 lie in the middle between roundtrip and combined car sharing on the one hand and free-floating car sharing on the other.

The proportion of men among car sharing users lies at 56.3 %. It thereby lies above the average in the total population of examined cities (48 %). This finding confirms the results of the study from 2016.[8] Yet it does not coincide with the studies WiMobil and EVA-CS, which both find that the proportion of men among car sharing clients lies between 70 and 80 percent.[9]

The proportion of men among the free-floating clients is, according to the present data, at 54.5 % rather low. The study share had determined for car2go a male ratio here of 67 %.[10] Whether the difference is caused by the relatively small size of the present sample or through the concentration on a particular survey area, cannot be determined. It is notable that the male proportion among car sharing users who are registered parallel with multiple variants, is clearly above average in almost every case. Multiple registering seems rather to be a domain of men.

	Average age	% of men	*n=*
Car sharing users	46	56.3 %	*1,122*
Main groups			
Only roundtrip	50	51.9 %	*269*
Only free-floating	39	54.5 %	*190*
Only peer-to-peer	45	53.2 %	*131*
Only combined	49	42.8 %	*157*
total	46	50.8 %	*747*

[8] bcs (2016)
[9] WiMobil (2016), EVA-CS (2015)
[10] share (2018), p.20

	Average age	% of men	*n=*
Roundtrip + free-floating	47	66.9 %	*159*
Free-floating + peer-to-peer	39	71.4 %	*64*
Combined + roundtrip	47	64.7 %	*38*
Combined + free-floating	39	50.0 %	*33*
total	44	65.3 %	*309*
Roundtrip + free-floating + peer-to-peer	40	82.1 %	*30*
Combined + roundtrip + free-floating	46	65.5 %	*34*
total	43	74.6 %	*64*

Table 31: Age and gender of car sharing users (German case study).

5.4.2.2 Household size and children

The average household size of the respondents is 2.14 persons. The households thereby resemble those of the three cities as a whole (2.18).[11] It is noteworthy that there are more persons in households which use peer-to-peer car sharing than in other car sharing households. It fits that these households are also among those in which children are most frequently found.

On average there are children living in 26 % of the households interviewed. There are nevertheless clear differences between the variants: In only 14 % of the households which use free-floating there are children living. For other variants it is nearly one third that has children. The users of multiple variants have - as a tendency - more children in their household than those who use only one variant.

	Average household size (persons)	% of households with kids	*n =*
Car sharing users	2.1	25.7 %	*1122*
Main groups			
Only roundtrip	2.1	26.4 %	*269*
Only free-floating	2.0	13.7 %	*190*
Only peer-to-peer	2.3	29.0 %	*131*
Only combined	2.1	29.3 %	*157*
Roundtrip + free-floating	2.2	28.9 %	*159*
Free-floating + peer-to-peer	2.4	32.8 %	*64*
Combined + roundtrip	2.2	26.3 %	*38*
Combined + free-floating	2.2	27.3 %	*33*

[11] Data for the cities as a whole (Frankfurt aM, Köln, Stuttgart) from population census 2011

	Average household size (persons)	% of households with kids	*n =*
Roundtrip + free-floating + peer-to-peer	2.4	36.7 %	*30*
Combined + roundtrip + free-floating	2.0	17.6 %	*34*

Table 32: Household size and proportion of households with children among car sharing users (German case study).

5.4.2.3 Education

Car sharing clients have an academic background much more often than the general population. A number of other studies have already supported this finding.[12] The present study confirms this: 72 % of respondents have a university degree. Another 17 % have not in fact studied, yet possess the general certificate for entrance to a university. By contrast only 9 % have a middle school certificate.

Respondents in possession of a less high educational level are rare among car sharing users (1.6 % main school, 1 % not applicable). By comparison: In the three entire cities the rate of persons with a main school degree lies at 30 %, whereas only around 40 % of the entire population has a certificate for entrance to university.[13]

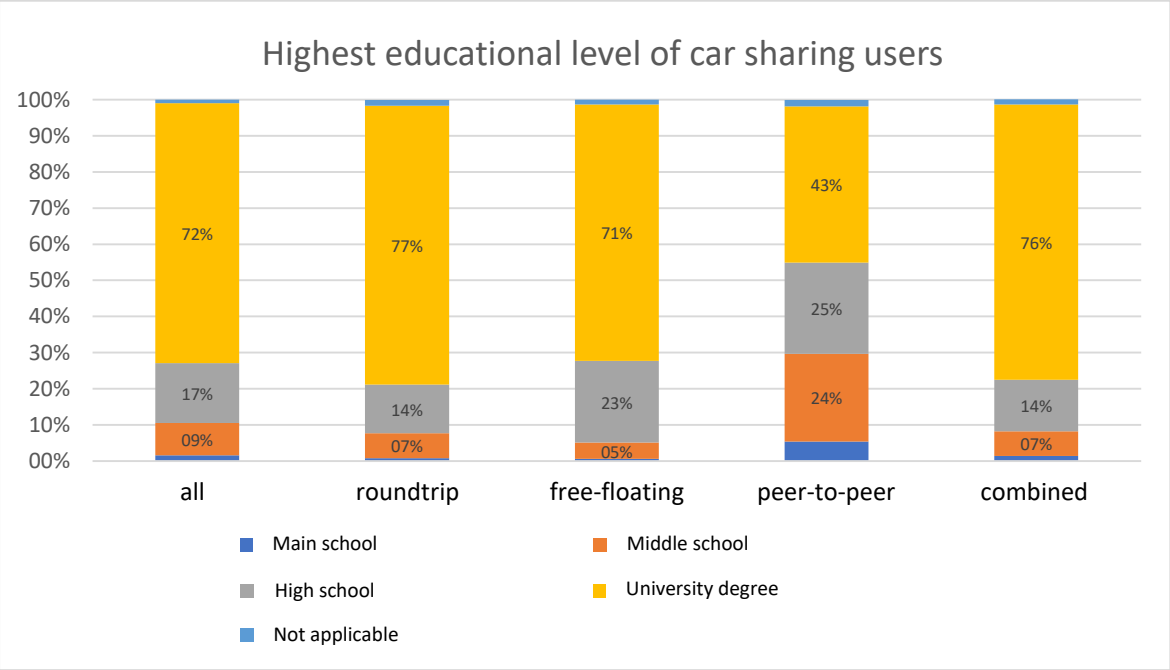

Figure 50: Education level of car sharing users (German case study).

This picture of an above average level of education is also visible in respect to the diverse user groups - with one exception: 'Only' 43.2 % of the peer-to-peer users have a university degree, 24.3 % a middle school certificate and 5.4 % have visited main school. Peer-to-peer car sharing seems

[12] WiMobil (2016), EVA-CS (2015), ifmo (2016), Multimo (2015), bcs (2016)
[13] Data for the cities as a whole (Frankfurt aM, Köln, Stuttgart) from population census 2011

in part to appeal to user groups, which are up to now not much present in other car sharing variants. This could be linked to users who are not seeking an everyday alternative to a private vehicle, but use a car only in very rare cases. This is suggested by the use data on these variants: Peer-to-peer users indicate to use the service once every half year or less often. This distinguishes them from all other car sharing user groups, who use car sharing more often.

	Average education index (high education = high index; maximum = 5,0)	% of respondents with university degree
Car sharing users	4.6	71.9 %
Main groups		
Only roundtrip	4.6	77.1 %
Only free-floating	4.6	71.0 %
Only peer-to-peer	4.0	43.2 %
Only combined	4.6	76.2 %
Roundtrip + free-floating	4.7	76.4 %
Free-floating + peer-to-peer	4.4	66.1 %
Combined + roundtrip	4.8	85.3 %
Combined + free-floating	4.6	78.6 %
Roundtrip + free-floating + peer-to-peer	4.8	82.1 %
Combined + roundtrip + free-floating	4.8	82.8 %

Table 33: Education level of car sharing users (German case study).

5.4.2.4 Job and income

Almost all car sharing users are employed or self-employed (87.4 %). In the three cities the employment rate lies significantly lower, namely at 56 %.[14] 71.1 % of car sharing users have a regular salaried position. The percentage of self-employed persons lies at 16.3 %. 5.7 % of respondents are presently undergoing training, by which a university education is almost exclusively the case. Only 7.0 % of those questioned indicated being neither employed nor in a training program.

It is noticeable when comparing car sharing user groups that the free-floating variant has considerably more students among their clients than all the other variants (12.3 %). At the same time there are practically no unemployed persons (0.6 %). The last finding is not surprising in view of the higher prices of free-floating car sharing relative to other car sharing-variants.

[14] Data for whole cities from study „best for planning"; cited according to share 2018, S. 20

Noticeably the peer-to-peer variant is being used by fewer employees (60.4 %) than other variants, whereby the percentage of self-employed individuals is higher. As regarding to the level of education, it can be recorded here, that the peer-to-peer variant appeals to a different socio-demographic group than other variants.

	employed	self-employed	in education (school)	in education (university)	not working, not in education
Car sharing users	71.1 %	16.3 %	0.9 %	4.8 %	7.0 %
Main groups					
Only roundtrip	73.9 %	13.9 %	0.0 %	2.4 %	9.8 %
Only free-floating	69.0 %	16.1 %	1.9 %	12.3 %	0.6 %
Only peer-to-peer	60.4 %	21.6 %	2.7 %	6.3 %	9.0 %
Only combined	72.1 %	11.6 %	0.0 %	4.1 %	12.2 %
Roundtrip + free-floating	78.6 %	13.6 %	1.4 %	1.4 %	5.0 %
Free-floating + peer-to-peer	57.1 %	26.8 %	1.8 %	7.1 %	7.1 %
Combined + roundtrip	73.5 %	26.5 %	0.0 %	0.0 %	0.0 %
Combined + free-floating	71.4 %	17.9 %	0.0 %	3.6 %	7.1 %
Roundtrip + free-floating + peer-to-peer	75.0 %	21.4 %	0.0 %	0.0 %	3.6 %
Combined + roundtrip + free-floating	79.3 %	13.8 %	0.0 %	0.0 %	6.9 %

Table 34: Employment situation of car sharing users (German case study).

The monthly net household income of car sharing users in the survey lies at 3,475 Euro. On average the net household income of employees in Germany in 2017 was 3,224 Euro.[15] Thus, car sharing users earn unusually well.

Among the individual variants, free-floating car sharing stands out with a high number of households receiving an income of more than 5,000 Euro (29.0 %). At the same time this user group also includes disproportionately many households with an income under 1,000 Euro (6.9 %). Both

[15]https://de.statista.com/statistik/daten/studie/5742/umfrage/nettoeinkommen-und-verfuegbares-nettoeinkommen/

figures highlight that these user group can be divided into two separate socio-demographic groups: students on the one hand and financially well-situated professionals on the other.

Only for peer-to-peer users it is not true, that they earn unusually well. Their net household income lies at 2,559 Euro, far below the other figures of the survey. This effect is likewise evident in the corresponding group of multi-users.

	Average net household income	< 1.000 Euro	1000 - 2000 Euro	2000 - 3000 Euro	3000 - 4000 Euro	4000 - 5000 Euro	>5000 Euro
Car sharing users	3,475 €	3.3 %	15.5%	25.9 %	20.0 %	15.8 %	19.5 %
Main groups							
Only roundtrip	3,503 €	1.5 %	15.2 %	25.4 %	22.3 %	18.8 %	16.8 %
Only free-floating	3,584 €	6.9 %	18.3 %	19.1 %	14.5 %	12.2 %	29.0 %
Only peer-to-peer	2,559 €	4.3 %	31.9 %	36.2 %	17.0 %	5.3 %	5.3 %
Only combined	3,458 €	0.8 %	15.0 %	30.8 %	19.2 %	17.5 %	16.7 %
Roundtrip + free-floating	3,781 €	4.4 %	7.0 %	21.1 %	28.1 %	14.9 %	24.6 %
Free-floating + peer-to-peer	2,990 €	2.0 %	25.5 %	35.3 %	13.7 %	11.8 %	11.8 %
Combined + roundtrip	4,397 €	0.0 %	0.0 %	10.3 %	31.0 %	31.0 %	27.6 %
Combined + free-floating	4,500 €	8.7 %	0.0 %	13.0 %	4.3 %	30.4 %	43.5 %
Roundtrip + free-floating + peer-to-peer	3,646 €	0.0 %	4.2 %	37.5 %	29.2 %	8.3 %	20.8 %
Combined + roundtrip + free-floating	4,227 €	0.0 %	4.5 %	22.7 %	9.1 %	36.4 %	27.3 %

Table 35: Average net household income of car sharing users

5.4.2.5 Conclusion: Socio-demographic characterization of car sharing users

Car sharing users are in general working, mostly in salaried jobs. They have an academic educational background and earn an above average income. They live predominantly in households with two or more persons. In most user groups the proportion of households with children lies between 26 % and 36 %. The users of free-floating systems have children to a lesser extent (13.7 %).

The users of free-floating car sharing break down into two separate socio-demographic groups: For one thing, there are more students here than with the other car sharing-variants. They

lower the average age of the group in relation to all the other car sharing users. For another, this variant is used above all by professionals with household incomes well above average. When free-floating is used parallel with the roundtrip and/or the peer-to-peer variant, there is in most cases a higher percentage of households with of children. This may indicate that a parallel use with different variants makes the free-floating variant more attractive for families.

Users of peer-to-peer car sharing earn less than the other user groups, are more frequently self-employed, have lesser university degrees and are far more often in possession of a middle school certificate. At the same time they have just as many children at home as do users of the combined variant. This suggests that peer-to-peer car sharing appeals to a new social group which the other car sharing-variants until now do not reach.

The gender ratio of car sharing users is balanced, generally with a light predominance of men in comparison with the population at large. The present study cannot confirm the strong predominance of men that was found regularly in other studies. For roundtrip car sharing this confirms a finding from a previous study.[16] For free-floating car sharing the finding is surprising and does not correspond with other studies. This could indicate a distortion on account of the size of the sample or it could have to do with the studies focus on a certain urban area, since the otherwise available data of other studies always relates to cities as a whole.

5.4.2.6 Political self-assessment

Car sharing users on the whole tend towards the left political spectrum. Only with the users of free-floating car sharing some 10.1 % claim to be politically slightly to the right. Overall this is confirmed in the finding of other studies that locate most car sharing users in the educated left-liberal milieu.[17]

	far left	left	slightly left	center	slightly right	right	far right
Car sharing users	4.1 %	26.3 %	37.4 %	24.9 %	5.6 %	1.5 %	0.3 %
Main groups							
Only roundtrip	7.6 %	31.0 %	39.5 %	17.6 %	3.8 %	0.5 %	0.0 %
Only free-floating	1.7 %	14.3 %	31.9 %	39.5 %	10.1 %	2.5 %	0.0 %
Only peer-to-peer	5.0 %	30.0 %	17.5 %	38.8 %	5.0 %	1.3 %	2.5 %
Only combined	3.7 %	35.8 %	38.5 %	16.5 %	3.7 %	1.8 %	0.0 %
Roundtrip + free-floating	0.0 %	20.0 %	49.1 %	23.6 %	7.3 %	0.0 %	0.0 %

[16] bcs (2016)
[17] See Multimo (2015) for details

	far left	left	slightly left	center	slightly right	right	far right
Free-floating + peer-to-peer	6.4 %	21.3 %	31.9 %	29.8 %	6.4 %	4.3 %	0.0 %
Combined + roundtrip	6.7 %	26.7 %	50.0 %	10.0 %	3.3 %	3.3 %	0.0 %
Combined + free-floating	0.0 %	20.0 %	25.0 %	40.0 %	10.0 %	5.0 %	0.0 %
Roundtrip + free-floating + peer-to-peer	3.8 %	38.5 %	46.2 %	7.7 %	3.8 %	0.0 %	0.0 %
Combined + roundtrip + free-floating	0.0 %	19.2 %	50.0 %	26.9 %	3.8 %	0.0 %	0.0 %

Table 36: Political self-assessment of car sharing users

5.4.3 Car ownership and season passes for public transport

In this report we want to focus on the mobility options directly linked to car sharing use. These are: The direct alternative to car sharing - the private car - and the most important complement to car sharing - public transport. Other transport modes, like bicycles for example, are not deeply analysed although these modes have also been part of our survey.

5.4.3.1 Possession of a private car

Many car sharing users possess no car because they cover the need through the use of car sharing. This applies to 68.1 % of the households in the present study. Thus the percentage of car-free households is much higher among car sharing users than in the average population. The inner city area with the highest proportion of car-free households in Germany is the Berlin city-center (defined by the rapid train circle line), within which 52 % of all households do not own a car.

There are sharp differences between the individual user groups. Respondents who use only the roundtrip variant are 80.7 % car-free, as are 78.3 % of those using the combined variant. Both figures correspond with the previous survey of 2016 in the same areas of study.[18]

New are the analogue values for peer-to-peer and free-floating car sharing. Users of the peer-to-peer variant are 63.1 % car-free. Here it has to be taken into account, that peer-to-peer users who offer a private car via the platform where not part of the sample. Our figures only show the car-ownership in households that do not offer their car.

Users of the free-floating variant own a car in the majority of cases, which is in sharp contrast to all other user groups. With free-floating car sharing only 31.6 % of the households are car-free. The situation is different when free-floating car sharing is used parallel with other car sharing-variants. Then these users are just as often without their own car as are users of other car sharing-variants (67.7 % to 88.6 % car-free households). Free-floating car sharing seems to enable or trigger

[18] bcs (2016): 78 % car-free households

a life without one's own car only in combination with other car sharing-variants. This also becomes visible if we look at the users of combined systems who get both variants from one provider. They are nearly as often car-free (78.3 %) as users of roundtrip car sharing (80.7 %).

Overall it stands out with all multiple-user groups that they are often car-free far above-average. The combination of variants seems in general to result in a strong reduction of car ownership.

Car-free households	% of respondents
Car sharing users	68.1 %
Main groups	
Only roundtrip	80.7 %
Only free-floating	31.6 %
Only peer-to-peer	63.1 %
Only combined	78.3 %
Roundtrip + free-floating	67.7 %
Free-floating + peer-to-peer	75.0 %
Combined + roundtrip	86.8 %
Combined + free-floating	71.9 %
Roundtrip + free-floating + peer-to-peer	87.5 %
Combined + roundtrip + free-floating	88.6 %

Table 37: Car-free households among car sharing users

In Table 38 the number of private cars in households is converted, as is common practice in transport science, to the count of private vehicles per 1,000 residents. The representation is limited to the main variants of car sharing use. Roundtrip and combined car sharing users show a very low rate of car ownership, respectively, 108 and 104 private cars per 1,000 residents. Peer-to-peer users show a rate twice as high at 229 private cars per 1,000 residents, which is nevertheless still below average for metropole residents.

By contrast, free-floating users show a car possession at 485 private cars per 1,000 residents, which is way above average for comparable urban spaces.[19]

[19] At the beginning of 2015 the cars-per-residents rate in Frankfurt am Main (whole city) was 322 cars per 1,000 inhabitants, in Cologne 352 cars per 1,000 inhabitants und in Stuttgart 368 cars per 1,000 inhabitants. For the study areas the rate is only available for Stuttgart: Here 1,000 inhabitants own 331 cars on average.

	Cars per 1,000 households	Cars per 1,000 persons
Car sharing users	410	192
Main groups		
Only roundtrip	223	108
Only free-floating	968	485
Only peer-to-peer	515	229
Only combined	223	104

Table 38: Car ownership ratio at the time of the survey

5.4.3.2 Development of car ownership during the car sharing membership

The variants lead to highly different results when it comes to the change in car ownership and the change in the number of car-free households during the car sharing membership. For describing this effect, the number of cars in households was compared at three points in time:

- Number of cars 12 months prior to the initial car sharing membership
- Number of cars at the time of entering the car sharing service
- Number of cars at the time of the survey

The 1,121 interviewees indicated having owned altogether 803 private cars in the year before registration with car sharing. With users of roundtrip and combined car sharing, the automobile stock decreased by roughly 60 % in the run-up to the registration. This marks a difference with free-floating users: Here the car stock decreased in the same time frame, but only by 17.6 %. Users of free-floating car sharing thus for the most part did not expect - different from users of other variants - that car sharing can or should replace their private car. This development looks different in those groups which use free-floating parallel with another car sharing-variant. In these groups the automobile stock is reduced by some 30 % to 60 %. The combination of free-floating with other variants seems to heighten the substitution-potential of car sharing.

From the time of registration to the time of the survey the car stock further decreased in nearly every user group. Here, too, free-floating users are the exception. Their vehicle stock at the time of the survey is higher than at the time of registration with car sharing. This represents an increase by 15.7 % and 95.3 % of the initial car stock is now present again. A similar development, but not as strong, can be seen with the peer-to-peer users. Here, as well, the vehicle stock is higher at the time of the survey than at the time of registration with car sharing (increase of 11.7 %).

An indication, why in the course of car sharing car ownership increased with free-floating users, may be given by the suitability assessment of these car sharing-variants as substitute for a private car. A majority of the free-floating users disagree with the statement "Car sharing is a full-featured substitute for a private car" (approval rating 2.8 with 5 being strongest approval) than all other car sharing users (approval rating 3.6).

Free-floating users who use other car sharing-variants in parallel, tend to evaluate the substituting potential of car sharing better. It's a corresponding matter of fact that a rise in car ownership with free-floating users is observable only in the group which uses this car sharing-variant exclusively, however not in groups which employ free-floating parallel with other car sharing-variants. This fact hints to the conclusion that free-floating car sharing for many car owners only opens an additional mobility option parallel to the private car, but is not seen as a substitute for this.

Total amount of cars in % of car stock 12 months before joining car sharing	12 months before joining car sharing	when joining car sharing	at time of survey
Car sharing users	100 %	59.2 %	57.3 %
Main groups			
Only roundtrip	100 %	41.7 %	34.3 %
Only free-floating	100 %	82.4 %	95.3 %
Only peer-to-peer	100 %	63.8 %	71.3 %
Only combined	100 %	39.8 %	35.7 %
Roundtrip + free-floating	100 %	68.0 %	58.3 %
Combined + free-floating	100 %	40.9 %	36.4 %
Combined + roundtrip	100 %	39.1 %	21.7 %
Free-floating + peer-to-peer	100 %	63.6 %	56.8 %
Combined + roundtrip + free-floating	100 %	45.5 %	18.2 %
Roundtrip + free-floating + peer-to-peer	100 %	58.8 %	47.1 %

Table 39: Development of automobile stock of car sharing users

The increase and decrease of car-free households in the user groups mirrors in large parts the development of the car stock: Car-free households also increase or stagnate at a high level in all car sharing-variants - except with free-floating users. With peer-to-peer users the number of car-free households increases slightly. The increase in automobile stock which was observed in this group was thus caused by households which acquired second or third cars.

In observing the multiple-user groups it is noteworthy that users who registered for roundtrip and free-floating services in parallel apparently approached the elimination of their cars differently

than other groups. While the rate of car-free households is already high during registration in roundtrip- and combined-only user groups, a greater part of this user-group first becomes car-free during their car sharing membership. This could indicate that these multiple-users found an effective substitute for their own private car only by accessing multiple car sharing-variants.

Car-free households in % of all households	when joining car sharing	at time of survey
Car sharing users	64.1 %	68.1 %
Main groups		
Only roundtrip	77.3 %	80.7 %
Only free-floating	34.9 %	31.6 %
Only peer-to-peer	62.2 %	63.1 %
Only combined	78.3 %	78.3 %
Roundtrip + free-floating	54.4 %	67.7 %
Combined + free-floating	69.0 %	75.0 %
Combined + roundtrip	75.7 %	86.8 %
Free-floating + peer-to-peer	66.1 %	71.9 %
Combined + roundtrip + free-floating	69.7 %	88.6 %
Roundtrip + free-floating + peer-to-peer	66.7 %	87.5 %

Table 40: Development of car-free households among car sharing users

5.4.3.3 Attitude towards the car

The differences in car ownership among user groups run parallel to certain differences in the attitude towards the car. For reasons of space and clarity, we will limit the comparison to the four main categories of car sharing users who only use one car sharing system, as well as the main group of parallel users of free-floating and roundtrip offers.

Overall the fun in driving a car is present among all car sharing user groups (approval rating 3.6). Yet free-floating and peer-to-peer users agree still more frequently than all the others with the statement "Driving a car is fun" (approval ratings 4.1 and 4.0). Conversely, they reject with significantly greater frequency the statement that the automobile is merely a means to an end (approval ratings 3.3 and 3.7). The group who uses free-floating and roundtrip services in parallel has a tendency to react more like roundtrip- and combined-only users.

Agreement with different statements (5 = strongly agree)	Driving a car is fun.	A car is a means to an end.
Car sharing users	3.6 (SD = 1.24)	4.0 (SD = 1.22)
Main groups		
Only roundtrip	3.1 (SD = 1.16)	4.3 (SD = 0.99)
Only free-floating	4.1 (SD = 1.14)	3.3 (SD = 1.38)
Only peer-to-peer	4.0 (SD = 1.23)	3.7 (SD = 1.30)
Only combined	3.4 (SD = 1.25)	4.2 (SD = 1.04)
Roundtrip + free-floating	3.5 (SD = 1.15)	4.0 (SD = 1.16)

Table 41: Attitude of car sharing users towards the car (fun/ means to an end)

The analysis of further questions exploring the habit of car-use shows that the higher rate of car ownership in free-floating and peer-to-peer user groups goes along with both emotional as well as rational aspects: All car sharing users respond to the statement "I feel strange travelling without a car" very resistant (approval rating 1.5). Still, the rejection of free-floating and peer-to-peer users is a bit less strong (approval ratings 1.8 and 1.9). At the same time, the statement "It would require an effort for me not to use a car." is treated by free-floating users rather neutral (approval rating 3.1), while users of combined and roundtrip variants tend to disapprove (approval ratings 1.8 to 2.5).

Users of free-floating and peer-to-peer car sharing seem to be emotionally and rationally involved into the habit of car use more often than other car sharing users.

Agreement with different statements (5 = strongly agree)	I feel strange travelling without a car.	It would require an effort for me not to use a car.
Car sharing users	1.5 (SD = 0.95)	2.4 (SD = 1.42)
Main groups		
Only roundtrip	1.2 (SD = 0.27)	2.0 (SD = 1.27)
Only combined	1.2 (SD = 0.63)	2.2 (SD = 1.25)
Only free-floating	1.8 (SD = 1.17)	3.1 (SD = 1.50)
Only peer-to-peer	1.9 (SD = 1.27)	2.7 (SD = 1.54)
Roundtrip + free-floating	1.3 (SD = 0.66)	2.3 (SD = 1.30)

Table 42: Emotional and rational components of car use among car sharing users (strange feeling/effort)

Furthermore, most car sharing users disagree with the statement "Using a car is something that I do automatically." (approval rating 2.0). With free-floating users the automatic habit of using a car seems to be a bit more common than with other groups (approval rating 2.7).

Agreement with different statements (5 = strongly agree)	Using a car is something that I do automatically.
Car sharing users	2.0 (SD = 1.19)
Main groups	
Only roundtrip	1.6 (SD = 0.92)
Only combined	1.8 (SD = 1.11)
Only free-floating	2.7 (SD = 1.36)
Only peer-to-peer	2.1 (SD = 1.20)
Roundtrip + free-floating	1.9 (SD = 1.07)

Table 43: Habit of car use with car sharing users (automatic use)

5.4.3.4 Possession of public transport season tickets

From the 1,121 interviewed car sharing users there are some 653 who possess a season ticket for public transport (58.3 %). Users of roundtrip car sharing own a season pass especially often (68.0 %). Users of free-floating or peer-to-peer car sharing have by contrast more seldom a public transport season ticket (47.7 % and 46.9 %). It is remarkable that also users of the combined system who otherwise tend to resemble users of roundtrip car sharing and who show a low rate of car ownership, are significantly more seldom in possession of public transport season tickets (55 %). An explanation for this may well be that this group has the highest rate of daily bike use among all groups.

Multiple users generally have a season ticket just as often as users of roundtrip car sharing. A major exception is constituted by parallel users of the three variants roundtrip, free-floating and peer-to-peer, who least have a season ticket at their disposal.

	# owners of pt season ticket	% owners of pt season ticket
Car sharing users	653	58.3 %
Main groups		
Only roundtrip	183	68.0 %
Only combined	87	55.4 %
Only free-floating	90	47.4 %
Only peer-to-peer	61	46.9 %
Roundtrip + free-floating	104	65.8 %
Combined + free-floating	20	62.5 %

	# owners of pt season ticket	% owners of pt season ticket
Combined + roundtrip	23	60.5 %
Free-floating + peer-to-peer	40	62.5 %
Roundtrip + free-floating + peer-to-peer	13	40.6 %
Combined + roundtrip + free-floating	24	68.6 %

Table 44: Ownership of public transport (pt) season tickets among car sharing users

5.4.3.5 Attitude towards public transport

The differences between user groups as relates to the possession of public transport season tickets can best be understood when one takes into account the attitude towards public transport. Users of the roundtrip and combined car sharing-variants agree with the statement "I like traveling with public transport" much more often (approval rating 3.6) than users of free-floating and peer-to-peer variants (both approval ratings 2.9). Conversely, users of free-floating and peer-to-peer car sharing signalize much more often that they prefer the car to public transport, when given the choice. To the statement "If I have the choice, I use a car rather than public transport." they respond more consenting (approval ratings 3.3 and 3.4) while all other groups tend to disagree (approval ratings 2.0 to 2.2). The lower possession of public transport tickets in free-floating and peer-to-peer user groups correlates with a more negative posture towards public transport.

The affinity for public transport is higher with free-floating and peer-to-peer users who use these variants in parallel with other car sharing-variants.

Agreement with different statements (5 = strongly agree)	I like traveling with public transport.	If I have the choice, I use a car rather than public transport.
Car sharing users	3.4 (SD = 1.19)	2.6 (SD = 1.39)
Main groups		
Only roundtrip	3.6 (SD = 1.08)	2.0 (SD = 1.09)
Only combined	3.6 (SD = 1.06)	2.2 (SD = 1.16)
Only free-floating	2.9 (SD = 1.25)	3.4 (SD = 1.36)
Only peer-to-peer	2.9 (SD = 1.21)	3.3 (SD = 1.53)
Roundtrip + free-floating	3.6 (SD = 1.16)	2.4 (SD = 1.28)

Table 45: Attitude of car sharing users towards public transport

5.4.3.6 Conclusion: Car ownership and season passes for public transport

On the whole, car sharing users possess far fewer private cars than the average population. They are at the same time unusually often in possession of a public transport season ticket. A more careful look at car sharing-variants reveals, however, considerable differences in the user groups.

Users of the roundtrip and combined variants give up most of their private cars prior to joining car sharing. More private cars are then dropped during the car sharing membership. Thus with these variants around 80 % of the households are, at the time of the survey, car-free. The automobile stock has fallen around 65 % relative to a point 12 months before first joining car sharing. The ratio of car ownership sinks to a very low 108 or 104 private vehicles per 1,000 persons.

It's completely different with the users of free-floating. Here the vehicle stock falls after the registration with car sharing at first lightly, to 82.4 % of the initial stand, but then rises to 95.3 % of the initial stand again. At the same time, the already low number of car-free households decreases and lies at the time of the survey at only 31.6 %. Free-floating users increase their car ownership during their participation in car sharing to 485 private vehicles per 1,000 respondents, which represents an unusually high figure for residents in inner city residential districts. The reason for this could be that free-floating users less often view their car sharing-variant as a fully adequate substitute for owning a car, than users of other systems. In addition, they have a more car-friendly attitude than other car sharing users: They indicate more frequently having fun driving a car, view the car more seldom as a means to an end, more often feel uneasy without a car, and more often indicate simply using a car without giving it a second thought.

It is remarkable, however, that users of free-floating car sharing who use the variant parallel with other car sharing-variants, become car-free to a much higher degree and also more strongly reduce their car stock than users who count on free-floating car sharing exclusively. Maybe free-floating becomes an alternative to a private car only in combination with other variants.

This thought is also supported by the findings regarding the users of combined car sharing. Their rate of car-free households, car stock and their attitude towards car sharing as a car-substitute is quite similar not to the free-floating users, but rather to the users of roundtrip systems.

Users of peer-to-peer car sharing are also more seldom car-free (63.1 %) than the average of all respondents. As with free-floating, the car stock in these user groups increased while participating in car sharing. Here current car owners acquired more private vehicles, while the number of car-free households also rose lightly. Peer-to-peer households more often find driving a car fun and view the car less as a means to an end. In this they quite resemble users of free-floating. These findings indicate that peer-to-peer users consist of two different groups: Rather car-friendly households on the one hand and households who tend to abandon a car on the other hand.

Possession of public transport season tickets is organized in the individual user groups in mirror image to car ownership: It is especially high with users of the roundtrip variant but, with the free-floating and peer-to-peer users it is clearly lower. Users of the combined variant own a public transport season ticket much less often then users of roundtrip services. But they have a significantly high daily use of bikes that might compensate for this.

The lower possession of public transport season tickets with free-floating and peer-to-peer users goes along with an attitude which prefers the car to public transport, if the choice is given. Then again it is to be noted here that the use of free-floating parallel with roundtrip car sharing systems goes along with a considerably higher affinity for public transport.

5.4.4 Use of transport modes

In this chapter we describe the general use of transport modes of car sharing clients and mode preferences in relation to individual ways. By this we describe more precisely how the individual user groups employ car sharing. And finally we address the question, to what extent the use of car sharing has an influence on the choice of transport modes.[20]

5.4.4.1 General use of transport modes

In observing the mode usage of car sharing clients we distinguish between those modes which come into use for everyday trips and those which are employed occasionally.

In order first to create an overview of the contexts, the use of transportation modes by all respondents will be summarized. While doing so it stands out: Car sharing users employ with particular frequency for their everyday trips the public transport and bicycle. A private car is used rarely. Car sharing, taxi and motorcycle play hardly a role in everyday mobility. Car sharing is usually used more seldom than once weekly. That is indicated by 78.7 % of the users. Thus car sharing plays a marginal role for daily mobility.

Car sharing users	Private car as driver	Private car as passenger	Car sharing	Bicycle for daily trips	Public transport	Taxi	Motorcycle / Scooter
daily	6.4 %	2.1 %	0.7 %	31.8 %	28.7 %	0.7 %	2.6 %
4-6 days per week	6.1 %	1.4 %	1.5 %	14.5 %	19.1 %	1.3 %	1.7 %
1-3 days per week	11.5 %	8.8 %	15.4 %	15.0 %	25.2%	4.8 %	3.2 %

[20] Walking was excluded from deeper analysis because the questions asked in the survey did not separate walking to and from other modes of transport and walking as a single mode. This leads to a distorted answering behaviour of respondents - especially in the areas under examination in this study, where public transport is a mode that can be easily accessed and is often used.

Car sharing users	Private car as driver	Private car as passenger	Car sharing	Bicycle for daily trips	Public transport	Taxi	Motorcycle / Scooter
less often	26.6 %	40.5 %	78.7 %	23.4 %	25.2 %	67.1 %	26.6 %
never	49.4 %	47.2 %	3.7 %	15.4 %	1.8 %	26.2 %	49.4 %

Table 46: Use of transport modes by car sharing users

As expected, the individual car sharing user groups differ in their use of transport. The most differentiated picture appears in relation to the employment of a private vehicle. More than 60 % of users of roundtrip and combined systems never have a private car in use. That corresponds to the high number of car-free households in these groups. Another 30 % or 24 % drive a car more seldom than once weekly. Even as passengers, these car sharing clients are almost never to be found in a private car.

Users of free-floating car sharing are driving a private car daily up to 15.3 %. Some 18.5 % are traveling at least four days a week as drivers of a private vehicle. Only 38.6 % employ a private vehicle less than weekly or never. 29 % of free-floating users additionally specify sitting at least once weekly as passenger in a private car. Also in this group the car stock reflects car usage – in this case the high proportion of car ownership and the low number of car-free households.

Peer-to-peer users also employ their own private vehicle more often daily (12.3 % of users) or weekly (24.7 %) as self-drivers. Some 19.2 % drive at least weekly as passengers in a private vehicle. Peer-to-peer users remain behind the figures of free-floating users in the use of private vehicles, but employ it much more often than users of roundtrip and combined systems.

In general, a direct correlation between the frequent use of a private car and the stock of cars in the individual groups can be established.

Main groups	Frequency of use	Private car as driver	Private car as passenger
Only roundtrip	daily	2.6 %	1.5 %
	4-6 days per week	2.6 %	0.0 %
	1-3 days per week	3.3 %	4.1 %
	less often	30.1 %	39.4 %
	never	61.3 %	55.0 %
Only combined	daily	3.8 %	0.0 %
	4-6 days per week	0.6 %	0.0 %
	1-3 days per week	7.6 %	4.5 %
	less often	24.2 %	34.4 %

Main groups	Frequency of use	Private car as driver	Private car as passenger
	never	63.7 %	61.1 %
Only free-floating	daily	15.3 %	3.2 %
	4-6 days per week	18.5 %	4.2 %
	1-3 days per week	27.5 %	21.6 %
	less often	19.0 %	45.3 %
	never	19.6 %	25.8 %
Only peer-to-peer	daily	12.3 %	6.2 %
	4-6 days per week	8.5 %	3.8 %
	1-3 days per week	16.2 %	9.2 %
	less often	35.4 %	49.2 %
	never	27.7 %	31.5 %

Table 47: Frequency of auto usage among car sharing users (only users of one variant)

If we consider the use of public transport in different user groups, no such clear picture as seen with private cars appears.

Clients of roundtrip services are very often good clients of public transportation. Some 35.3 % are using it daily, 54.6 % use it at least four times a week. In all other user groups, public transport is utilized by between 39.2 % (peer-to-peer) and 45.2 % (combined) four or more times per week. In each case somewhat more than a quarter of the respondents in these groups are daily users of public transport.

Free-floating users show an about average utilization of public transport. Some 41 % employ it at least four times weekly. This result is notable if we take into account the high percentage of car ownership and the stronger car-affinity in this group. A possible explanation is the character of the areas of investigation: These are close to the city centre, public transport is very well developed, the stops are within easy reach. In this situation it would be simply unreasonable not to rely on public transport for many daily trips, especially for the way to and from work.

The specific character of the areas examined is certainly also responsible for the high frequency of bicycle use among all respondents. The bike is used daily by 29.7 % of the users of roundtrip car sharing. Some 59.4 % use it at least weekly for 'everyday' purposes. Peer-to-peer users behave similarly, with 31.5 % showing daily bicycle usage and 57.6 % using the bike at least weekly.

In respect to "daily bicycle use" the users of the combined system stand out, with almost half of them (47.1 %) bicycling daily. Some 70.6 % ride a bike at least once weekly for carrying out everyday transactions.

The free-floating users on the other hand fall out of the ordinary range because in this group only 17.4 % bicycle daily, only 44.7 % mount a bike at least once a week. Measured in comparison to the other groups, the free-floating users demonstrate a rather low bicycle use. The high frequency of bicycle use particularly within car sharing user groups which in the majority of cases possess no private vehicle, signals the importance of a well-developed bike infrastructure for supporting a multimodal traffic behaviour, which relies on car sharing instead of the private car.

Main groups	Frequency of use	Bicycle for daily trips	Public transport
Only roundtrip	daily	29.7 %	35.3 %
	4-6 days per week	15.2 %	19.3 %
	1-3 days per week	14.5 %	26.8 %
	less often	22.3 %	17.8 %
	never	18.2 %	0.7 %
Only combined	daily	47.1 %	25.5 %
	4-6 days per week	10.8 %	19.7 %
	1-3 days per week	12.7 %	23.6 %
	less often	19.1 %	29.3 %
	never	10.2 %	1.9 %
Only free-floating	daily	17.4 %	26.3 %
	4-6 days per week	10.5 %	14.7 %
	1-3 days per week	16.3 %	25.3 %
	less often	34.7 %	29.5 %
	never	21.1 %	4.2 %
Only peer-to-peer	daily	31.5 %	27.7 %
	4-6 days per week	11.5 %	11.5 %
	1-3 days per week	14.6 %	20.0 %
	less often	26.9 %	36.9 %
	never	15.4 %	3.8 %

Table 48: Frequency of use of bicycle and public transport among car sharing users (users of one variant)

Looking at multiple users we see that they much less frequently employ the private vehicle, as either self-drivers or passengers, than those groups which use only free-floating or peer-to-peer car sharing. Thus the picture drawn above, in which multiple users more closely resemble users of roundtrip and combined systems, is confirmed. This also applies to the use of public transport and bicycle.

5.4.4.2 Use of transport modes according to trip purposes

In our survey the use of transport modes was analysed not only in general, but also in relation to the following individual trip purposes:

- Way to work/education
- Visit a friends/relative in another city
- Shopping stroll in the city center
- Dinner in a restaurant
- Taking an excursion in nice weather
- Shopping for daily needs
- Bulk shopping
- Recreational activities on the weekend

Respondents were asked to name spontaneously for each trip purpose the mode of transport which they usually take. In the following we present an exemplary selection, which we found to be most characterizing for the user groups.

For the way to work the clients of roundtrip or combined car sharing count almost exclusively on public transport or on a bicycle. A large group from within the free-floating clients counts likewise on public transportation modes (28.7 %) or on a bicycle (16 %). However, another large group, namely 36.2 % of free-floating clients, uses a private car to go to work. In the group of peer-to-peer users no uniform picture becomes evident. Here 25.8 % of the respondents employ a private vehicle, though equally large groups take a bike (23.4 %) or public transport (27.3 %).

The multiple users predominantly choose public transport and bicycle for this trip purpose. Here, as well, the above-cited finding is confirmed, that free-floating users reveal a particular auto-affinity which to this extent is no longer that evident with users of multiple car sharing systems.

It should be emphasized that car sharing plays a significant role in none of the user groups when it comes to going to work. 9.4 % of the parallel users of free-floating and peer-to-peer normally employ car sharing for the way to work. This is the highest figure in all groups.

For roundtrip car sharing the marginal relevance for the way to work corresponds with our expectations. In roundtrip car sharing the obligation to return the car to its assigned parking space and the impossibility of ending the booking in the interim makes this mode an expensive choice for the way to work. Yet for free-floating car sharing the values are astounding, since it is known from other studies that this variant is employed for one-way rides to and from the workplace.[21] A possible explanation for the absence of such rides in the present study could again be the inner city character

[21] See WiMobil (2016), pp.155

of the area under examination: Work-related commutes are perhaps simply too short for justifying the utilization of car sharing vehicles. This also seems to be suggested by the high number of bicycle uses.

Trip purpose: way to work/education	Private car as driver or passenger	Bicycle	Public transport	Car sharing
Car sharing users	14.5 %	31.7 %	37.2 %	3.2 %
Main groups				
Only roundtrip	6.1 %	28.8 %	49.6 %	1.1 %
Only free-floating	36.2 %	16.0 %	28.7 %	5.3 %
Only peer-to-peer	25.8 %	23.4 %	27.3 %	3.1 %
Only combined	6.6 %	46.5 %	32.5 %	2.5 %
Roundtrip + free-floating	10.1 %	30.4 %	43.7 %	3.8 %
Combined + free-floating	3.1 %	34.4 %	46.9 %	0.0 %
Combined + roundtrip	2.6 %	63.2 %	26.3 %	0.0 %
Free-floating + peer-to-peer	15.7 %	29.7 %	35.9 %	9.4%
Roundtrip + free-floating + peer-to-peer	6.3 %	56.3 %	25.0 %	0.0 %
Combined + roundtrip + free-floating	11.5 %	37.1 %	4.0 %	5.7 %

Table 49: Use of transport modes for the way to work among car sharing users (if added, figures do not amount to 100%, since some of the modes asked about are not represented)

A **visit with relatives or friends in another city** is, in contrast to the way to work, not a daily routine, but an event which is singular and usually planned in advance. Clients of the roundtrip and combined car sharing rely in large numbers on car sharing for this purpose (28.9 % and 34.4 %). In addition, public transport and intercity rail play an important role. Both results correspond to the expectations. As has already been shown in other studies, roundtrip vehicles are employed for longer, planned ways, since they are bookable long in advance.[22] Also the strong use of bus and train cannot come as a surprise as users of these variants show a strong affinity to public transport.

Free-floating clients for this trip purpose rely in the majority (51.6 % as driver and 8.9 % as passenger) on the private vehicle. Car sharing plays practically no role (4.7 %). Presumably there are two reasons for this: Firstly, the availability of free-floating car sharing vehicles is unclear, owing to the lack of a long-term reservation option. Secondly a free-floating vehicle would be more expensive than the private car.

[22] See above

Trip purpose: Visit friends/relatives in another city	Private car as driver or passenger	Public transport	Railway	Car sharing
Car sharing users	25.8 %	19.0 %	25.0 %	23.9 %
Main groups				
Only roundtrip	12.1 %	22.9 %	29.3 %	28.9 %
Only free-floating	60.5 %	14.7 %	13.2 %	4.7 %
Only peer-to-peer	31.0 %	19.4 %	18.6 %	20.9 %
Only combined	17.2 %	19.7 %	24.2 %	34.4 %
Roundtrip + free-floating	24.1 %	20.9 %	24.1 %	27.8 %
Combined + free-floating	21.9 %	12.5 %	40.6 %	25.0 %
Combined + roundtrip	13.6 %	13.2 %	31.6 %	31.6 %
Free-floating + peer-to-peer	17.2 %	10.9 %	31.3 %	31.3 %
Roundtrip + free-floating + peer-to-peer	6.3 %	31.3 %	37.5 %	15.6 %
Combined + roundtrip + free-floating	14.3 %	14.3 %	37.1 %	25.7 %

Table 50: Use of transport modes by car sharing users for visits in another city (values aggregated do not yield 100%, since some of the required means of transport are not represented)

5.4.4.3 Car sharing usage

As already pointed out, car sharing is no means of everyday transport. Across most user groups car sharing is usually employed once a month (37.1 % to 44.5 % of users). Another third of the users employs car sharing only once every six months (27.3 % to 32.6 %). An exception here is created by peer-to-peer car sharing, because this variant is used more seldom. 52.5 % of the users employ this car sharing-variant only once every six months, 30.8 % only once a year. This suggests that peer-to-peer car sharing is employed only very selectively for planned and longer trips. On that note it seems closer to classical car rental than to other car sharing options.

Furthermore, car sharing-variants with free-floating vehicles (i.e., stand-alone free-floating and combined systems) have a comparatively high proportion of clients who use the option weekly. This is indicated by 17.2 % and 18.4 % of the clients. Roundtrip car sharing by contrast is employed weekly by only 11.3 % of the users, peer-to-peer car sharing only by 2 % of the clients.

Car sharing users	Roundtrip	Combined	Free-floating	Peer-to-peer
At least 1 x per week	11.3 %	17.2 %	18.4 %	2.0 %
At least 1 x per month	41.1 %	44.5 %	37.1 %	14.6 %
At least 1 x in 6 months	32.6 %	27.3 %	31.1 %	52.5 %
At least 1 x per year	15.0 %	11.0 %	13.4 %	30.8 %

Table 51: Frequency of car sharing use

Most multiple-users tend to employ car sharing like the users of the roundtrip variant. Here the simultaneous registration for free-floating triggers no increases in the frequency of use. It appears that the parallel registration is done to widen the mobility options but not to establish new mobility patterns relying on car sharing.

5.4.4.4 Car sharing usage according to trip purposes

Broken down by inquired travel purposes it becomes plainly evident that car sharing is used for planned, irregular occasions. Bulk shopping, recreational activities on the weekend, visiting relatives/friends in another city and an excursion in nice weather, are occasions to which respondents relate car sharing. Everyday trips or short trips, like the way to work, dinner in a restaurant, a shopping stroll in the city centre or the daily shopping, are all specified conversely by only very few respondents as occasions for car sharing.

Only users of free-floating see this very different. They do not consider a car sharing vehicle when the route is longer or has to be planned in advance. The reason: In all these cases users will more likely rely on their own car. By contrast, shorter and rather spontaneous ways are disproportionately often related to car sharing.

While all the other car sharing user groups choose for dining in a restaurant to go by bicycle or public transportation or to go by foot, 19.5 % of free-floating users specify this as an occasion for using car sharing. The same effect is shown with the occasion “shopping stroll in the city centre.” This is named by 13.8 % of free-floating clients as a reason for car sharing usage, while all the other groups in great majority use environmental friendly modes.

All this shows that many free-floating clients have integrated free-floating car sharing into their mobility, not as a substitute, but rather as an addition to their car. It is very likely that the ability of free-floating to provide one-way rides is a reason for this. Free-floating users seem utilize free-floating predominantly as a “self-driving taxi”.

In fact, free-floating users support the statement “Car sharing is rather an option in addition to a private car” far more frequently (approval rating 3.4), while users of stations-based and combined car sharing-variants object to the same statement strongly (approval ratings 1.9 and 1.8).

	Way to work	Dinner in a restau-rant	Shoppin g stroll in the city center	Shoppin g for daily needs	Bulk shoppin g	Visiting relatives / friends in another city	Recre-ational activities on the weeken d	Excursio n in nice weather
Car sharing users	3.2 %	6.9 %	5.4 %	3.6 %	33.7 %	23.9 %	18.8 %	18.4 %
Main groups								
Only roundtrip	1.1 %	1.1 %	1.9 %	1.9 %	41.2 %	28.9 %	20.2 %	25.8 %
Only free-floating	5.3 %	19.5 %	13.8 %	7.4 %	14.8 %	4.7 %	7.9 %	5.3 %
Only peer-to-peer	3.1 %	3.1 %	4.7 %	3.1 %	17.8 %	20.9 %	14.0 %	12.4 %
Only combined	2.5 %	5.1 %	3.2 %	3.8 %	40.8 %	34.4 %	21.0 %	17.8 %
Roundtrip + free-floating	3.8 %	8.2 %	6.3 %	3.2 %	41.8 %	27.8 %	24.1 %	19.0 %
Combined + free-floating	0.0 %	0.0 %	0.0 %	3.1 %	40.9 %	25.0 %	21.9 %	18.8 %
Combined + roundtrip	0.0 %	0.0 %	0.0 %	0.0 %	52.6 %	31.6 %	23.7 %	28.9 %
Free-floating + peer-to-peer	9.4 %	10.9 %	7.8 %	4.7 %	29.7 %	31.3 %	21.9 %	26.6 %
Roundtrip + free-floating + peer-to-peer	0.0 %	9.4 %	3.1 %	0.0 %	37.5 %	15.6 %	25.0 %	6.3 %
Combined + roundtrip + free-floating	5.7 %	5.7 %	5.7 %	5.7 %	45.7 %	25.7 %	28.6 %	40.0 %

Table 52: Car sharing as preferred mode of transport for diverse travel purposes

5.4.4.5 Influence of car sharing on the use of other modes

Starting to use car sharing can alter the use of other modes if car sharing on certain ways or for certain purposes is competing with previously used modes. When this phenomenon leads to the substituting of one transport mode for another, this shift can also bring about radical changes of the entire traffic behaviour. With car sharing such radical change takes place especially when the private car is replaced. This has been pointed out by previous studies.[23]

In the present study car sharing users were asked, to what extent their use of transportation modes has changed following their registration with car sharing. Note that this is not an analysis of shifts in modal split, but merely an inquiry into the users' self-assesed travel behaviour.

Clients of roundtrip car sharing specify that they have turned from the private vehicle to public transport and the bicycle. 22.5 % are today using means of public transport more often than prior to participating in car sharing. Only 9.5 % use public transport less today. A positive balance for the environmental alliance arises likewise with bicycle use. Some 4.3 % report a decrease in use, but 11.1 % an increase. And 45.5 % of roundtrip clients are today using the private car less, while only 6.5 % experience an increase in car use. Overall, cities and the environment are clearly profiting here from a behavioural change.

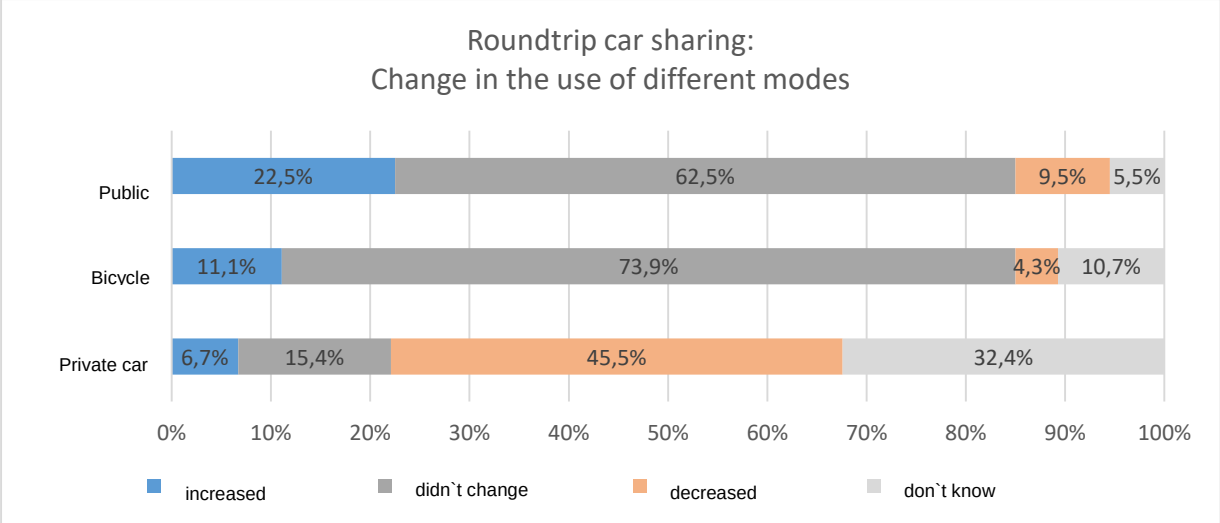

Figure 51: Changes in transportation use after registration with roundtrip car sharing

The traffic behaviour of users of the combined system changed in a similar way. Corresponding to the above-outlined preferences, the increase of bicycle use in relation to the increase in public transport is greater with this group, compared to the roundtrip users. By contrast, users of free-floating see very different changes. Though 10.5 % report of an increase in public transport use, 33.3 % travel less with public transport since they joined the car sharing service. This

[23] bcs (2016), WiMobil (2016)

fits with the observation that users of free-floating tend to travel short, inner city routes with car sharing. Evidently these car sharing-variant competes with public transport on exactly this routes.[24]

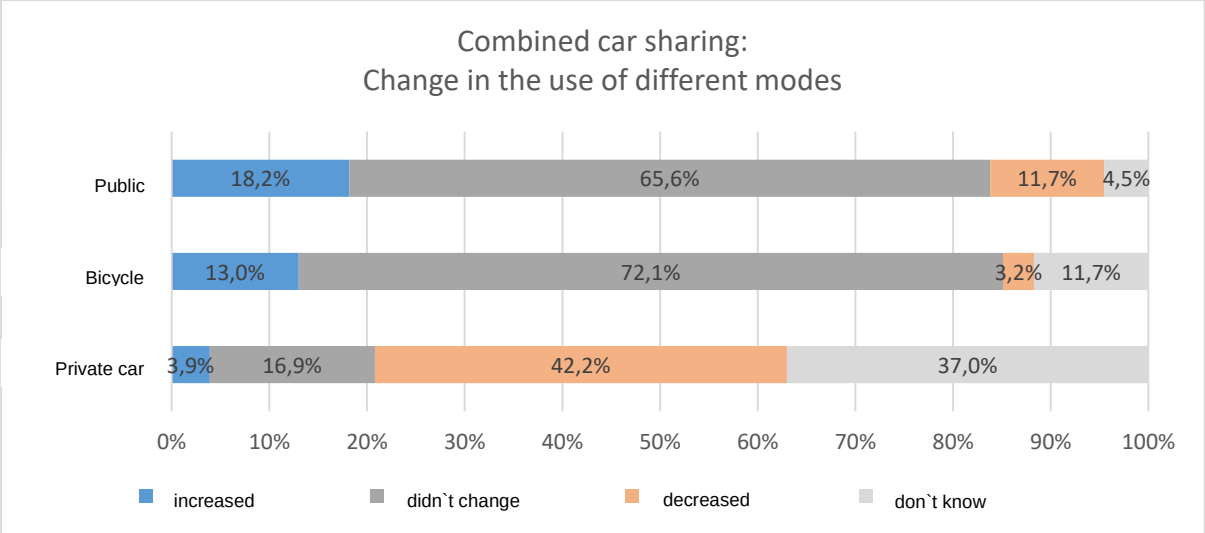

Figure 52: Changes in transportation use after registration with combined car sharing

Bicycle use reported by small subgroups who report both increases and reductions of use. Effects cancel each other out in the end. As regards city traffic and environment protection, this car sharing variant seems to have a negative total balance. It is however notable that free-floating car sharing, together with a reduction of public transport use, also diminishes private vehicle use. This is reported by 33.3 % of the users. Only 13.6 % see an increase of use here. Keeping in mind, that free-floating users did not get car-free, this change may well represent the replacement of trips with the private car by free-floating car sharing and not a significant change in mobility behaviour.

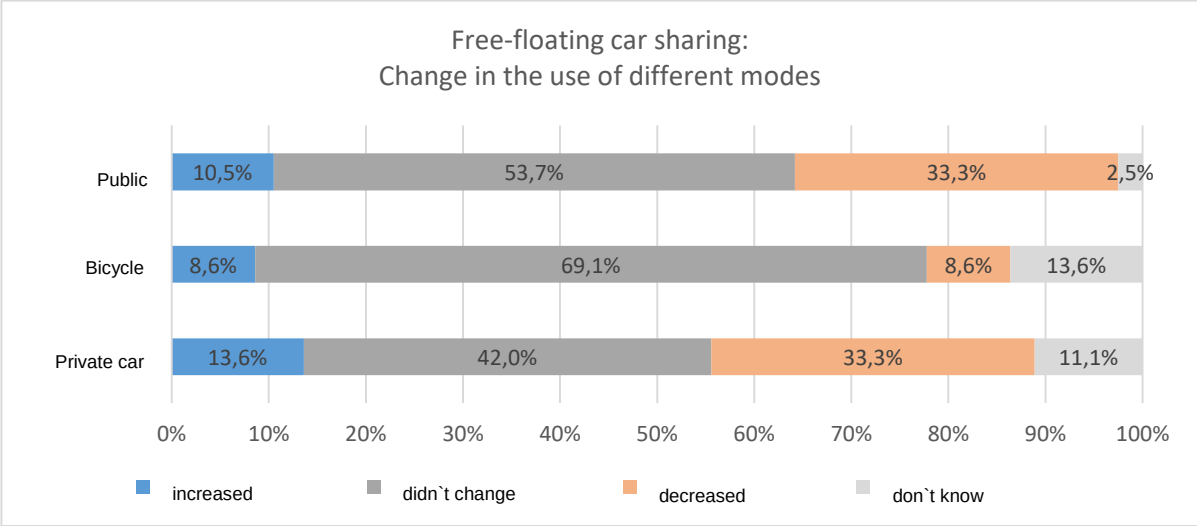

Figure 53: Changes in transportation use after registration with free-floating car sharing

[24] It is an open question what this competition is really like: Is free-floating car sharing just removing single trips from public transport or does it reduce the purchase of public transport season tickets? We were not able to clarify on this on the basis of the present data.

Peer-to-peer car sharing occupies a middle position between roundtrip and combined systems on the one hand and free-floating systems on the other. Here, as well, a reduction of public transport use occurs, but it is not as significant as with free-floating users. The use of bicycles also decreases slightly. In relation to the private car this car sharing-variant has a reductive effect, although to a more limited extent than with other variants.

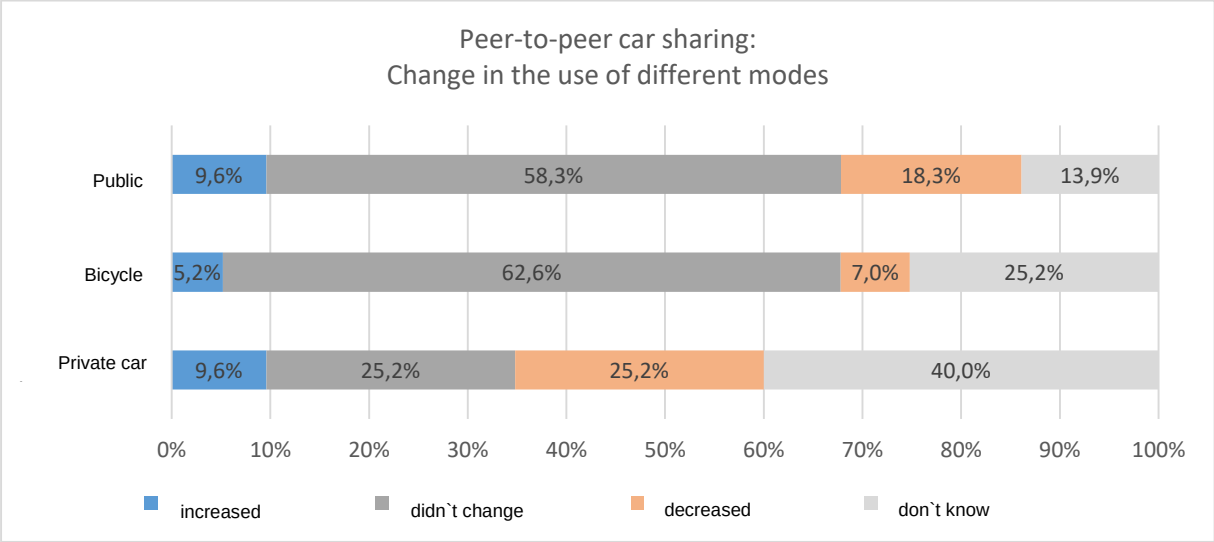

Figure 54: Changes in transportation use after registration with peer-to-peer car sharing

From the perspective of cities and municipalities which want to reduce the number and use of private vehicles by implementing and promoting car sharing, roundtrip and combined car sharing systems seem to be the most effective instruments. Free-floating appears double-edged: According to customer's statements it reduces the use of private vehicles, but it also has a negative effect on the use of public transport. At the same time it stimulates no additional use of the bicycle. For the peer-to-peer car sharing a similar double-edged balance is the result.

5.4.4.6 Conclusion: Influence of car sharing on the use of other modes

All car sharing clients are also very good clients of public transportation. This is true even for the less public transport-conscious clients of free-floating and peer-to-peer car sharing. While all the other user groups hardly ever use a private vehicle, free-floating clients employ one often. This discrepancy corresponds to the higher ratio of car ownership in this group.

The use of bicycles is likewise very pronounced among nearly all user groups. This could well have to do with high number of car-free households in most user groups and with the highly compact, inner city character of the areas of study. In contrast to the other groups, free-floating clients use the bicycle little.

Asked which mode of transport they match with certain trip purposes, it is notable that the respondents turn to car sharing, when dealing with planned occasions which occur neither regularly

nor too frequently. Bulk shopping, weekend recreational activities, visits with relatives/friends in another city and excursions in nice weather, are all occasions which are linked to car sharing. Every day or short routes, like the way to work, dinner in a restaurant, a shopping stroll or the daily shopping are identified by only few respondents as occasions for car sharing use. Here public transport or the bike is employed. Many respondents also cover these routes by foot.

Again the users of free-floating see this altogether differently. They practically never consider a car sharing vehicle when a route is longer or needs to be planned in advance. In these cases use is made of their private car. Car sharing is disproportionately linked to the shorter and more spontaneous routes like going to a restaurant or doing a shopping stroll in the city centre. Free-floating is thus used above all as a transport mode for local mobility in the city.

In respect to a change in the choice of transportation modes, roundtrip and combined car sharing systems seem to be effective instruments for reducing car-use and triggering the use of environment-friendly modes: A majority of clients indicate that they more frequently use public transport and bikes following their registration with car sharing. Free-floating car sharing does not operate like this: According to client statements it reduces the use of private vehicles, but it also reduces to a considerable degree the use of public transport. Surely this fits with the observation that free-floating is employed above all for short routes in the city, on which these variant competes directly with public transport.

For peer-to-peer car sharing, as with free-floating, a rather double-edged total balance becomes evident. Here too the use of public transport decreases after registration with car sharing. The competition is however not as strongly pronounced as with free-floating. If one recalls that peer-to-peer car sharing is only used very seldom and only for planned, longer routes (excursions, recreational activities, visits to another city), then the competition may well exist here with long-distance public transport connections which are not well-developed.

In all cases it has to be kept in mind that the findings of this study result from the car sharing users' self- assessment of usage patterns and changes over time. The findings in this chapter do not represent objective modal split evaluations.

5.4.5 Attitude towards car sharing

In this chapter we analyse whether clients of car sharing consider the service useful and competitive in relation to the private car. Additionally, we examine how satisfied the individual user groups are with car sharing as regards certain performance features. And finally, we ask how clients want to employ car sharing in the future.

5.4.5.1 Evaluation of car sharing's performance

All user groups strongly agree with the statement that car sharing is a useful service. When inquired concretely, whether car sharing is helpful for carrying out certain activities, the agreement somewhat drops off in all user groups, yet remains high nevertheless. This is not the case with users of free-floating. Here agreement is significantly lower than in all other groups. This seems plausible in view of the fact that these car sharing clients usually have a private car, and car sharing represents an additional mobility option for trips in the inner city. Thus free-floating is helpful, because it makes one-way trips possible, but it does not make additional activities possible for clients in the first place.

Agreement with different statements (5 = strongly agree)	Car sharing is a useful service.	Car sharing helps me to carry out activities which are important to me.
Car sharing users	4.7 (SD = 0.60)	4.1 (SD = 1.10)
Main groups		
Only roundtrip	4.8 (SD = 0.47)	4.4 (SD = 0.91)
Only combined	4.7 (SD = 0.54)	4.2 (SD = 1.04)
Only free-floating	4.5 (SD = 0.67)	3.5 (SD = 1.24)
Only peer-to-peer	4.6 (SD = 0.71)	4.1 (SD = 1.12)
Roundtrip + free-floating	4.7 (SD = 0.63)	4.2 (SD = 1.04)

Table 53: Evaluation of usefulness of car sharing by car sharing users

A majority among car sharing clients thinks that car sharing can substitute a private car. Only users of free-floating show less approval (2.8). They view car sharing more as an additional option to one's own car (3.4).

As seen in many other respects already, those users who use free-floating parallel to roundtrip, show alignment with the evaluation of roundtrip and combined car sharing users. A parallel use with other variants evidently leads to an improved evaluation of car sharing as a substitute for a private car.

Agreement with different statements (5 = strongly agree)	Car sharing is a full replacement for a private car.	Car sharing is more of an add-on to a private car.
Car sharing users	3.5 (SD = 1.28)	2.3 (SD = 1.42)
Main groups		
Only roundtrip	3.8 (SD = 1.11)	1.9 (SD = 1.19)
Only combined	3.9 (SD = 1.18)	1.8 (SD = 1.16)

Agreement with different statements (5 = strongly agree)	Car sharing is a full replacement for a private car.	Car sharing is more of an add-on to a private car.
Only free-floating	2.8 (SD = 1.31)	3.4 (SD = 1.39)
Only peer-to-peer	3.5 (SD = 1.31)	2.5 (SD = 1.42)
Roundtrip + free-floating	3.6 (SD = 1.30)	2.3 (SD = 1.43)

Table 54: Evaluation of car sharing as a car-substitute by car sharing users

The statement that car sharing is less expensive than the maintenance of a private car, gets a high level of agreement among users. However users of free-floating show more scepticism than users of roundtrip and combined variants.

In view of the price difference between free-floating and other car sharing-variants, this scepticism is justified. So, for example, a drive of two hours and a stretch of 10 kilometres with roundtrip car sharing in Frankfurt on the Main costs 6.20 Euros. Free-floating users pay for the same booking 17.90 Euros.

A day trip (eight hours, 120 kilometres) in roundtrip car sharing costs 34.20 Euros, in free-floating 76.10 Euros.[25]

Agreement with different statements (5 = totally agree)	Car sharing is cheaper than the maintenance of a private car.
Car sharing users	4.2 (SD = 1.05)
Main groups	
Only roundtrip	4.5 (SD = 0.92)
Only combined	4.4 (SD = 0.91)
Only free-floating	3.7 (SD = 1.17)
Only peer-to-peer	4.1 (SD = 1.13)
Roundtrip + free-floating	4.3 (SD = 0.99)

Table 55: Evaluation of car sharing by car sharing users: Cheaper than a private car?

[25] The calculation compares the prices of the cheapest trip with a compact car using the standard- or basic-tariff of selected providers which took part in this survey. Hour- or day-packages were taken into account, temporary marketing discounts were excluded; city: Frankfurt a.M.; time of evaluation: August 2018.

5.4.5.2 Satisfaction with car sharing

The respondents were presented with four dimensions of satisfaction: Low costs, high convenience of use, good vehicle-availability and good accessibility of booked vehicles.

For the measuring of satisfaction the question is decisive, what the clients consider to be the most important criteria in the first place. For high satisfaction with some features of the service may not be worth much, if clients consider the feature itself unimportant.

A comparison of the four dimensions shows, that high availability and good accessibility of vehicles are more important than low costs and convenience. This seems comprehensible, since the first two attributes determine whether car sharing is a mobility option at someone's disposal. In contrast, convenience is no precondition for use, but rather an internal characteristic of the offer. And considering the high income in almost all user-groups it is not surprising that costs are not in the focus of most car sharing users.

How important ... (5 = very important)	... are low costs?	... is high convenience?	... is good vehicle availability?	... is good vehicle accessibility?
Car sharing users	4.2	4.1	4.6	4.5

Table 56: Importance of satisfaction characteristics among car sharing users

The satisfaction with vehicle availability is notably high among roundtrip users. Users of the combined and peer-to-peer systems are also satisfied with the vehicle availability. The vehicle-availability of free-floating car sharing on the other hand is comparatively poorly evaluated. This result corresponds with the findings of previous studies.[26]

Free-floating users being rather dissatisfied with vehicle-availability is not surprising upon closer examination: Availability of vehicles in this variant depends on the number of vehicles incidentally available in the area of the request at the time the request is made. Only a very high number of vehicles per square kilometre could minimise the risk that the client at the time of request finds no vehicle in his or her area. In contrast, with roundtrip vehicles the availability at each individual station can be managed according to the demand on site. The result is an objectively better availability of vehicles in the roundtrip variant.

The poorer availability of free-floating vehicles seems to also gain notice in the evaluation of the combined variant. This variant receives a better evaluation than stand-alone free-floating, but also a significantly less good evaluation than the roundtrip variant. However with the present data

[26] ifmo (2016); Multimo (2015)

we were not able to track the difference in satisfaction back to that user of the combined system, who uses free-floating vehicles a lot.

A majority of peer-to-peer users is also satisfied with vehicle availability. Since with this variant the availability is not planned, but is instead derived from the random supply structure, this result could be related to the fact that a considerable surplus of vehicles exists on the platform - as measured by the number of actual bookings.

(5 = very important/very satisfied)	How important is good vehicle availability?	How satisfied are you with your car sharing service in respect to vehicle availability?
Only roundtrip	4.6	4.1
Only combined	4.6	3.7
Only free-floating	4.7	2.8
Only peer-to-peer	4.4	3.7

Table 57: Satisfaction with the vehicle-availability of different car sharing variants (only users of one variant)

Multiple-users can carry out a direct comparison between different car sharing variants. That is why their evaluation of the variants is of special interest. As expected free-floating car sharing is also in direct comparison often seen as the less available car sharing variant. That applies especially for groups which use roundtrip car sharing and free-floating in parallel.

There are also indications that multiple use influences the perspective on all variants: Parallel users of the combined and roundtrip systems, for instance, evaluate the availability in roundtrip car sharing worse. These users perhaps see the absence of free-floating vehicles in the roundtrip system as a lack of availability.

How satisfied are you with your car sharing service in respect to vehicle availability? (5 = very satisfied)	Combined	Roundtrip	Free-floating	Peer-to-peer
Roundtrip + free-floating		4.1	2.8	
Combined + free-floating	3.3		3.1	
Combined + roundtrip	3.7	3.4		
Free-floating + peer-to-peer			3.5	3.5
Roundtrip + free-floating + peer-to-peer		3.8	3.1	3.0
Combined + roundtrip + free-floating	3.6	3.5	2.9	

Table 58: Satisfaction with vehicle-availability among different car sharing variants (only parallel users)

In respect to the accessibility of vehicles we see a distribution of satisfaction similar to that with availability. Roundtrip car sharing is evaluated best, stand-alone free-floating worst. The evaluation of free-floating is however not as low as with availability. The vehicles seem, if they are indeed available, to be in a reasonable distance. In the highly condensed inner city areas of study, this is not really astonishing. The picture would surely be different, if respondents would live for instance in a peripheral area of town.

(5 = very important/very satisfied)	How important is good vehicle accessibility?	How satisfied are you with your car sharing service in respect to vehicle accessibility?
Only roundtrip	4.5	4.3
Only combined	4.5	3.9
Only free-floating	4.6	3.3
Only peer-to-peer	4.4	3.7

Table 59: Satisfaction with the accessibility of the vehicles in different car sharing variants (only users of one variant)

Regarding costs, a majority of car sharing clients is satisfied. Differences in satisfaction between the user groups are not as strong as the real price differences, particularly between the remaining variants and free-floating. It is true that free-floating finishes worst, yet the remaining variants are not much better. That may be explained by the fact that the well earning clients in all user groups do not set any particular emphasis here.

It is surprising that the peer-to-peer users, who earn comparatively less than other user groups, nevertheless do not ascribe any particular importance to the costs of car sharing. Perhaps these users do not focus on costs, because the frequency of use in this variant is low. But if peer-to-peer car sharing is used, clients are especially satisfied with costs. That is in line with the much lower prices for long-term rentals in peer-to-peer car sharing compared to all other variants.

(5 = very important/ very satisfied)	How important are low costs?	How satisfied are you with your car sharing service in respect to low costs?
Only roundtrip	4.0	3.8
Only combined	4.1	3.7
Only free-floating	4.2	3.5
Only peer-to-peer	3.8	3.9

Table 60: Satisfaction with the costs of different car sharing variants (only users of one variant)

Multiple-users can do a direct cost comparison between the car sharing-variants. Free-floating is evaluated worse as related to costs. That is in line with the actual price difference between

the variants. Users who participate in peer-to-peer car sharing seem to be most satisfied with the costs of these variants. This also correlates with the real price differences in the sector of long-term rentals. However, if roundtrip car sharing is part of the portfolio, this variant is rated best.

The combined system is consistently evaluated best by those employing it parallel with other variants. This could be linked to the fact that in the combined system free-floating vehicles are offered for nearly the price of a roundtrip vehicle. Thus a price advantage exists in comparison with stand-alone free-floating car sharing. The additional supply of inexpensive free-floating vehicles in the combined system may also lead to an improved perception of the price performance in comparison with the roundtrip variant, although no objective price advantage is available here.

How satisfied are you with your car sharing service in respect to low costs? (5 = very satisfied)	Combined	Roundtrip	Free-floating	Peer-to-peer
Roundtrip + free-floating		3.7	2.9	
Combined + free-floating	3.7		3.1	
Combined + roundtrip	4.0	3.2		
Free-floating + peer-to-peer			3.3	4.2
Roundtrip + free-floating + peer-to-peer		3.7	3.0	3.3
Combined + roundtrip + free-floating	3.7	3.4	3.2	

Table 61: Satisfaction with the costs of car sharing variants (only parallel users)

As regards convenience of use, the car sharing systems get notably similar high ratings. Clients of the roundtrip variant evaluate the convenience of their car sharing variant best.

(5 = very important/ very satisfied)	How important is high convenience?	How satisfied are you with your car sharing service in respect to convenience?
Only roundtrip	4.1	4.3
Only combined	4.1	3.9
Only free-floating	4.2	4.0
Only peer-to-peer	3.8	4.0

Table 62: Satisfaction with the convenience of car sharing variants (only users of one variant)

This picture becomes more complex with the multiple users. In comparison, the free-floating variant reaches as good ratings as the remaining variants in respect to convenience of use. Peer-to-peer car sharing by contrast is evaluated worse than other systems. That could have to do with the relatively complicated bookings process and the fact that, in contrast to other systems, a personal key-swap is usually necessary in peer-to-peer car sharing.

How satisfied are you with your car sharing service in respect to convenience? (5 = very satisfied)	Combined	Roundtrip	Free-floating	Peer-to-peer
Roundtrip + free-floating		3.9	3.9	
Combined + free-floating	3.6		3.9	
Combined + roundtrip	4.1	3.4		
Free-floating + peer-to-peer			3.9	3.8
Roundtrip + free-floating + peer-to-peer		4.1	4.1	3.1
Combined + roundtrip + free-floating	3.9	3.5	3.9	

Table 63: Satisfaction with the convenience of different car sharing variants (only parallel users)

5.4.5.3 Reliability and good service

Asked about the reliability and trustworthiness of car sharing, users of all variants issue very good grades. The reliability of free-floating and peer-to-peer systems is graded slightly less good than that of other variants. That may have to do with the unclear availability of the vehicles in free-floating systems. For peer-to-peer car sharing the possibility of the private car owner to refuse a requested booking, may weaken the perception of reliability.

Based on my previous experiences with car sharing, I know, ... (5 = totally agree)	... that car sharing is a reliable service.
Car sharing users	4.3 (SD = 0.85)
Main groups	
Only roundtrip	4.6 (SD = 0.67)
Only combined	4.3 (SD = 0.77)
Only free-floating	4.0 (SD = 0.96)
Only peer-to-peer	4.0 (SD = 0.95)
Roundtrip + free-floating	4.3 (SD = 0.83)

Table 64: Evaluation of trustworthiness and reliability of different car sharing variants

The service is also superbly evaluated by car sharing users.

Based on my previous experiences with car sharing, I know, ... (5 = totally agree)	... that the service is good.
Car sharing users	4.2
Main groups	
Only roundtrip	4.4

Based on my previous experiences with car sharing, I know, ... (5 = totally agree)	... that the service is good.
Only combined	4.2
Only free-floating	4.0
Only peer-to-peer	4.0
Roundtrip + free-floating	4.2

Table 65: Evaluation of the service in different car sharing-variants

5.4.5.4 Future use of transport modes and of car sharing

Car sharing users see no need for a change in their use of different modes in the future. They strongly agree to the respective statement (approval rating 4.3). Users of the combined systems are especially convinced that they will not change their mobility behaviour (approval rating 4.6). Only the users of free-floating agree somewhat less (approval rating 3.9).

All respondents also want to continue using car sharing (approval rating 4.6).

In contrast to that, the statement "I plan use car sharing more than today" is met with disapproval (approval rating 2.4). Users of the roundtrip systems show the strongest disapproval (approval rating 2.2).

The preceding section has already shown that car sharing is a service seen as useful with highly satisfied customers. Above all the users of the roundtrip and combined systems are exceedingly satisfied. It is thus to be expected that the respondents view their rather seldom use of car sharing as "exactly right". This might be disappointing from a product-marketing point of view. Under the perspective of traffic policy however it is good news: Evidently neither roundtrip nor combined car sharing animate the users to greater employment of cars.

With the users of free-floating the rejection of an increase in car sharing use must be interpreted somewhat differently. Most users of free-floating employ this variant not as a car-substitute. They often use it parallel with their own car. Here the rejection of an increased use seems to reflect a lack of demand for further car sharing trips.

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Agreement with different statements (5 = totally agree)	I will continue traveling like today.	I will continue to use car sharing.	I plan to use car sharing more than I do today.
Car sharing users	4.3 (SD = 1.01)	4.6 (SD = 0.81)	2.4 (SD = 1.12)
Main groups			
Only roundtrip	4.5 (SD = 0.90)	4.7 (SD = 0.59)	2.2 (SD = 0.98)
Only combined	4.6 (SD = 0.92)	4.6 (SD = 0.81)	2.3 (SD = 1.16)
Only free-floating	3.9 (SD = 1.18)	4.4 (SD = 0.94)	2.7 (SD = 1.10)
Only peer-to-peer	4.2 (SD = 1.00)	4.3 (SD = 0.93)	2.6 (SD =1.24)
Roundtrip + free-floating	4.4 (SD = 0.95)	4.6 (SD = 0.84)	2.4 (SD = 1.15)

Table 66: Anticipation of future travel behaviour by car sharing users

5.4.5.5 Conclusion: Satisfaction with car sharing

When asked which characteristics of a car sharing system they consider particularly important, the respondents emphasize above all the availability and good accessibility of the vehicles. Convenience and low costs are somewhat less important.

Categorically, the satisfaction of users of all car sharing-variants with all analysed service dimensions is very high. Users of roundtrip and combined systems appear especially satisfied. Users of free-floating reveal dissatisfaction with the vehicle availability.

Users of roundtrip and combined car sharing do not want to widen their car sharing use in the future, although a majority possess no private car. Evidently these car sharing-variants precisely service the needs for auto-mobility, but they produce no further demand. This is exactly the desired effect from a transport policy perspective.

Users of peer-to-peer car sharing are in general likewise very satisfied with their variant in all its dimensions. Only the satisfaction with the reliability of the system is lower than average compared with other variants.

Based on the customer judgements all car sharing variants perform very well regarding trustworthiness, reliability and good service. Again, the roundtrip and combined variants are leading the field.

Parallel users of different car sharing-variants can perform a comparison between the different variants. In their evaluation free-floating car sharing performs slightly less well than other variants in the areas of availability and cost. Peer-to-peer car sharing enjoys a good evaluation especially in regard to the costs. In regard to the convenience of use parallel users evaluate the variants similarly. Only the peer-to-peer system performs a bit under average, which can be explained

by the fact that in this system car-providers can refuse bookings and a physical key-swap is needed in most cases.

5.4.6 Reasons for car sharing use

Car sharing users were also asked which incentives to use car sharing are decisive for them. Here vehicle availability is seen by most users as the most important aspect (78.8 %), followed by a financial aspect, namely being able to use a car, without having to buy one (73.8 %) and a convenience aspect: Not having to care for repairs and maintenance (72.1 %). Some 67.7 % of the respondents find cost savings over the privately owned car significant. And only after that follows the supposed sustainability of car sharing (60.1 %).

	Incentives for car sharing use:	Qualification of aspect	% of the respondents
1	The accessibility of car sharing pick up locations near my place / workplace	Availability	78.8 %
2	The convenience of having a car only when I need it	Financial	73.1 %
3	To avoid responsibilities with maintenance and repairs of my own car	Convenience	72.1 %
4	To reduce expenses compared to a private car	Financial	67.7 %
5	To travel more sustainably	Sustainability / Ecology	60.1 %
6	To avoid looking for parking spots	Convenience	54.8 %
7	For more convenience	Convenience	35.1 %
8	Other reasons	Other	5.0 %

Table 67: Ranking of incentives for car sharing use by car sharing users

Although this ranking order of incentives is similar in all user groups, a look at the individual groups is nevertheless worthwhile. There one finds objective differences between the car sharing-variants and also attitudinal differences among the user groups. Roughly 80 % of the users of roundtrip and combined systems find the financial- and convenience-aspect important. With free-floating and peer-to-peer users the respective figure is only around 60 %. Similar differences appear in respect to the cost savings over the privately owned vehicle. The free-floating users stand out here with especially noticeable indifference: Only 47.9 % deem this an important reason, while with users of roundtrip and combined systems the figure lies at over 70 %. These differences correspond to the different rates of car ownership in the respective groups.

Also sustainability plays a variable role in the groups: Among the users of roundtrip and combined systems around 70 %, deem sustainability an important reason to use car sharing. With

the users of peer-to-peer car sharing only 46.9 % evaluate this as important. And only 42.6 % of the users of free-floating car sharing think that sustainability is an argument in favour of car sharing.

The comparatively lower household income of peer-to-peer users is reflected by the fact that this group specifies the possible cost savings over the private vehicle as in comparison a very important incentive for their use (63.1 %).

	The accessibility of car sharing pick up locations near my place / workplace	The convenience of having a car only when I need it	To avoid responsibilities with maintenance and repairs of my own car	To reduce expenses compared to a private car	To travel more sustainably
Car sharing users	78.8 %	73.1 %	72.1 %	67.7 %	60.1 %
Main groups					
Only roundtrip	83.3 %	79.6 %	79.9 %	73.2 %	68.4 %
Only combined	87.3 %	85.4 %	81.5 %	75.8 %	70.1 %
Only free-floating	72.1 %	56.8 %	57.9 %	47.9 %	42.6 %
Only peer-to-peer	62.3 %	61.5 %	60.0 %	63.1 %	46.9 %
Roundtrip + free-floating	82.9 %	70.3 %	69.6 %	70.3 %	63.3 %
Combined + free-floating	71.9 %	81.3 %	84.4 %	71.9 %	71.9 %
Combined + roundtrip	84.2 %	84.2 %	86.8 %	84.2 %	65.8 %
Free-floating + peer-to-peer	79.7 %	81.3 %	71.9 %	67.2 %	59.4 %
Roundtrip + free-floating + peer-to-peer	87.5 %	81.3 %	87.5 %	84.4 %	75.0 %
Combined + roundtrip + free-floating	77.1 %	74.3 %	68.6 %	68.6 %	57.1 %

Table 68: Incentives for car sharing use as seen by car sharing users

40 % of the free-floating clients claim that more convenience is an incentive for them to use this variant. In other user groups only about 30 % see a reason here. The users of combined car sharing also stand out a bit, because still 35 % consider higher convenience an argument for car sharing use. They thus tend towards the attitude of free-floating users. Apparently, free-floating

opens up a new experience of convenience in automobile use. This seems to be something that has not escaped the clients of the combined system.

% of respondents who see this as an incentive for the use of car sharing:	More convenience
Car sharing users	35.1 %
Main groups	
Only roundtrip	29.4 %
Only combined	35.0 %
Only free-floating	40.0 %
Only peer-to-peer	26.2 %
Roundtrip + free-floating	42.4 %
Combined + free-floating	31.3 %
Combined + roundtrip	44.7 %
Free-floating + peer-to-peer	46.9 %
Roundtrip + free-floating + peer-to-peer	37.5 %
Combined + roundtrip + free-floating	28.6 %

Table 69: Convenience as an incentive for the use of car sharing among car sharing users

5.4.6.1 Attitude toward sustainability and environmental protection

In general all car sharing users are in the opinion that sustainability and environmental protection are important themes.

(5 = very important)	Sustainability and environmental protection are ... important to me.
Car sharing users	4.6 (SD = 0.97)
Main groups	
Only roundtrip	4.7 (SD = 0.89)
Only combined	4.7 (SD =1.07)
Only free-floating	4.4 (SD = 0.88)
Only peer-to-peer	4.7 (SD = 1.21)
Roundtrip + free-floating	4.5 (SD = 0.81)

Table 70: Attitude toward sustainability and environmental protection among car sharing users

However, when one asks more precisely about certain problems, the picture gets more complex. That car use brings about many avoidable environmental problems, is more seldom affirmed by users of free-floating and peer-to-peer car sharing than by other users groups. This fits with the higher car-affinity and the higher rate of car-owning households in this group.

Agreement with different statements (5 = strongly agree)	I believe that using the car causes many environmental problems.
Car sharing users	4.4 (SD = 0.98)
Main groups	
Only roundtrip	4.7 (SD = 0.67)
Only combined	4.5 (SD = 0.84)
Only free-floating	3.9 (SD = 1.20)
Only peer-to-peer	4.1 (SD = 1.23)
Roundtrip + free-floating	4.5 (SD = 0.87)

Table 71: Attitude towards auto use and environmental pollution among car sharing users

Car sharing users sense a strong moral commitment to arrange their mobility in the most environment-friendly manner and would feel good if they could travel more sustainably. Groups do not however differ much in this respect. The only difference found is for users of roundtrip car sharing who feel significantly more morally obliged to travel sustainably (approval rating 4.1) than users of the free-floating variant (approval rating 3.7).

Agreement with different statements (5 = strongly agree)	I feel morally obliged to reduce the environmental impact due to my travel patterns.	I would feel good if I travel more sustainably.
Car sharing users	4.0	4.1
Main groups		
Only roundtrip	4.1	4.1
Only combined	4.0	4.2
Only free-floating	3.7	4.2
Only peer-to-peer	4.0	4.0
Roundtrip + free-floating	3.9	4.2
Combined + free-floating	4.3	4.2
Combined + roundtrip	4.0	3.8

Agreement with different statements (5 = strongly agree)	I feel morally obliged to reduce the environmental impact due to my travel patterns.	I would feel good if I travel more sustainably.
Free-floating + peer-to-peer	3.8	4.4
Roundtrip + free-floating + peer-to-peer	4.2	4.1
Combined + roundtrip + free-floating	4.1	3.9

Table 72: Aspiration to be mobile environment-friendly among car sharing users (moral commitment and good feeling)

Table 73: Characterization of users of different car sharing variants

Dimension	Roundtrip	Free-floating	Combined	Peer-to-peer
Age, gender & family status	Average age: ~50 Slightly more men than women 2.1 persons per household 1/3 with children in household	Average age: ~40 Slightly more men than women 2.0 persons per household Only 14 % with children in household	Average age: ~50 Slightly more women than men 2.1 persons per household 1/3 with kids in household	Average age: ~45 Slightly more men than women 2.3 persons per household 1/3 with children in household
Education, job status & income	Over 70 % with university degree High employment rate (74 %) Above average hh income (3.503 €)	Group consists of two sub-groups: well payed employees and students Over 70 % with university degree High employment rate (69 %); above average rate of students Above average hh income (3.584 €)	Over 70 % with university degree High employment rate (72 %) Above average hh income (3.458 €)	„Only" 43 % with university degree Lower employment rate (60 %); more self-employed (22 %) Average hh income (2.559 €)
Use of cars, public transport & bike	Car-free households: 81 % Weekly use of car: very low PT-card owners: 68 % Use bike daily: 30 %	Car-free households: 32 % 34 % use private car at least 4 times per week (driver) PT-card owners: 47 % Use bike daily: 17 %	Car-free households: 78 % Weekly use of car: very low PT-card owners: 55 % Use bike daily: 47 %	Car-free households: 63 % 25 % use private car at least 4 times per week (driver) PT-card owners: 47 % Use bike daily: 32 %
Attitude towards cars & public transport	Car = more means to an end Positive attitude towards pt	Car = more fun Rather car than pt (if possible) More car-affine and pt-averse then non-users owning a car	Car = more means to an end Positive attitude towards pt	Car = more fun Rather car than pt (if possible)
Use of car sharing	Main use case: longer & planned trips Main activity: bulk shopping Frequency of use: 6-12 per year	Main use case: short inner city trips/convenience rides Main activity: dinner in restaurant Frequency of use: 12- 52 per year	Main use case: longer & planned trips Main activity: bulk shopping Frequency of use: 6-12 per year	Main use case: longer & planned trips Main activity: Visit friends in other town Frequency of use: 1-6 per year
Attitude towards car sharing	Car sharing = substitute for private car Satisfaction with vehicle availability: high	Car sharing = addition to private car Satisfaction with vehicle availability: low	Car sharing = substitute for private car Satisfaction with vehicle availability: high/average	Car sharing = substitute for private car/addition to private car Satisfaction with vehicle availability: high/average

5.5 Results: Comparing car sharing users and non-users

In this chapter, we will compare the already presented survey results of car sharing users with those of non-users. We want to look at which users of the different car sharing systems are most similar to non-users. We will again present tables from previous chapters, adding data from non-user survey. For reasons of space and clarity, we will limit the comparison to the four main categories of car sharing users who only use one car sharing system, as well as the main group of parallel users of free-floating and roundtrip offers. Non-users were in turn divided into subcategories of household with and without constant availability of a car.

5.5.1 Social demographics of non-users

The average age of the non-users is 52 and therefore about six years higher than the average age of car sharing users. Men are slightly more present in the sample (56.6 %) as with the car sharing users. The majority of respondents in households without constant availability of a car are women. Men make up 46.3 % of respondents here.

	Average age	Male respondents	*n=*
Non-users			
All non-users	52	56.6 %	*185*
Non-users with a car	52	59.8 %	*139*
Non-users without a car	52	46.3 %	*45*
Car sharing users			
All car sharing users	46	56.3 %	*1122*
Main groups			
Only roundtrip	50	51.9 %	*269*
Only free-floating	39	54.5 %	*190*
Only peer-to-peer	45	53.2 %	*131*
Only combined	49	42.8 %	*157*
Roundtrip + free-floating	47	66.9 %	*159*

Table 74: Age and sex of car sharing users and non-users

The average household size of non-users is the same as that of car sharing users. The amount of households with children is also nearly the same. However, with 2.3 persons per household, non-user households with car availability are larger and generally consist of more than two persons, while two-thirds of households without a car consist of only one person. Only 4.4 % of households without a car have children under the age of 18.

	Average household size	Households with children	*n=*
Non-users			
All non-users	2.1	24.9 %	*185*
Non-users with a car	2.3	30.9 %	*139*
Non-users without a car	1.4	4.4 %	*45*
Car sharing users			
All car sharing users	2.1	25.7 %	*1122*
Main groups			
Only roundtrip	2.1	26.4 %	*269*
Only free-floating	2.0	13.7 %	*190*
Only peer-to-peer	2.3	29.0 %	*131*
Only combined	2.1	29.3 %	*157*
Roundtrip + free-floating	2.2	28.9 %	*159*

Table 75: Household size and the number of households with kids among car sharing users and non-users

Since the selection of non-users was done by randomly writing to postal addresses in selected districts in the three cities of interest, it is all the more surprising that the level of education of non-users is above average and similar to that of car sharing users. Academic education also predominates in the group of non-users: 66.9% (compared to 71.9% of car sharing users) have a university degree. The calculated education index is 4.5, and is almost equal to the index of car sharing users (4.6). The subgroup of non-users without a car deviates significantly from the subgroup of non-users with car: "Only" 53.7% of those who don't own a car have a university degree.

	Average education index (the higher the index, the higher the degree; Maximum = 5.0)	Share of university degrees
Non-users		
All non-users	4.5	66.9 %
Non-users with a car	4.5	70.9 %
Non-users without a car	4.4	53.7 %
Car sharing users		
All car sharing users	4.6	71.9 %
Main groups		
Only roundtrip	4.6	77.1 %
Only free-floating	4.6	71.0 %

	Average education index (the higher the index, the higher the degree; Maximum = 5.0)	Share of university degrees
Only peer-to-peer	4.0	43.2 %
Only combined	4.6	76.2 %
Roundtrip + free-floating	4.7	76.4 %

Table 76: Educational level of car sharing-uses compared to non-users

Non-users as well as car sharing users are predominantly permanently employed (66.9 % compared to 71.1 % among car sharing users). At 16.6%, the rate of unemployed persons is more than twice as high as the rate of unemployed car sharing users. For non-user households without a car, unemployment is even at 19.5 %.

The average net-income in non-users households is 3,430 euros/month, which is almost identical to the average household income of car sharing users (3,475 euros/month). Therefore, even the non-users in our sample earn above average (in Germany). The average household income of non-users without a private car differs from those with a car: 2,730 euros/month per household without a car compared to 3,694 euros/month in households with at least one car.

5.5.2 Conclusion: Socio-demographic characteristics of non-users compared to car sharing users

Surprisingly, the demographics of surveyed non-users, who were randomly selected in the areas of study are not very different to those of the average car sharing users.

Upon closer inspection, however, this statement must be limited to the subgroup of non-users who always have access to their own car, as the subgroup without a car clearly differs. But as the latter only accounts for about a quarter of the total non-users, their influence on the group average is relatively low. When only looking at the subgroup of non-users with a car, the socio-demographic characteristics are essentially similar to those of the exclusive roundtrip or combined car sharing users, as well as free-floating users and are significantly different to the socio-demographic characteristics of peer-to-peer users.

5.5.3 Political self-assessment

As stated before, car sharing users - by their own account - lean more the left of the political spectrum. Roughly 20 % to 40 % describe themselves to be in the political centre. Surveyed non-users show the same tendency. Their answers have here been added to the already known political orientation table.

	very left	left	slightly left	centre	slightly right	right	very right
Non-users							
All non-users	2.0%	25.7%	35.1%	25.7%	9.5%	1.4%	0.7%
Non-users with a car	2.6%	21.1%	36.8%	26.3%	10.5%	1.8%	0.9%
Non-users without a car	0.0%	41.2%	29.4%	23.5%	5.9%	0.0%	0.0%
Car sharing users							
All car sharing users	4.1%	26.3%	37.4%	24.9%	5.6%	1.5%	0.3%
Main groups							
Only roundtrip	7.6 %	31.0 %	39.5 %	17.6 %	3.8 %	0.5 %	0.0 %
Only free-floating	1.7 %	14.3 %	31.9 %	39.5 %	10.1 %	2.5 %	0.0 %
Only peer-to-peer	5.0 %	30.0 %	17.5 %	38.8 %	5.0 %	1.3 %	2.5 %
Only combined	3.7 %	35.8 %	38.5 %	16.5 %	3.7 %	1.8 %	0.0 %
Roundtrip + free-floating	0.0%	20.0%	49.1%	23.6%	7.3%	0.0%	0.0%

Table 77: Political orientation of car sharing users compared to non-users (self-assessment), detailed

5.5.4 Ownership and usage of smartphones

84.6% of non-users have smartphones, while 94.6% of car sharing users do. Car ownership does not seem to impact smartphone ownership among non-users, as the subgroups barely differ in this point. In comparison, car sharing users of all groups own slightly more smartphones than non-users do. It even reaches 100% in groups using free-floating car sharing.

	% all respondents
Non-users	
All non-users	84.6 %
Non-users with a car	84.9 %
Non-users without a car	83.7 %
Car sharing users	
All car sharing users	94.6 %
Main groups	
Only roundtrip	88.5 %
Only free-floating	98.9 %
Only peer-to-peer	91.1 %
Only combined	93.7 %
Roundtrip + free-floating	100.0 %

Table 78: Comparing smartphone ownership for car sharing users and non-users

In general, both by car sharing-users and non-users view smartphones as a good instrument for planning their route and mobility. However, approval ratings among car sharing users are generally more positive than among non-users.

For planning my mobility, smartphones are ...	... well suited.	... practical.
Non-users	3.9	4.1
Car sharing users	4.5	4.6

Table 79: Importance of the smartphone use for mobility planning for car sharing users and non-users

5.5.5 Car ownership and attitude toward cars

24.5% of non-users live in car-free households. This is a much smaller fraction than for car sharing users, where 68.1% of respondents live in car-free households. Only the group of car sharing users who only use free-floating comes close to that of non-users. Here, 31.6% live in car-free households.

	% of all respondents
Non-users	
All non-users	24.5 %
Car sharing users	
All car sharing users	68.1 %
Main groups	
Only roundtrip	80.7 %
Only free-floating	31.6 %
Only peer-to-peer	78.3 %
Only combined	63.1 %
Roundtrip + free-floating	67.7 %

Table 80: Percentage of car-free households for car sharing users compared non-users

The motorisation rate, expressed in cars per 1,000 persons, is 484 among non-users, which is identical to car sharing users who only use free-floating services (485) and more than four times as high than with users of roundtrip or combined car sharing variants.

	Cars per 1,000 households	Cars per 1, 000 persons
Non-users		
All non-users	1,016	484
Non-users with a car	1,345	585

	Cars per 1,000 households	Cars per 1, 000 persons
Non-users without a car	0	0
Car sharing users		
All car sharing users	410	192
Main groups		
Only roundtrip	223	108
Only free-floating	968	485
Only peer-to-peer	515	229
Only combined	223	104

Table 81: Car ownership rate among car sharing users and non-users at the time of the survey

In their entirety, non-users show a rather indifferent attitude towards the car. The part of the group agreeing that "Driving a car is fun" is just as large as the part that disagrees. Car owners among non-users assess the statement more positively, but noticeably their affirmation does not reach that of users of free-floating or peer-to-peer services. This suggests that it is not normal car-owners who entered the free-floating and peer-to-peer service but car owners with an especially high level of car-affinity.

Non-users without their own car agree the least with the statement "Driving a car is fun". Even car sharing-users agree more. This suggests that a certain level of car-affinity is needed to enter whatever kind of car sharing service. It may follow from this, that the car-free non-user subgroup is least likely to enter car sharing.

The statement "A car is a means to an end", is approved among non-users and car sharing-users. An instrumental attitude to the car is surprisingly widespread among non-users with a car. This might be a good basis for conversion of non-users to car sharing. Again non-users with a car have a much more instrumental attitude than users of free-floating car sharing.

Agreement with different statements (5 = totally agree)	Driving a car is fun.	A car is a means to an end.
Non-users		
Non-users with a car	3.3 (SD = 1.15)	4.0 (SD = 1.12)
Non-users without a car	2.4 (SD = 1.09)	4.4 (SD = 1.04)
Car sharing users		
Only roundtrip	3.1 (SD = 1.16)	4.3 (SD = 0.99)
Only free-floating	4.1 (SD = 1.14)	3.3 (SD = 1.38)
Only peer-to-peer	4.0 (SD = 1.23)	3.7 (SD = 1.30)

Agreement with different statements (5 = totally agree)	Driving a car is fun.	A car is a means to an end.
Only combined	3.4 (SD = 1.25)	4.2 (SD = 1.04)
Roundtrip + free-floating	3.5 (SD = 1.15)	4.0 (SD = 1.16)

Table 82: Attitude toward cars of non-users compared with car sharing users

An emotional component of the habit of car use is tested with the statement "I feel strange traveling without a car." Non-users clearly disagree with this. Again, non-users without a car rate the statement more negative and reach rejection values similar to that or roundtrip and combined car sharing-users. Non-users with a car show slightly less refusal, comparable to free-floating or peer-to-peer users.

Although non-users with a car only slightly agree with the statement "It would require an effort for me not to use a car," it is the highest average agreement of all groups. These non-users seem to be convinced that the car is the most convenient means of transport for them. In this respect they show similarities to free-floating users.

Non-users without a car reject the statement most decidedly of all subgroups. They seem to have adapted to a car-free life and are in this respect more comparable to users of the combined and roundtrip system.

Agreement with different statements (5 = totally agree)	I feel strange travelling without a car.	It would require an effort for me to not use a car.
Non-users		
Non-users with a car	1.9 (SD = 1.19)	3.4 (SD = 1.34)
Non-users without a car	1.3 (SD = 0.84)	1.6 (SD = 1.07)
Car sharing users		
Only roundtrip	1.2 (SD = 0.70)	2.0 (SD = 1.27)
Only combined	1.2 (SD = 0.63)	2.2 (SD = 1.25)
Only free-floating	1.8 (SD = 1.17)	3.1 (SD = 1.50)
Only peer-to-peer	1.9 (SD = 1.27)	2.7 (SD = 1.54)
Roundtrip + free-floating	1.3 (SD = 0.66)	2.3 (SD = 1.30)

Table 83: Attitude toward cars of non-users compared with car sharing users (Uneasiness, effort)

The statement "Using a car is something that I do automatically." - also an item about habit - is rejected in all groups. Non-users with cars in their household respond, similar to free-floating users, almost neutral. The disagreement of non-users without a car is highest among all subgroups and is comparable to those of the users of roundtrip and combined variants.

Agreement with different statements (5 = totally agree)	Using a car is something that I do automatically.
Non-users	
Non-users with a car	2.6 (SD = 1.40)
Non-users without a car	1.4 (SD = 0.86)
Car sharing users	
Only roundtrip	1.6 (SD = 0.92)
Only combined	1.8 (SD = 1.11)
Only free-floating	2.7 (SD = 1.36)
Only peer-to-peer	2.1 (SD = 1.20)
Roundtrip + free-floating	1.9 (SD = 1.07)

Table 84: Habit of car use among car sharing users and non-user

5.5.6 Conclusion: Car ownership and attitude toward cars

Non-users do not have a particularly emotional attitude toward the car, even though they have a significantly high level of car ownership. Comparing the two subgroups of non-users to the different car sharing variants, one pattern is consistent: Car owners among non-users show some similarities to car sharing users who only use free-floating or peer-to-peer offers. However non-users who own a car seem not be as car-affine as users of free-floating or peer-to-peer car sharing.

Non-users without their own car either resemble or surpass the preferences of users of the roundtrip and combined offers. They in turn show more car-aversion than the respective car sharing-user groups.

5.5.7 Possession of public transport season tickets and attitude toward public transport

38.0 % of all non-users surveyed hold a public transport seasonal ticket. This is a smaller fraction than for car sharing users overall, as well as for the individual subgroups among car sharing users. Here again, we observe a clear split among non-users: Only 30.0 % of those with a car in the household hold a public transit pass. On the other hand, nearly two-thirds of those living in households without a car have a public transit pass. This value is surpassed only by users of roundtrip car sharing offers and those who combine roundtrip and free-floating car sharing.

Possession of public transit passes	Number of transit pass holders	% of transit pass holders
Non-users		
All non-users	70	38.0 %
Non-users with a car	41	29.5 %
Non-users without a car	29	64.4 %
Car sharing users		
All car sharing users	653	58.3 %
Main groups		
Only round trip	183	68.0 %
Only combined	87	55.4 %
Only free-floating	90	47.4 %
Only peer-to-peer	61	46.9 %
Roundtrip + free-floating	104	65.8 %

Table 85: Comparison of the number of public transit pass holders among non-users and car sharing users

If, despite car ownership, the emotional connection to a car is relatively low, the approval of public transport is generally only slightly more positive.

The statement "I like traveling with public transport" is rated neutral among non-users with an average approval rating of 3.2. The difference between non-users with cars and non-users in car-free households is less pronounced than expected, when considering the different proportion of public transit pass holders in both groups.

Noticeably, approval of this item is much the same among car-free non-users and among roundtrip and combined car sharing-users, as well as among and car sharing-users registered with both roundtrip and free-floating offers.

On the other hand, non-users who own a car differ in this point from the users of combined and roundtrip service, whereas differences to free-floating and peer-to-peer users can be neglected. Thus non-users with a car and free-floating and peer-to-peer users seem to share a stronger resentment against public transport.

The agreement with the statement "If I have the choice, I use a car rather than the public transport" is reversed, but follows the same pattern. Non-user without a car reject the statement, just like roundtrip and combined car sharing-user. Non-users who own a car show more approval – as free-floating and peer-to-peer users do.

Agreement with different statements (5 = totally agree)	I like traveling with public transport	If I have the choice, I use a car rather than public transport.
Non-users		
Non-users with a car	3.1 (SD = 1.23)	3.0 (SD = 1.33)
Non-users without a car	3.5 (SD = 1.24)	2.2 (SD = 1.35)
Car sharing users		
Only round trip	3.6 (SD = 1.08)	2.0 (SD = 1.09)
Only combined	3.6 (SD = 1.06)	2.2 (SD = 1.16)
Only free-floating	2.9 (SD = 1.25)	3.4 (SD = 1.36)
Only peer-to-peer	2.9 (SD = 1.21)	3.3 (SD = 1.53)
Roundtrip + free-floating	3.6 (SD = 1.16)	2.4 (SD = 1.28)

Table 86: Attitude toward public transport of non-users compared to car sharing users

5.5.8 Use of transport modes

Just like car sharing users, non-users most likely use their bike for every day routes. On the one hand, this is remarkable because the average age of non-user is six year higher than for car sharing users. On the other hand, it may be a result of their central residential location, which allows short distances to other urban areas or to the city centre. The use of other modes depends heavily on whether non-users have access to a car in the household or not.

	Private car as driver	Private car as passenger	Car sharing	Bicycle for daily trips	Public transport	Taxi	Motorbike/ scooter
Non-user with a car							
daily	8.6 %	0.7 %	-	20.9 %	5.0 %	0.0 %	2.2 %
4-6 days per week	19.4 %	2.9 %	-	7.9 %	13.7 %	0.0 %	0.7 %
1-3 days per week	43.2 %	12.2 %	-	24.5 %	30.9 %	0.7 %	1.4 %
Less frequent	20.9 %	44.6 %	-	18.7 %	42.4 %	54.7 %	5.0 %
never	7.9 %	39.6 %	-	28.1 %	7.9 %	44.6 %	90.6 %
Non-users without a car							
daily	0.0 %	0.0 %	-	34.1 %	43.2 %	0.0 %	2.3 %
4-6 days per week	0.0 %	0.0 %	-	11.4 %	15.9 %	2.3 %	0.0 %
1-3 days per week	0.0 %	2.3 %	-	18.2 %	27.3 %	0.0 %	2.3 %

	Private car as driver	Private car as passenger	Car sharing	Bicycle for daily trips	Public transport	Taxi	Motorbike/ scooter
Less frequent	15.9 %	34.1 %	-	20.5 %	13.6 %	68.2 %	2.3 %
never	84.1 %	63.6 %	-	15.9 %	0.0 %	29.5 %	93.2 %
Car sharing user							
daily	6.4 %	2.1 %	0.7 %	31.8 %	28.7 %	0.7 %	2.6 %
4-6 days per week	6.1 %	1.4 %	1.5 %	14.5 %	19.1 %	1.3 %	1.7 %
1-3 days per week	11.5 %	8.8 %	15.4 %	15.0 %	25.2 %	4.8 %	3.2 %
Less frequent	26.6 %	40.5 %	78.7 %	23.4 %	25.2 %	67.1 %	26.6 %
never	49.4 %	47.2 %	3.7 %	15.4 %	1.8 %	26.2 %	49.4 %

Table 87: Use of transport modes for car sharing-user and non-users

8.6 % of non-users with cars in the household use the private car as a driver on a daily basis; 0.7 % use it as a passenger. More than 70% of non-users with a car drive at least once a week. Compared to the different types of car sharing, the rate of car usage is only surpassed by customers of free-floating or peer-to-peer offers. If this consideration is extended to day-to-day car use, non-users with a car in the household will access their own car as a driver a little more frequently than these two car sharing groups. It is also worth noting that 7.9 % of the surveyed non-users with a car in the household never use it as a driver. Presumably, they are more likely to be taken as passengers in this household car.

Non-users without a car in the household almost never resort to a private car as a driver in their choice of transport. Only 15.9 % of them use a private car - possibly borrowed from friends, relatives, etc. - at least once a week. That is even lower than for any of the car sharing-user subgroups. This can be explained by the fact that even in the car sharing-user group with the highest proportion of car-free households, 12.5 % of households still own their own car, while by definition the considered non-user subgroup does not have a car in the household.

	Frequency of use	Private car as driver	Private car as passenger
Non-user with a car			
	daily	8.6 %	0.7 %
	4-6 days per week	19.4 %	2.9 %
	1-3 days per week	43.2 %	12.2 %
	Less frequent	20.9 %	44.6 %

	Frequency of use	Private car as driver	Private car as passenger
	never	7.9 %	39.6 %
Non-user without a car			
	daily	0.0 %	0.0 %
	4-6 days per week	0.0 %	0.0 %
	1-3 days per week	0.0 %	2.3 %
	Less frequent	15.9 %	34.1 %
	never	84.1 %	63.6 %
Car sharing user			
Only roundtrip	daily	2.6 %	1.5 %
	4-6 days per week	2.6 %	0.0 %
	1-3 days per week	3.3 %	4.1 %
	Less frequent	30.1 %	39.4 %
	never	61.3 %	55.0 %
Only combined	daily	3.8 %	0.0 %
	4-6 days per week	0.6 %	0.0 %
	1-3 days per week	7.6 %	4.5 %
	Less frequent	24.2 %	34.4 %
	never	63.7 %	61.1 %
Only free-floating	daily	15.3 %	3.2 %
	4-6 days per week	18.5 %	4.2 %
	1-3 days per week	27.5 %	21.6 %
	Less frequent	19.0 %	45.3 %
	never	19.6 %	25.8 %
Only peer-to-peer	daily	12.3 %	6.2 %
	4-6 days per week	8.5 %	3.8 %
	1-3 days per week	16.2 %	9.2 %
	Less frequent	35.4 %	49.2 %
	never	27.7 %	31.5 %
roundtrip + free-floating	daily	2.5 %	0.0 %
	4-6 days per week	4.4 %	1.9 %
	1-3 days per week	15.2 %	7.6 %
	Less frequent	24.1 %	38.0 %

	Frequency of use	Private car as driver	Private car as passenger
	never	53.8 %	52.5 %

Table 88: Frequency of use of the private car among car sharing users and non-users

As already described, the daily use of bicycles is comparatively high even among non-users with a car: 20.9% travel by bike daily for everyday trips, 53.3% at least once a week. Thus, their use of bicycles in everyday traffic exceeds that of free-floating users, the car sharing subgroup most similar to this group of non-users.

34.1% of non-users without a car in the household use the bike on a daily basis, 63.7% get the bike out at least once a week to cover every day commuting. This rate is only exceeded by users of combined car sharing in Frankfurt, both in their daily and weekly frequency of use.

In the category public transport, as well, non-users without their own car in the household are at the top of all subgroups presented here. 43.2% of them rely on public transport in their city on a daily basis. Only 13.6% take the bus or train less than once a week, while no one from this group never uses public transport. The closet car sharing subgroup in terms of daily use of public transport is roundtrip car sharing-user. They differentiate from the non-users without a car by 7.9 percentage points. Car sharing customers, who combine roundtrip and free-floating offerings, are the most likely to use public transport at least weekly.

	Frequency of use	Bicycle for daily trips	Public transport
Non-user with a car			
	daily	20.9 %	5.0 %
	4-6 days per week	7.9 %	13.7 %
	1-3 days per week	24.5 %	30.9 %
	Less frequent	18.7 %	42.4 %
	never	28.1 %	7.9 %
Non-user without a car			
	daily	34.1 %	43.2 %
	4-6 days per week	11.4 %	15.9 %
	1-3 days per week	18.2 %	27.3 %
	Less frequent	20.5 %	13.6 %
	never	15.9 %	0.0 %
Car sharing user			
Only roundtrip	daily	29.7 %	35.3 %

	Frequency of use	Bicycle for daily trips	Public transport
	4-6 days per week	15.2 %	19.3 %
	1-3 days per week	14.5 %	26.8 %
	Less frequent	22.3 %	17.8 %
	never	18.2 %	0.7 %
Only combined	daily	47.1 %	25.5 %
	4-6 days per week	10.8 %	19.7 %
	1-3 days per week	12.7 %	23.6 %
	Less frequent	19.1 %	29.3 %
	never	10.2 %	1.9 %
Only free-floating	daily	17.4 %	26.3 %
	4-6 days per week	10.5 %	14.7 %
	1-3 days per week	16.3 %	25.3 %
	Less frequent	34.7 %	29.5 %
	never	21.1 %	4.2 %
Only peer-to-peer	daily	31.5 %	27.7 %
	4-6 days per week	11.5 %	11.5 %
	1-3 days per week	14.6 %	20.0 %
	Less frequent	26.9 %	36.9 %
	never	15.4 %	3.8 %
roundtrip + free-floating	daily	27.8 %	31.0 %
	4-6 days per week	16.5 %	26.6 %
	1-3 days per week	18.4 %	25.9 %
	Less frequent	19.6 %	16.5 %
	never	17.7 %	0.0 %

Table 89: Frequency of use of the bike and public transport among car sharing users and non-users

The following focuses on two trip purposes - chosen from a series of other purposes - and analysis the use of mode of transport for the different subgroups. One is the trip to work or educational institution, the other the less frequent trip to visit friends or relatives in another city.

About one third of non-users who own a car use it to get to work or to their educational institution. Only users of free-floating car sharing surpass this rate slightly. The frequency of use of bicycles and public transport to get to work/educational is reversed: Free-floating customers use

their bike to get to work (16%) as often as non-users with a car use public transport (16.5%) and vice versa.

Compared with non-users without a car, it can be seen that among non-users with car, taking the car to go to work mainly undermines the use of public transport (16.5% compared to 56.8%) and, though significantly less, the use of the bicycle (27.3% vs. 31.8%).

Trip purpose: way to work/education	Private car as driver or passenger	Bicycle	Public transport	Car sharing
Non-users				
All non-users	26.2 %	28.4 %	26.2 %	0.0 %
Non-users with a car	34.6 %	27.3 %	16.5 %	0.0 %
Non-users without a car	0.0 %	31.8 %	56.8 %	0.0 %
Car sharing users				
All car sharing users	14.5 %	31.7 %	37.2 %	3.2 %
Main groups				
Only roundtrip	6.1 %	28.8 %	49.6 %	1.1 %
Only free-floating	36.2 %	16.0 %	28.7 %	5.3 %
Only peer-to-peer	25.8 %	23.4 %	27.3 %	3.1 %
Only combined	6.3 %	46.5 %	32.5 %	2.5 %
Roundtrip + free-floating	10.1 %	30.4 %	43.7 %	3.8 %

Table 90: Use of modes of transport for car sharing users and non-users for the way to work (values do not add up to 100%, as not all modes of transport surveyed are pictured here)

Non-users with their own car predominantly use the latter for weekend leisure trips - here a visit to friends/relatives in another city is used as a typical example. The train is used only 8.6% of the time, while all other modes of transport play no role at all. Non-users with a car differ from all car sharing subgroups in this point.

Non-users without a car, on the other hand, behave as environmentally friendly as any car sharing subgroup. They use public transport (public transport plus train) almost as often as non-users drive their own car.

Trip purpose: Visiting friends/relatives in another city	Private car (as driver or passenger)	Public transport	Railway	Car sharing
Non-users				
All non-users	64.0 %	8.7 %	17.5 %	0.0 %
Non-users with a car	82.0 %	1.4 %	8.6 %	0.0 %

Trip purpose: Visiting friends/relatives in another city	Private car (as driver or passenger)	Public transport	Railway	Car sharing
Non-users without a car	6.8 %	31.8 %	45.5 %	0.0 %
Car sharing users				
All car sharing users	25.8 %	19.0%	25.0%	23.9%
Main groups				
Only roundtrip	13.1 %	22.9 %	29.3 %	28.9 %
Only free-floating	60.5 %	14.7 %	13.2 %	4.7 %
Only peer-to-peer	31.0 %	19.4 %	18.6 %	20.9 %
Only combined	17.2 %	19.7 %	24.2 %	34.4 %
Roundtrip + free-floating	24.1 %	20.9 %	24.1 %	27.8 %

Table 91: Use of modes of transport for car sharing users and non-users when travelling to another city (values do not add up to 100%, as not all modes of transport surveyed are pictured here)

5.5.9 Assessment of car sharing by non-users

Of the 182 non-users surveyed, 181 had already heard of car sharing. However, 35.2 % of the respondents do not know anything or very little about how car sharing works. 39.7% on the other hand, responded that they are well informed. The remaining 25.1 percent of surveyed non-users positioned themselves somewhere in the middle (approval rating 3). Based on this, we can assume that at least 60 percent of surveyed respondents have a general idea about what car sharing is and how it works.

Asked whether they can name a specific car sharing provider, 70% to 90% of non-users responded that they know a free-floating provider that operates in their city. Free-floating offers are also known nationwide. 23.3% and 9.3% of respondents in Stuttgart and Cologne, respectively, know DriveNow, even though the provider does not operate in those cities.

Non-users are also well informed about roundtrip car sharing providers operating in their respective cities (69.8% to 79.3%). The exception is Stadtmobil in Frankfurt. Only 50% had heard of the offer, even though the surveyed non-users were from an area with a relatively dense network of Stadtmobil vehicles.30 On the other hand, 13.8% of respondents in Cologne had also heard of Stadtmobil, even though the provider does not operate there.

The combined car sharing provider book-n-drive is well-known on its home market, but not in the other cities (in which it does not operate).

It is noticeable that peer-to-peer car sharing is almost unknown among surveyed non-users. The public seems to still be generally unaware of this type of car sharing.

	Stuttgart	Frankfurt	Cologne
Free-floating			
Car2go	86.0 %	71.6 %	89.7 %
Drivenow	9.3 %	23.3 %	69.0 %
Roundtrip			
Cambio	0.0 %	0.0 %	79.3 %
Stadtmobil	76.7 %	51.7 %	13.8 %
Flinkster	69.8 %	36.2 %	79.3 %
Combined			
Book-n-drive	0.0 %	75.9 %	3.4 %
Peer-to-peer			
Drivy	2.3 %	0.9 %	0.0 %
Snappcar	0.0 %	2.6 %	0.0 %
Getaway	0.0 %	0.0 %	0.0 %
Other providers	9.3 %	2.6 %	3.4 %
Don't know	4.7 %	12.9 %	0.0 %

Table 92: Brand awareness of car sharing offers among non-users (fields highlighted in grey = provider does not operate in that city)

Surprisingly, a large number of the surveyed non-users feel that car sharing is a useful service (approval rating 4.3). The perception of non-users with and without a private car does not differ. Non-users, however, disagree with the statement that car sharing could help them go about activities that are important to them (approval rating 2.9). In this case, there is a clear difference between the answers of non-users with and those without a car. A majority of non-users who do not own a car consider car sharing to be a mobility option that could extend their possibilities (approval rating 3.4).

Agreement with different statements (5 = totally agree)	Car sharing is a useful service.	Car sharing helps (could help) me to carry out activities which are important to me.
Non-user	4.3	2.9
Non-users with a car	4.3	2.8
Non-users without a car	4.3	3.4
Non-user who were once signed up for car sharing	4.6	3.9
Car sharing user	4.7	4.1

Table 93: Assessment of the usefulness of car sharing by car sharing users and non-users

Non-users generally disagree with the statement that car sharing is more of an add-on to the private car (approval rating 2.2). Those who own a car are the most likely to imagine this (approval rating 2.4). Rejection is particularly strong among non-users without a car in the household (approval rating 1.7).

Noticeably non-users with a car do not concur with the view of free-floating users, who consider car sharing to be an additional option to their own car (approval rating 3.4). On the other hand non-users with a car rather doubt that car sharing can substitute a private vehicle (approval rating 2.9) and are very much with free-floating users here.

Non-users who do not have a car, however, consider car sharing to be more of a full-fledged car substitute. They agree with this statement as strongly as respondents who already use roundtrip or combined car sharing.

Both statements together show that non-users view car sharing as a car-substitute. However, most owners of a private car cannot imagine that it will give them the same flexibility as a private car.

Agreement with different statements (5 = totally agree) Car sharing ...	... is a full replacement for a private car.	... is more of an add-on to a private car.
Non-user		
Non-users with a car	2.9 (SD = 1.20)	2.4 (SD = 1.33)
Non-users without a car	3.9 (SD = 1.02)	1.7 (SD = 1.07)
Car sharing user		
Only roundtrip	3.8 (SD = 1.11)	1.9 (SD = 1.19)
Only combined	3.9 (SD = 1.18)	1.8 (SD = 1.16)
Only free-floating	2.8 (SD = 1.31)	3.4 (SD = 1.39)
Only peer-to-peer	3.5 (SD = 1.31)	2.5 (SD = 1.42)
Roundtrip + free-floating	3.6 (SD = 1.30)	2.3 (SD = 1.43)

Table 94: Assessment of car sharing as a car-substitute by car sharing users and non-users

It is interesting to see that a majority of car owners among the non-users do not consider the cost of a private car an advantage. A majority of them agrees with the statement that car sharing is probably cheaper (approval rating 3.9). They are in line free-floating and peer-to-peer users here and show a lower approval to this statement than current users of roundtrip and combined car sharing.

Agreement with different statements (5 = totally agree)	Car sharing is (possibly) cheaper than the maintenance of a private car.
Non-user	
Non-users with a car	4.0 (SD = 1.03)
Non-users without a car	4.2 (SD = 0.98)
Car sharing user	
Only roundtrip	4.5 (SD = 0.92)
Only combined	4.4 (SD = 0.91)
Only free-floating	3.7 (SD = 1.17)
Only peer-to-peer	4.1 (SD = 1.13)
Roundtrip + free-floating	4.3 (SD = 0.99)

Table 95: Assessment by car sharing users and non-users: Is car sharing cheaper than a private car?

The scepticism of non-users regarding the availability of car sharing vehicles is on average less pronounced (approval rating 3.1). Even more surprising is that even car owners do not show much greater scepticism towards car sharing (approval rating 3.1).

Due to the different line of questioning, the collected data on the satisfaction of car sharing users with the availability is not directly comparable. We show these here only for a qualitative comparison.

Agreement with different statements (5 = totally agree) Car sharing cars ...	... are probably available when needed.	... can probably be easily accessed after having been reserved.
Non-user	3.1	3.5
Non-users with a car	3.1	3.5
Non-users without a car	3.3	3.5
Non-user who were once signed up for car sharing	3.2	3.6
For comparison: satisfaction rating of car sharing users	Vehicle availability	Vehicle accessibility
Only roundtrip	4.1	4.3
Only combined	3.7	3.9
Only free-floating	2.8	3.3
Only peer-to-peer	3.7	3.7

Table 96: Assessment of vehicle availability and accessibility by car sharing users and non-users

It is noticeable that users of free-floating actually assess vehicle availability less positive (satisfaction rating 2.8), than non-users would anticipate it to be. This could be an alarm sign: The entry of non-users into car sharing via the free-floating model could be rather unfavourable for the assessment of the performance of the car sharing as a whole. The high acquisition performance of this variant may therefore be a problem for what new customers learn about car sharing.

Most non-users see car sharing as an environmentally friendly service. They agree with the statement on a similar level to that of car sharing users.

Agreement with different statements (5 = totally agree)	Car sharing is (probably) environmentally friendly.
Non-user	3.7
Non-users with a car	3.8
Non-users without a car	3.6
Car sharing user	4.0

Table 97: Assessment of the environmental impact of car sharing by car sharing users and non-users

Non-users see car sharing not as convenient or inconvenient. Ratings are mostly neutral. Non-users with a private car disapprove slightly with the respective statement, non-users without a car show slight approval. The difference in approval between car-owning non-users and car sharing users is noticeable. Considering how good car sharing is rated in other fields, convenience seems to be the most serious problem, non-users see with car sharing.

Agreement with different statements (5 = totally agree)	Car sharing is (supposedly) convenient.
Non-user	3.0
Non-users with a car	2.8
Non-users without a car	3.4
Car sharing user	3.9

Table 98: Assessment of the convenience of car sharing by car sharing users and non-users

5.5.10 Conclusion: Assessment of car sharing by non-users

Non-users view car sharing more as a car-substitute than as an addition to a private car. The reason for this is probably the fact that most non-users own a car and cannot imagine car sharing adding anything to that. Non-users without a private car view this differently because for them car sharing would of course be a new mobility option that would bring new opportunities.

Non-users generally view car sharing as a useful service but car-owners among them do not believe that it can really replace a private car. They especially doubt that car sharing is convenient. This could well be their main reason to not consider car sharing an option.

In respect to other themes non-users show a positive attitude towards car sharing: A majority believes that car sharing is cheaper than a private car and that car sharing is environment-friendly.

Non-users react neutral to the statement that car sharing vehicles will be available and accessible when needed. They have a better opinion concerning accessibility then concerning the convenience of car sharing.

5.6 Incentives to use car sharing

Non-users where asked what they view as relevant incentives to use car sharing. In general their answers do not differ from that of the car sharing users. The availability of car sharing pick up locations is the most relevant incentive for groups, users and non-users. This seems to be the basis on which a decision to use car sharing can be done.

It is remarkable that non-users more often than users think to avoid looking for a parking spot might be an incentive. This is especially relevant as an argument for roundtrip car sharing systems, in which every vehicle has its reserved parking space.

As we saw in the previous chapter, the convenience of car sharing is questioned by non-users who own a car. Thus only a few non-users see an incentive here. It is interesting however that non-user do not as often as car sharing users think that avoiding the responsibility for maintenance and repairs could be an incentive for car sharing. The convenience of the car and of car sharing seem to be rated separately.

	Incentives to use car sharing:	% of non-users	% of car sharing users
1	The availability of car sharing pick up locations near my place / workplace	75.1 %	78.8 %
2	The convenience of having a car only when I need it	65.4 %	73.1 %
3	To avoid responsibilities with maintenance and repairs of my own car	63.8 %	72.1 %
4	To travel more sustainably	63.2 %	60.1 %
5	To reduce expenses compared to a private car	62.7 %	67.7 %
6	To avoid looking for parking spots	60.5 %	54.8 %
7	For more convenience	22.2 %	35.1 %
8	Other reasons	5.4 %	5.0 %

Table 99: Ranking of the incentives to use car sharing according to car sharing users and non-users

Car sharing users and non-users rate the incentives for car sharing very similar. This is more outstanding than the small differences here and there. In respect to the possibility to reduce costs with car sharing non-users without a car have a very different attitude then non-users with a car. This should however not be astonishing as these users do not pay for a private car and therefor do not see an important incentive here.

	The availability of car sharing pick up locations near my place / workplace	The convenience of having a car only when I need it	To avoid response-abilities with maintenance and repairs of my own car	To travel more sustainably	To reduce expenses compared to a private car
Non-user	75.1 %	65.4 %	63.8 %	63.2 %	62.7 %
Non-users with a car	77.0 %	63.3 %	61.9 %	63.3 %	65.5 %
Non-users without a car	71.1%	73.3%	71.1%	64.4%	55.6%
Non-users that have been subscribed to CS before	53.3 %	46.7 %	43.3 %	46.7 %	46.7 %
Car sharing users	78.8 %	73.1 %	72.1 %	60.1 %	67.7 %
Main groups					
Only roundtrip	83.3 %	79.6 %	79.9 %	68.4 %	73.2 %
Only combined	87.3 %	85.4 %	81.5 %	70.1 %	75.8 %
Only free-floating	72.1 %	56.8 %	57.9 %	42.6 %	47.9 %
Only peer-to-peer	62.3 %	61.5 %	60.0 %	46.9 %	63.1 %

Table 100: Incentives for car sharing usage among car sharing users and non-users

5.6.1 Attitude of non-users towards sustainability and protection of the environment

Non-users rate sustainability and protection of the environment as important as car sharing users do.

Agreement with different statements (5 = very important)	Sustainability and protection of the environment are ... important to me.
Non-user	4.4
Car sharing users	4.5

Table 101: Attitude towards sustainability and environment protection among car sharing users and non-users

Non-users also show a high degree of concern when it comes to the environmental impact of car traffic. A majority agrees with the statement "I believe that using the car causes many environmental problems."

Agreement with different statements (5 = strongly agree)	I believe that using the car causes many environmental problems.
Non-user	4.3
Car sharing users	4.4

Table 102: Attitude towards the impact of cars on the environment among car sharing users and non-users

Car sharing users and non-users feel equally morally obliged to reduce the environmental impact of their travel behaviour and would equally feel good if they would travel more sustainably.

Agreement with different statements (5 = strongly agree)	I feel morally obliged to reduce the environmental impact due to my travel patterns.	I would feel good if I travel more sustainably.
Non-user	3.9	4.0
Car sharing users	4.0	4.1

Table 103: Willingness to travel environment-friendly among car sharing users and non-users (moral obligation and good feeling)

5.6.2 Conclusion: Attitude of non-users towards sustainability and protection of the environment

There are no big differences visible in the attitude of car sharing users and non-users towards sustainability and protection of the environment. The problem awareness seems to be high in both

groups. Users and non-users alike think that it would be morally right and a source of feeling good, if they travel as environmentally friendly as possible. This leads to the conclusion that the decision to use or not use car sharing was mainly triggered by other attitudes than the ones discussed in this section.

5.6.3 Probability of non-user conversion to car sharing

We asked non-users several questions about their willingness to use car sharing in the future. This questions triggered different degrees of approval and disapproval.

Most non-users do not want to change their present use of different modes (approval rate 4.1). The statement indicating that non-users want to actively join a car sharing service is rejected by a majority of respondents (approval rate 1.9). A statement that non-users think about joining a car sharing service is rejected too, however less strong (approval rate 2.3).

A different reaction is caused by the statement that non-users might use car sharing if the circumstances of their live would change. In this case a majority of respondents shows approval (approval rate 3.6). This difference in reaction indicates that non-users believe, their present mobility behaviour is organized according to their present life- and job-situation. Car sharing could play a role if the perceived objective present needs and constraints would change. In future research on conversion of non-users to car sharing, this finding should be taken into account.

Agreement with different statements (5 = strongly agree)	I will continue traveling like today.	I think about using car sharing.	I will join a car sharing service.	I would use car sharing if the circumstances of my life would change.
Non-users	4.1	2.3	1.9	3.6
with car in household	4.2	2.2	1.8	3.7
without car in household	3.9	2.6	2.0	3.1

Table 104: Willingness to use car sharing among non-users

5.6.4 Support for car sharing

Car sharing users and non-users where asked if they would support a further expansion of car sharing. Car sharing users strongly agree to this. But also non-users support a further expansion of car sharing. Non-users who own a car are a bit more reluctant, but even in this group support is higher than rejection. Furthermore, both non-user groups do have a positive attitude towards car sharing in general. This is an encouraging finding for both, car sharing operators and city authorities who want to promote car sharing.

Agreement with different statements	My support for implementation of car sharing in society is... ... very weak. (=1) ... very strong. (=5)	Overall, my view of car sharing is... ... very negative. (=1) ... very positive. (=5)
Non-user	3.4	4.0
Non-users with car in household	3.3	4.0
Non-users without car in household	3.7	4.2
Car sharing users	4.2	4.7
Main groups		
Only roundtrip	4.3	4.7
Only combined	4.2	4.7
Only free-floating	4.2	4.6
Only peer-to-peer	3.8	4.5

Table 105: General attitude towards car sharing and support to the implementation of car sharing in car sharing users and non-users

5.7 Back-end data of car sharing services

5.7.1 Method

In order to have an objective view on the usage of different car sharing systems, the car sharing providers operating in the research areas of the study where asked for back-end data. The data was gathered with a questionnaire sent to each operator.

Unfortunately the response to this questionnaire was fragmentary. Only three roundtrip service providers answered all questions. The free-floating provider did not deliver any answers, the providers of the combined and peer-to-peer system gave some, but not all data. The following table shows the response in detail:

Question	Response			
	Roundtrip	Free-floating	Combined	Peer-to-peer
Number of customers in research area	x		x	x
Number of customers in the whole town	x		x	x
Number of vehicles in research area	x		x[37]	x
Number of vehicles in whole town	x		x	x
Number of bookings per customer	x			x

Question	Response			
	Roundtrip	Free-floating	Combined	Peer-to-peer
Average duration of booking	x			
Average distance per booking	x			
Number of starts of bookings per weekday	x			
Number of starts of bookings per hour on working days	x			

Table 106: Back-end data: Response of services

This result makes it clear, that a full account on the usage patterns can only be given for roundtrip services. In some cases data from other sources was available and was integrated.

5.7.2 Results

5.7.2.1 Average duration of bookings and average distance travelled

The average duration of bookings and the average distance travelled with different car sharing variants can give hints at different usage patterns. Unfortunately only roundtrip operators contributed to this study. To get a more complete picture missing data was added from other sources. These sources are indicated in the footnotes to the following table.

	Round-trip[27]	Free-floating[28]	Combined[29]		Peer-to-peer
			Round-trip	Free-floating	
Average duration of bookings	535 min.	29 min.	448 min	188 min	-
Average distance travelled per booking	73 km	10 km	71 km	26 km	-

Table 107: Average duration of bookings and average distance travelled in different car sharing-systems

The figures show effects of usage patterns that have been already identified in this study in the qualitative data:

- Roundtrip vehicles are used for longer, planned ways.
- Free-floating vehicles are used mostly for short inner city trips

[27] Data from roundtrip operators for this study
[28] Data from car2go and DriveNow given to bcs, figures are the average of all German operational areas, August 2018
[29] Figures are from a yet unpublished evaluation project for a German combined car sharing provider that was not part of this study, Information given to bcs in 04/2018

This is in line with findings of the study WiMobil[30] and the results from STARS Deliverable 2.2.

The data form the combined system is remarkable in this context: While data for roundtrip vehicles in this variant resemble very much usage patterns found in roundtrip-only systems, free-floating vehicles are used differently than known form stand-alone free-floating systems: They are longer measured by time and distance travelled. We conclude from this that free-floating vehicles in combined systems are only seldom used for inner city convenience trips. This would also be in line with the high usage frequency of bikes and public transport within the user group of the combined system.

	Round-trip	Free-floating	Combined		Peer-to-peer
			Round-trip	Free-floating	
Number of customers in research areas	3,498	16,282	3,295		840

Table 108: Number of customers in the research area and for different car sharing-systems

5.7.2.2 Customers and number of vehicles

The customers and vehicles in the research areas and the respective towns distribute as follows:

	Round-trip	Free-floating	Combined		Peer-to-peer[31]
			Round-trip	Free-floating	
Number of customers in research areas	3,498	16,282	3,295		840
Number of customers in all three towns	30,447	-	15,397		8,500
Number of car sharing vehicles in research areas	149	-	61	-	129
Number of car sharing vehicles in all three towns	1,020	1,200	271	191	450

Table 109: Number of customers and car sharing vehicles in the research area and in all three cities

In all three cities (Frankfurt, Cologne, Stuttgart) roundtrip operators have 30,447 customers. They can use a total of 1,020 car sharing cars. On average 29.9 customers share one roundtrip vehicle.

[30] See WiMobil (2016), pp.136
[31] Only users who do not offer a private car on the platform where counted. Thus car sharing customers where clearly separated from households who offer car sharing.

The combined system provides 271 roundtrip cars and 191 free-floating cars in Frankfurt. In this variant 33.3 customers share one vehicle.

The peer-to-peer variant has 8,500 customers in all three cities that are customer-only and do not offer an own private car via the platform. Thus 18.9 customers share a vehicle in the variant. This is remarkable because these customers tend to use a peer-to-peer car only every 6 months or more seldom. This indicates that there are much more vehicles offered on the platform then are sought for. We conclude from this that peer-to-peer systems might have a stabilizing effect on car ownership on the side of car owners.

	Round-trip	**Free-floating**	**Combined**		**Peer-to-peer**
			Round-trip	Free-floating	
Number of customers per car sharing vehicle	29.9	-	33.3		18.9

Table 110: Customers per car sharing vehicle

5.7.2.3 Booking patterns

We report the bookings patterns only for the roundtrip variant.

The bookings are evenly spread over the weekdays with a peak being reached on Saturdays. This peak fits with the observation made early that roundtrip car sharing is often used for longer and planned trips like visiting friends in another town.

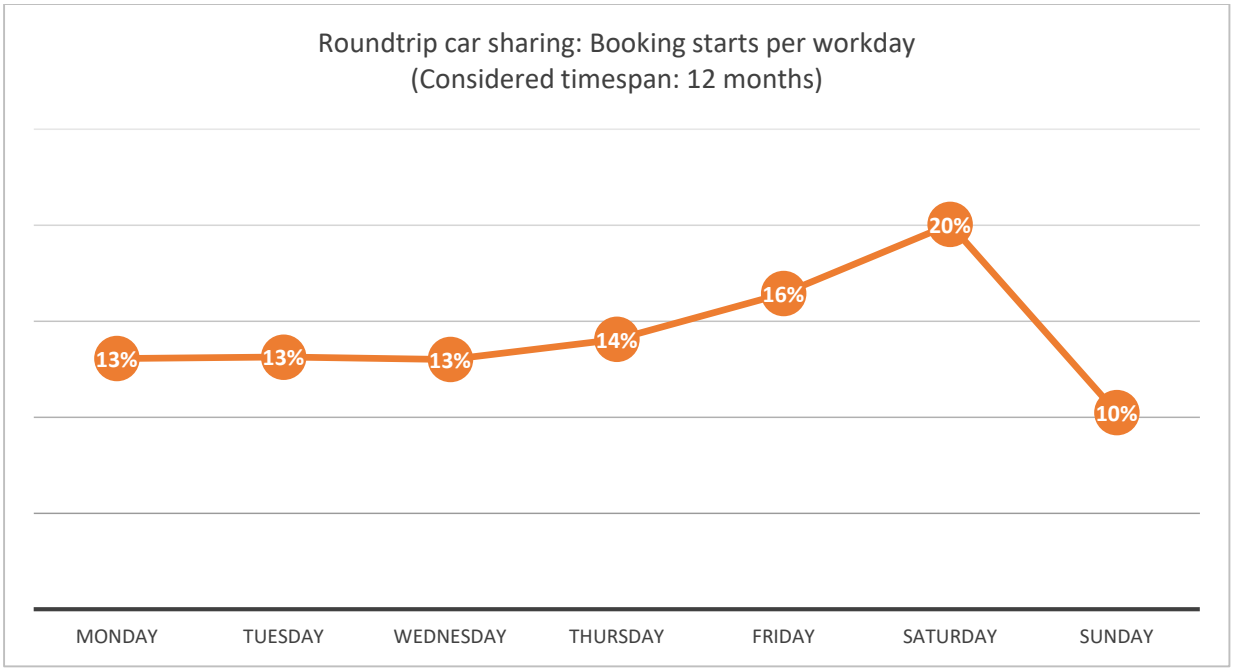

Figure 55: Booking starts per workday in roundtrip car sharing systems

Looking at the booking starts per workday it might be astonishing that most trips start between 10 a.m. and 4 p.m. – exactly in the time when most car sharing customers are supposed to be at work. Two facts can help understanding this:

- The use of roundtrip cars for longer planned trips includes many activities done when users are on vacation or have individual free days.
- The booking data includes all car-uses for business reasons. The amount of these bookings is especially high in inner city areas as roundtrip cars are often used by firms and administrative bodies as a substitute for a company vehicle.

We think that both effects are visible in the back-end data we got from roundtrip operators.

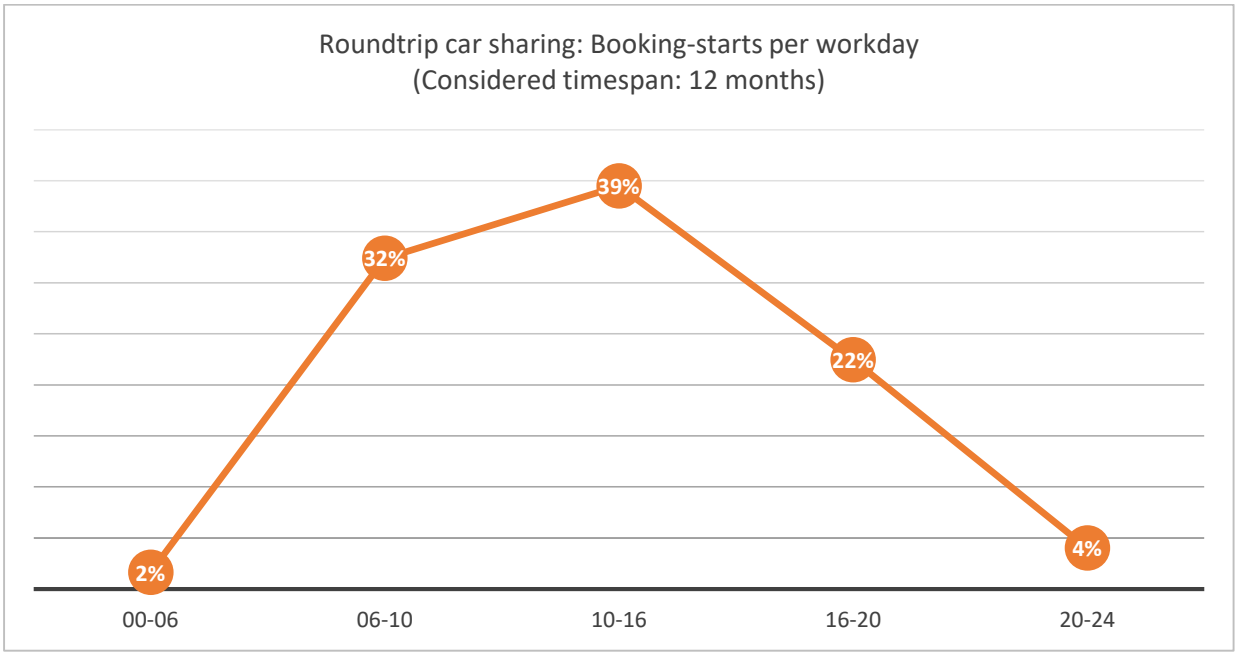

Figure 56: Booking-starts on workdays in roundtrip car sharing systems

The study WiMobil[32] reports a daily booking peak before midday for the roundtrip provider Flinkster. The authors see this as a result of the fact that roundtrip cars are often used for longer planned trips. Since the timespan we look at lasts from 10 a.m. to 4 p.m. it might well be that most booking starts we look at fall into the first third of this timespan as well. The structure of the provided data made it impossible to check this in detail.

There is however a strong difference between the data for roundtrip services we show here and the booking patterns for free-floating cars. The study WiMobil shows booking peaks for the provider DriveNow at early morning and in the afternoon[33]. Additional user-surveys show that these peaks are caused by trips to and from work. Such trips cannot be found in roundtrip systems.

[32] See WiMobil (2016), pp.140
[33] See above

GENERAL CONCLUSIONS

The results altogether give valuable information for car sharing operators and stakeholders regarding the prediction of behaviour of users and non-users based on a range of aspects. These results also provide substantial information to guide practitioners aiming at social change because it goes beyond merely describing sociodemographic aspects, which tend to be more stable along time.

The model proposed in Section 2.4 presented the main predictors for car sharing use for users and non-users of car sharing. Variables included are Perceived Usefulness, Subjective Norms and Perceived Behaviour Control. It showed the individual effect of each behavioural and socioeconomic aspect on the intention to use car sharing. The analysis with the EU sample provided a general overview, while it was possible to go deeper into the details and local aspects in the three case studies.

Practitioners cannot change people's monthly income, housing or family size. But they may implement transport systems accordingly to people's attitudes, perceptions and personal norms.

Complementarily, car sharing operators can use the results for a better understanding of the behavioural aspects involved on the transport mode decision making. Variables such as "motives for car sharing use", "perceived usefulness of car sharing services", "social network" and "perceived behaviour control" should be explored in order to offer services and features that have the best fit with the necessities of consumers.

The outcome of this research shows that the different car sharing profiles appeals differently for a variety of consumers characteristics. The results from the German case study shows how different the demands are when comparing free-floating car sharing users to the other profiles. For this sample, free-floating car sharing users had the least percentage of car-free households, the higher frequency of private car use and the least frequency of bike usage. The free-floating car sharing consumers mainly use the services for short inner city trips while the others consumers mainly use car sharing for longer and planned trips. Meanwhile, free-floating car sharing consumers were the group most dissatisfied with vehicle availability.

In the case study carried out in Flanders, it was showed that almost two thirds of the respondents do not own fewer cars since they started to use car sharing. While the respondents were satisfied with the different aspects of the car sharing services, the environmental impact due to the use of the car was differentiated by the car sharing operator that the respondents were members of. Users of car sharing services with electric cars were the most satisfied with the ecological impact of the car sharing service. The analysis of free-floating on the case study with URBI data showed that users in Madrid tend to rent electric car sharing vehicles more frequently than their peers in Berlin, Milan and Turin.

These results bring insights for future research, for instance, why do free-floating car sharing users differ from the others in term of pattern of usage? Is it the case that this kind of service attracts a specific kind of user with a specific demand or do the consumers develop new patterns of travel behaviour after getting access for the specific service? Furthermore, in the current scope of research, we focus on car sharing only. However, in future research other kinds of shared transportation (for instance, bike sharing) could also be explored.

Another interesting and highly relevant question has emerged due to our results. Are free-floating car sharing services inflating the demand for travels? This is a delicate discussion, since that practitioners need to develop a two folded strategy: to guarantee the freedom of citizens to commute and travel, and to guarantee that this demand will not compromise the quality of life of citizens in urban areas. Research have shown how negatively traffic congestion, noise pollution and air pollution may affect people's life in different levels, such as health, well-being and daily routines (Dolan, Peasgood, & White, 2008).

Another reflection need to be mentioned. The descriptive analyses such as frequencies and percentages presented in this text are descriptions and not yet subject to deeper analysis. In addition the respondents are volunteers of participating on the survey. Therefore, it is not possible to imply that they are in all respects representative of the general population. It is important to be aware of any possible sample bias regarding age, gender, income and education levels. A considerable part of the sample did not know or did not want to respond to the question regarding monthly income (11% of total) as well as, 65% of the respondents had some kind of university degree.

Other important aspect with descriptive analysis of sociodemographic variables is that it may not be the best way to express one aspect of people behaviour. For example, the Figure 57 shows the correlation between the income variable (measured based on monthly income) and people's perception of how well they manage their expenses with their income. Those two ways of measuring income complement each other and give more robust information about people behaviour because it also encompasses behavioural and psychological dimensions.

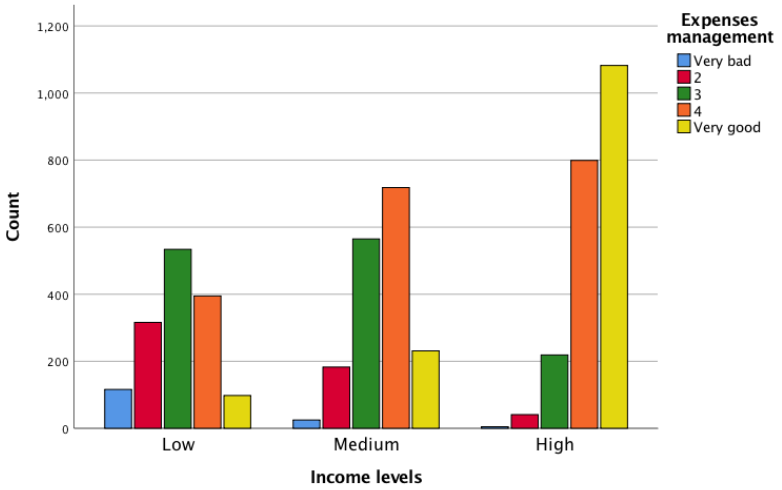

Figure 57: Correlation between income and expenses management.

Finally, the results of this research is under the umbrella of the Sustainable Development Goals (SDGs)[34], which Horizon 2020 is part as an strategy to accomplish with the European agenda for sustainable development. By taking in account social, behavioural and psychological aspects of transport behaviour, this research brings valuable information to support a more sustainable development of car sharing services.

[34] https://ec.europa.eu/research/environment/index.cfm?pg=sdgss

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APPENDIX 1

Case study in Germany: Questionnaire for car sharing-users

Nr.	Case study, Frankfurt aM, Cologne, Stuttgart
0.1	Dear carsharing customer, thank you for taking part in this survey for the EU research project STARS. Before the survey starts, please read the following advice on data security carefully. If you have any questions concerning this survey or the STARS project do not hesitate to contact the Bundesverband CarSharing e.V. via the following address: projektassistenz@carsharing.de -Next- -EU-Logo- This project has received funding from the European Union's Horizon 2020 Programme under Grant Agreement No 769513
0.2	Privacy policy & Informed Consent This survey is conducted as part of the research project STARS. STARS is funded by the European Union under the Horizon 2020 program. Responsible for content and procedure of the survey is the Bundesverband CarSharing e.V.. With the technical implementation is the company Omnitrend entrusted. By signing this form, you confirm the following: • I agree to the digital recording of my answers to the questions. • I have been given the opportunity to ask questions about the survey and the project. • My participation in the survey is voluntary. I can withdraw from the study at any time and I do not have to give any reasons. • I understand that my personal details (in that case: IP-address, time of link-calling) will only be used within the project and will only be processed and stored for the analysis of my question within this survey. • I understand that my answers given in the survey when publishing results (for example in specialist publications and research reports) are used only in an anonymous or pseudonymous form. Individuals or households are never identifiable. • I agree for the data I provide to be archived in anonymised or pseudonymous form. Yes (Checkbox) -Next-
1	**Q.** How many people, including yourself, live in your household? • 1 • 2 • 3 • 4 • 5 or more
2	**Q.** Do you have children living in your household? You can select more than one option. • No • Yes, 0-3 years old • Yes, 4-6 years old • Yes, 7-15years old • Yes, 16 years old or older

3	**Q.** How many cars are there in your household? (Please also count company cars you got from your employer and which are allowed for personal use). • No car • One car • Two cars • Three or more cars
4	**Q.** How many drivers / licensees, including yourself, are there in your household? • None • 1 • 2 • More than 2
5	**Q.** Do you own a season ticket for public transport in the town where you live? • Yes • No
6	**Q.** The following statements relate to your attitude towards diverse means of transport. To what extent do you agree with the following statements? 1 – Strongly disagree 5 – Strongly agree • Driving a car is fun. • I like traveling with public transport. • A car is a means to an end. • If I have the choice, i use a car rather than public transport. • Cycling is fun. *Randomised order*
7	**Q.** The following statements relate to your relationship with car use. To what extent do you agree with the following statements? 1 – Strongly disagree 5 – Strongly agree • I feel strange travelling without a car. • I use the car without planning ahead. • It would require an effort for me not to use a car. • Using a car is part of my daily routine. • Using a car is something that I do automatically. • I have been using a car for a long time. • Driving a car saves time. • Driving a car makes life easier. *Randomised order*
8	**Q.** If you think about your daily travel, how often do you use the following modes in the town where you live? Daily – 4-6 days/week – 1-3 days/week – More seldom – Never • Private car as a driver • Private car as a passenger • Carsharing • Public Transport • Motorcycle/ scooter • Taxi • Bicyle in every-day life • Bicycle for leisure

	• Walking
9	**Q.** Below, some activities are listed. Which travel mode are you most likely to use for these activities? Please give the first answer that comes to mind. Private car as driver - private car as passenger - Carsharing - Public Transport - Motorcycle/ Scooter - Taxi - Cycling - Walking - railway – Other • Way to work/education • Visit friends/relatives in another city • Shopping stroll in the city center • Dinner in a restaurant • Taking an excursion in nice weather • Shopping for daily needs • Bulk shopping • Recreational activities on the weekend
10	**Q.** Do you own a smartphone? • Yes • No
11	if Q10 = yes **Q**. The following statements are about how you perceive the use of smartphone in everyday travel, for example, to check timetables, itineraries, costs, available transportation options, and more. 1 – Strongly disagree 5 – Strongly agree The use of smartphone in connection with travel is ... ...well suited. ...valuable. ...practical.
12	if Q10 = yes **Q.** To what extent do you use internet and / or apps to plan travels when using the following means of transportation? For example, to check timetables, itineraries, available transportation options and more. Always - Most of the times - Sometimes - Rarely - Never - I do not use this mode of transport • Private car • Carsharing • Public Transport • Cycling • Walking • Taxi • Railway • Other

13	**Q.** To which of the following carsharing providers are you subscribed as a customer**?** List Cologne: • Cambio • Car2go • DriveNow • Drivy • Flinkster • Snappcar • Other List Frankfurt: • Book-n-drive • Car2go • Stadtmobil • Flinkster • Drivy • Snappcar • Other List Stuttgart: • Car2go • Stadtmobil • Drivy • Flinkster • Snappcar • Other
14	*If only one answer in Q13* **Q.** Please name the year you registered with (name of provider).
15	*If only one answer in Q13* **Q.** How many cars were there in your household at the time you registered with (name of provider)? • None • One • Two • Three or more
16	*Wenn nur eine Auswahl in Q13* **Q.** Did you abandon a car in the 12 months <u>before</u> registering with (name of provider)? • Yes, one car • Yes, two cars • Yes, three cars or more • No • I do not know
13.1	*If more than one answer in Q13* **Q.** Please sort the operators you are registered with in order of your registration (The operator you registered with first should be on top of the list)**.**
14.1	*If more than one answer in Q13* **Q.** Please name the year you registered with (name of provider1).

14.2	*If more than one answer in Q13* **Q.** Please name the year you registered with (name of provider2)
15.1	*If Q13.1 was used* **Q.** How many cars were there in your household at the time you registered with (name of provider1)? • None • One • Two • Three or more
16.1	*If Q13.1 was used* **Q.** Did you abandon a car in the 12 months <u>before</u> registering with (name of provider)? • Yes, one car • Yes, two cars • Yes, three cars or more • No • I do not know
17	**Q.** How did your use of transport options change after you registered with carsharing? - Before registering with carsharing, i used the bicycle … - Before registering with carsharing, i used a private car ….. - Before registering with carsharing, i used public transport ….. • …less often than today. • …as often as today. • …more often than today. • … I do not know.
18	**Q.** If there was no carsharing at all, how many cars would you have in your household? • None • One • Two • Three or more • I do not know
19	**Q.** If you look back at the last twelve months: How often did you use a carsharing car from the following provider? • Minimum once a week • Minimum once a month • Minimum once in six months • Minimum once a year • never <u>List Frankfurt:</u> Car2go Book-n-drive Stadtmobil Flinkster Drivy or Snappcar <u>List Cologne:</u>

	Car2go or DriveNow Cambio Flinkster Drivy or Snappcar <u>List Stuttgart:</u> Car2go Stadtmobil Flinkster Drivy or Snappcar
20	**Q.** How important are the following features of a carsharing service for you? 1 - very unimportant 5 - very important • low costs • high convenience • high availability of cars at the requested time • good accassability of booked cars
21	**Q.** How satisfied are you with the carsharing service of (name of provider) in respect to the following characteristics? 1 - very unsatisfied 5 - very satisfied • low costs • high convenience • high availability of cars at the requested time • good accassability of booked cars *3 named providers in Q13 in randomized order*
22	**Q.** How suitable is the carsharing offer of (name of provider) for the following activities? 1 - very unsuitable 5 - very suitable - Way to work/school - Visit friends/relatives in another city - Shopping stroll in the city center - Dinner in a restaurant - Taking an excursion in nice weather - Shopping for daily needs - Bulk shopping - Recreational activities on the weekend
23	**Q.** Are there any car sharing pick up locations close to your workplace/place where you study, or is your workplace/place where you study within an operational area? <u>List Cologne:</u> • Car2go • DriveNow • Cambio • Flinkster • Drivy • Snappcar • Andere <u>List Frankfurt:</u> • Car2go • Book-n-drive

	• Stadtmobil • Flinkster • Drivy • Snappcar • Andere <u>Liste Stuttgart:</u> • Car2Go • Drivy • Flinkster • Snappcar • Stadtmobil • Andere • Weiß nicht • Not applicable, i am not working or in an education.
24	**Q.** The following statements are about your perceptions of carsharing. To what extent do you agree with the following statements. 1 – strongly disagree 5 – strongly agree Carsharing is … • … a full replacement for a private car. • … cheaper than the maintenance of a private car. • … more of an add-on to a private car. • … convenient. • … envorinment-friendly. • … expensive.
25	**Q.** The following statements are about your perceptions of carsharing use. To what extent do you agree with the following statements? 1 – Strongly disagree 5 – Strongly agree • It is possible for me to use carsharing for my regular trips. • I am sure that I can choose carsharing for my regular trips during the next week. • Carsharing is a useful service. • Carsharing helps me to carry out activities that are important to me. • Learning how to use carsharing was easy for me. • It is difficult to book a car at the carsharing website/app.
26	**Q.** Based on my previous experience with carsharing, I think carsharing services … • … provide good service. • … are reliable. • … are trustworthy. 1 – Strongly disagree 5 – Strongly agree
27	**Q.** To what extent do you agree with the following statements about your future travels in the next six months? 1 – Strongly disagree 5 – Strongly agree • I will continue traveling like today. • I will continue to use carsharing. • I plan to use carsharing more than I do today. • I would use carsharing more if the circumstances of my life would change.

28	**Q.** What is your gender? • Male • Female • Other
29	**Q.** In which year you were born?
30	**Q.** What is the highest education you have? Select the answer that you think best suits you. If you have not yet completed your education, please mark the degree you will reach next. • Main school • Middle school • High school • University degree (Diplom, Magister, Bachelor, Master) • Non applicable
31	**Q.** What is your current job-/employment situation? • Employed • Self-employed • Job education • School education • University education • Not employed/self-employed, not in an education
32	**Q.** What ist he monthly net income of your household? • 1000 – 2000 Euro • 2000 – 3000 Euro • 3000 – 4000 Euro • 4000 – 5000 Euro • >5000 Euro • I do not want to answer.
33	**Q.** How do you manage your expenses with your current income? • Very good • Rather good • Neither good nor bad • Rather bad • Very bad • I do not want to answer.
34	**Q.** The following statements concern the environmental impacts of travelling. To what extent do you agree with the following statements? 1 – Strongly disagree 5 – Strongly agree • It is urgent to do something against the ecological destruction caused by using the car. • I believe that using the car causes many environmental problems.
35	**Q.** To what extent do you agree with the following statements about transport use and environmental effects? 1 – Strongly disagree 5 – Strongly agree • I feel morally obliged to reduce the environmental impact due to my travel patterns. • I would feel guilty if I did not reduce the environmental impact of my travel patterns. • I would feel good if I travel more sustainably.

36	**Q.** To what extent do you agree with the following statements about your social network's view on your use of carsharing services? 1 – Strongly disagree 5 – Strongly agree People who are important to me… • … use carsharing. • … like that I use carsharing. • … consider it positive that I use carsharing. • … think that I should use carsharing more often instead of other modes of transportation.
37	**Q.** Political issues are sometimes viewed differently, according to the extend sutainability and environment-protection are viewed as important. Where would you position yourself? Sustainability and environmental protection are … 1 - … not at all important to me. 5 - …very important to me. I do not want to answer.
38	**Q.** Political issues are sometimes also referred to as "left" and "right". Generally, where would you place your views on this scale? • far left • left • lightly left • center • lightly right • right • far right
39	**Q:** In your opinion, which of the following motives are incentives for you to use carsharing? Please, note that you can select more than one alternative. • The availability of carsharing pick-up locations near my place / workplace. • To reduce expenses compared to the private car. • To travel more sustainably. • For more convenience. • The convenience of having a car only when I need it. • To avoid responsibilities for maintenance and repairs of my own car. • To avoid looking for parking spots. • Other
40	**Q.** The following statements regard your views on carsharing and car sharing use in general. My support for further implementation of carsharing in society is… 1 - … very weak. 5 - … very strong. Overall, my view of car sharing is… 1 - … very negative. 5 - … very positive.

Questionnaire for non-users

Nr.	Case study, Frankfurt aM, Cologne, Stuttgart
0.1	Dear Madam, dear Sir, Thank you for taking part in this survey for the EU research project STARS. Before the survey starts, please read the following advice on data security carefully. If you have any questions concerning this survey or the STARS project do not hesitate to contact the Bundesverband CarSharing e.V. via the following address: projektassistenz@carsharing.de -Next- -EU-Logo- This project has received funding from the European Union's Horizon 2020 Programme under Grant Agreement No 769513
0.2	Privacy policy & Informed Consent This survey is conducted as part of the research project STARS. STARS is funded by the European Union under the Horizon 2020 program. Responsible for content and procedure of the survey is the Bundesverband CarSharing e.V.. With the technical implementation is the company Omnitrend entrusted. By signing this form, you confirm the following: • I agree to the digital recording of my answers to the questions. • I have been given the opportunity to ask questions about the survey and the project. • My participation in the survey is voluntary. I can withdraw from the study at any time and I do not have to give any reasons. • I understand that my personal details (in that case: IP-address, time of link-calling) will only be used within the project and will only be processed and stored for the analysis of my question within this survey. • I understand that my answers given in the survey when publishing results (for example in specialist publications and research reports) are used only in an anonymous or pseudonymous form. Individuals or households are never identifiable. • I agree for the data I provide to be archived in anonymised or pseudonymous form. Yes (Checkbox) -Next-
1	**Q.** Are you registered with a carsharing service at the moment? • Yes • No *Yes = Exit*
2	**Q.** Do you have adriving license? • Yes • No *Yes = Exit*
3	**Q.** How many people, including yourself, live in your household? • 1 • 2 • 3 • 4 • 5 or more

4	**Q.** Do you have children living in your household? You can select more than one option. • No • Yes, 0-3 years old • Yes, 4-6 years old • Yes, 7-15years old • Yes, 16 years old or older
5	**Q.** How many cars are there in your household? (Please also count company cars you got from your employer and which are allowed for personal use). • No car • One car • Two cars • Three or more cars
6	**Q.** How many drivers / licensees, including yourself, are there in your household? • None • 1 • 2 • More than 2
7	**Q.** Do you own a season ticket for public transport in the town where you live? • Yes • No
8	**Q.** The following statements relate to your attitude towards diverse means of transport. To what extent do you agree with the following statements? 1 – Strongly disagree 5 – Strongly agree • Driving a car is fun. • I like traveling with public transport. • A car is a means to an end. • If I have the choice, i use a car rather than public transport. • Cycling is fun. *Randomised order*
9	**Q.** The following statements relate to your relationship with car use. To what extent do you agree with the following statements? 1 – Strongly disagree 5 – Strongly agree • I feel strange travelling without a car. • I use the car without planning ahead. • It would require an effort for me not to use a car. • Using a car is part of my daily routine. • Using a car is something that I do automatically. • I have been using a car for a long time. • Driving a car saves time. • Driving a car makes life easier. *Randomised order*

10	**Q.** If you think about your daily travel, how often do you use the following modes in the town where you live? Daily – 4-6 days/week – 1-3 days/week – More seldom – Never • Private car as a driver • Private car as a passenger • Carsharing • Public Transport • Motorcycle/ scooter • Taxi • Bicycle for daily trips • Bicycle for leisure • Walking
11	**Q.** Below, some activities are listed. Which travel mode are you most likely to use for these activities? Please give the first answer that comes to mind. Private car as driver - private car as passenger - Carsharing - Public Transport - Motorcycle/ Scooter - Taxi - Cycling - Walking - railway – Other • Way to work/education • Visit friends/relatives in another city • Shopping stroll in the city center • Dinner in a restaurant • Taking an excursion in nice weather • Shopping for daily needs • Bulk shopping • Recreational activities on the weekend
12	**Q.** Do you own a smartphone? • Yes • No
13	if Q12 = yes **Q**. The following statements are about how you perceive the use of smartphone in everyday travel, for example, to check timetables, itineraries, costs, available transportation options, and more. 1 – Strongly disagree 5 – Strongly agree The use of smartphone in connection with travel is … …well suited. …valuable. …practical.

14	if Q12 = yes **Q.** To what extent do you use internet and / or apps to plan travels when using the following means of transportation? For example, to check timetables, itineraries, available transportation options and more. Always - Most of the times - Sometimes - Rarely - Never - I do not use this mode of transport • Private car • Carsharing • Public Transport • Cycling • Walking • Taxi • Railway • Other
15	**Q.** Have you heard about carsharing? • Yes • No *No = go to Q25*
16	**Q.** Do you know how carsharing functions – for example the booking and using of vehicles? 1 – i do not know at all how carsharing functions <-> 5 – I know exactly how carsharing functions
17	**Q.** Which oft he following carsharing operators do you know? • Car2go • DriveNow • Book-n-drive • Cambio • Stadtmobil • Flinkster • Drivy • Snappcar • Getaway • Other
18	**Q.** Have you been registered with a carsharing provider before? If yes – which provider? • Car2go • DriveNow • Book-n-drive • Cambio • Stadtmobil • Flinkster • Drivy • Snappcar • Getaway • Other
19	**Q.** Which of the following operators provide cars near the place where you life? • Car2go • DriveNow • Book-n-drive • Cambio

	• Stadtmobil • Flinkster • Drivy • Snappcar • Getaway • Other • I do not know.
20	**Q.** Are there any car sharing pick up locations close to your workplace/place where you study, or is your workplace/place where you study within an operational area? • Car2go • DriveNow • Book-n-drive • Cambio • Stadtmobil • Flinkster • Drivy • Snappcar • Getaway • Other • I do not know. • Not applicable – i am not working or in an education.
21	**Q.a** The following statements are about your perceptions of carsharing. To what extent do you agree with the following statements? It is not important how familiar you are with carsharing – a guess is enough. 1 – strongly disagree 5 – strongly agree, I do not know. Carsharing is … • … a full replacement for a private car. • … cheaper than the maintenance of a private car. • … more of an add-on to a private car. • … convenient. • … envorinment-friendly. • … expensive. **Q.b** I guess carsharing vehicles … • … are available at the requested time. • … are easily accessible after they are booked.
22	**Q.** The following statements are about your perceptions of carsharing use. To what extent do you agree with the following statements? There are no wrong answers – we just want to know what you think. 1 – Strongly disagree 5 – Strongly agree • It would be possible for me to use carsharing for my regular trips. • I am sure that I would be able to choose carsharing for my regular trips during the next week. • Carsharing is a useful service. • Carsharing would help me to carry out activities that are important to me. • Learning how to use carsharing would be easy for me. • It would be difficult to book a car at the carsharing website/app.
23	Based on my perception, I think carsharing services … • … provide good service. • … are reliable.

	• … are trustworthy. 1 – Strongly disagree 5 – Strongly agree
24	**Q.** To what extent do you agree with the following statements about your future travels in the next six months? 1 – Strongly disagree 5 – Strongly agree • I will continue traveling like today. • I think about using carsharing. • I will join a carsharing service. • I would use carsharing if the circumstances of my life would change.
25	**Q.** What is your gender? • Male • Female • Other
26	**Q.** In which year you were born?
27	**Q.** What is the highest education you have? Select the answer that you think best suits you. If you have not yet completed your education, please mark the degree you will reach next. • Main school • Middle school • High school • University degree (Diplom, Magister, Bachelor, Master) • Not applicable
28	**Q.** What is your current job-/employment situation? • Employed • Self-employed • Job education • School education • University education • Not employed/self-employed, not in an education
29	**Q.** What ist he monthly net income of your household? • 1000 – 2000 Euro • 2000 – 3000 Euro • 3000 – 4000 Euro • 4000 – 5000 Euro • >5000 Euro • I do not want to answer.
30	**Q.** How do you manage your expenses with your current income? • Very good • Rather good • Neither good nor bad • Rather bad • Very bad • I do not want to answer.
31	**Q.** The following statements concern the environmental impacts of travelling. To what extent do you agree with the following statements? 1 – Strongly disagree 5 – Strongly agree • It is urgent to do something against the ecological destruction caused by using the car.

	• I believe that using the car causes many environmental problems.
32	**Q.** To what extent do you agree with the following statements about transport use and environmental effects? 1 – Strongly disagree 5 – Strongly agree • I feel morally obliged to reduce the environmental impact due to my travel patterns. • I would feel guilty if I did not reduce the environmental impact of my travel patterns. • I would feel good if I travel more sustainably.
33	**Q.** To what extent do you agree with the following statements about your social network's view on your use of carsharing services? 1 – Strongly disagree 5 – Strongly agree People who are important to me… • … use carsharing. • … would like if I use carsharing. • … would agree if i use of carsharing. • … would think that I should use carsharing instead of other modes of transportation.
34	**Q.** Political issues are sometimes viewed differently, according to the extend sutainability and environment-protection are viewed as important. Where would you position yourself? Sustainability and environmental protection are … 1 1 - … not at all important to me. 5 - …very important to me. I do not want to answer.
35	**Q.** Political issues are sometimes also referred to as "left" and "right". Generally, where would you place your views on this scale? • far left • left • lightly left • center • lightly right • right • far right
36	If Q15 = Yes **Q:** In your opinion, which of the following motives are incentives for you to use carsharing? Please, note that you can select more than one alternative. • The availability of carsharing pick-up locations near my place / workplace. • To reduce expenses compared to the private car. • To travel more sustainably. • For more convenience. • The convenience of having a car only when I need it. • To avoid responsibilities for maintenance and repairs of my own car. • To avoid looking for parking spots. • Other
37	If Q15 = Yes **Q.** The following statements regard your views on carsharing and car sharing use in general. My support for further implementation of carsharing in society is…

	1 - ... very weak. 5 - ... very strong. Overall, my view of car sharing is... 1 - ... very negative. 5 - ... very positive.

Questionnaire for gathering back-end data

The questionnaire to gather the back-end data was tailored to the different car sharing variants. We show the questionnaire for the combined variant here, because it contains questions for roundtrip and free-floating cars alike.

Key indicator	Explanation	Your answer
Year your service started working	• Per city	
# of customers		
Number of customers in the survey-area	• Reference date 01.06.2018 • Postal code areas: 60385, 60316, 60318	
Number of customers in whole city	• Reference date 01.06.2018 • Per city	
# of vehicles roundtrip		
Number of vehicles in survey-area	• Reference date 01.06.2018 • Please send table of stations in addition	
Number of vehicles in whole city	• Reference date 01.06.2018 • Per city • Vehicles floating in homezones are counted as roundtrip	
# of vehicles free-floating		
Number of booking starts in survey-area	• Postal code areas: 60385, 60316, 60318 • Reference timespan 01.07.2017 to 30.06.2018	
Number of vehicles in whole city	• Reference date 01.06.2018 • Per city • Operational areas consisting of more than one city, please produce a vehicle-ratio per city	
Frequency of use		
Number of customers in survey area who booked a vehicle 1 und 11 **times per year.**	• Postal code areas: 60385, 60316, 60318 • Reference timespan 01.07.2017 to 30.06.2018	
Number of customers in survey area who booked a	• Postal code areas: 60385, 60316, 60318 • Reference timespan 01.07.2017 to 30.06.2018	

vehicle 12 und 51 **times per year.**		
Number of customers in survey area who booked a vehicle 12 und 51 **times per year or more.**	• Postal code areas: 60385, 60316, 60318 • Reference timespan 01.07.2017 to 30.06.2018	
Booking data roundtrip vehicles		
Average duration of booking	• Per city • In minutes • Reference timespan 01.07.2017 to 30.06.2018	
Average distance travelled per booking	• Per city • In kilometers • Reference timespan 01.07.2017 to 30.06.2018	
Number of booking starts per day	• Per city • Per week-day • Reference timespan 01.07.2017 to 30.06.2018	Monday Tuesday Wednesday Thursday Friday Saturday Sunday
Average number of booking starts per timespan on workdays (Mon-Fri)	• Per city • Per timespan on workdays Reference timespan 01.07.2017 to 30.06.2018	00-06 06-10 10-16 16-20 20-24
Booking data free-floating vehicles		
Average duration of booking	• Per city • In minutes • Reference timespan 01.07.2017 to 30.06.2018	
Average distance travelled per booking	• Per city • In kilometers • Reference timespan 01.07.2017 to 30.06.2018	
Number of booking starts per day	• Per city • Per week-day • Reference timespan 01.07.2017 to 30.06.2018	Monday Tuesday Wednesday Thursday Friday Saturday Sunday

Average number of booking starts per timespan on workdays (Mon-Fri)	• Per city • Per timespan on workdays Reference timespan 01.07.2017 to 30.06.2018 •	00-06 06-10 10-16 16-20 20-24

APPENDIX 2

List with car sharing organisations active in Belgium

	Category of car sharing	Active in regions
BattMobiel	Roundtrip home zone-based	Flanders
Bolides	Roundtrip home zone-based	Flanders
Cambio	Roundtrip station-based	Flanders, Brussels, Wallonia
Caramigo	Peer-to-peer	Flanders, Brussels, Wallonia
Cozycar	Peer-to-peer (closed communities)	Flanders, Brussels, Wallonia
Dégage	Peer-to-peer (closed communities)	Flanders
DriveNow	Free-floating with operational area	Brussels
Drivy	Peer-to-peer	Flanders, Brussels, Wallonia
Partago	Roundtrip home zone-based	Flanders
Poppy	Free-floating with operational area	Flanders
Stapp.in	Roundtrip station-based	Flanders
Tapazz	Peer-to-peer	Flanders, Brussels, Wallonia
Ubeeqo	Roundtrip station-based	Brussels
Wibee	Roundtrip home zone-based	Brussels, Wallonia
Zen Car	Roundtrip station-based	Flanders, Brussels
Zipcar	Free-floating with operational area	Brussels

List of extra questions to the case study Flanders

Q1. Which of the following car sharing services have you already used? Multiple answers are possible.

Battmobiel

Bolides

Cambio

Caramigo

Cozycar

Dégage

DriveNow

Drivy

Partago

Poppy

Stapp.in

Tapazz

Ubeeqo

Wibee

Zen Car

Zipcar

For each car sharing service the respondents indicated in the first question, they get to see question 2 to 4 again.

Q2. When did you start car sharing through that service?

Q3. Do you own fewer cars since you started car sharing through that service?

No

Yes

Q4. Tho what extent are you satisfied with …

1 – Stronlgy dissatisfied 7 – Strongly satisfied

the overall service of this car sharing service?
the proximity of the cars of this car sharing service?
the ease of use of the cars of this car sharing service?
the cost price of this car sharing service?
the flexibility of this car sharing service?
the supply of ecological cars from this car sharing service?

APPENDIX 3

Main surveys used in the introductory paragraph section 1

Carplus survey in UK

The Carplus Annual Survey is the most comprehensive dataset collected across the car sharing sector on an annual basis. It is structured in three complementary reports: one is based on data regarding members living in England (excluding London) and Wales, another one focusses on London members and the third one on the car sharing members of Scotland. So, it gives car sharing insights and car sharing member characteristics in different context areas (regional and urban) of United Kingdom

Information from the following surveys was exploited in this research:

- Carplus Annual Survey 2015/16 - England and Wales;
- Carplus Annual Survey 2014/15 - England and Wales (only for Peer-to-peer and corporate car sharing data);
- Carplus Annual Survey 2016/17 – London;
- Carplus Annual Survey 2016/17 – Scotland.

Language remark: in United Kingdom the term used to identify car sharing services is *car club;* thus *round trip car club* stands for round trip car sharing while *flexible car club* stands for free-floating car sharing. Here we will just refer to car sharing as done in the whole STARS project.

The survey was completed in England (excluding London) and Wales by a sample of 2.583 out of about 27.000 individual round-trip car sharing members. Amongst them, there were 1.985 longer term members and 598 new members (who are member for less than one year at the moment of the survey).

In Scotland the survey was completed by 586 round-trip car sharing members (471 longer term members and 115 new members), from a membership of around 11.500.

The survey was completed in London by 2.901 round-trip car sharing members and 1.122 free-floating car sharing members from a membership of 193.500. Concerning round-trip members, 2.290 were longer term members and 611 new members (who joined within the six months prior to completing the survey). Regarding the 1.122 free-floating members, they were DriveNow customers. Of these respondents, 572 were new joiners (those that have been a member for six months or less) and the other 550 longer term members. 35% of flexible car club members who responded are also members of round-trip car sharing services.

Additional information regarding Peer-to-peer car sharing and Corporate car sharing are available in the Carplus Annual Survey 2014/2015 (Steer Davies Gleave, April 2015) (Steer Davies Gleave, April 2015) (Steer Davies Gleave, April 2015).

In particular, 84 peer-to-peer car sharing members living in England (including London), Scotland and Wales were investigated. The survey, predominantly London-based, found similar results to the survey of round-trip members. The sample of 943 car sharing members whose membership is provided through their employer was structured as follow:

- 653 members living in England and Wales (excluding London);
- 301 members living in London;
- 90 members living in Scotland.

Enquête Nationale sur l'Autopartage (Car sharing National survey in France)

In France the second National Survey on Car sharing was conducted in 2016 by the research centre 6-t. The report presents the results of four quantitative surveys and a qualitative survey of car sharing users. The aim of these surveys is to update and supplement the knowledge generated by the First National Survey on users, uses and impacts of car sharing carried out in 2012.

The mentioned surveys were structured as follow:

- A survey of 2061 car sharing users in France. This survey aims to provide a "snapshot" of car sharing in the overall France in 2016;
- A longitudinal survey consisting of re-interviewing 276 respondents to the 2012 survey, to assess the evolution of their behaviour over the past four years;
- A survey of 158 fleet managers in companies and communities using car sharing;
- A survey of 83 users of the car-sharing service "Koolicar".

Language remark: in France the term used to identify car sharing services is *autopartage;* thus *autopartage en boucle* stands for round trip car sharing while *autopartage en trace directe sans station* stands for free-floating car sharing. In the following document we will just refer to car sharing as done in the whole STARS project.

Car sharing in the Netherlands – Trends, users characteristics and mobility effects

The report, which was written by the KiM (Netherlands Institute for Transport Policy Analysis), wants to provide answers to many questions related to the car sharing diffusion, such as future car sharing trends, what is the current size of the car sharing market, who uses car sharing services and for what purposes.

For this study it was made use of several research techniques and data sources: interviews with experts in the Netherlands and data from the car sharing survey 2014 conducted by TNS NIPO (Monitor autodelen) gave useful information to determine the current size and potential of the car sharing market in the Netherlands. This survey was held among a representative sample of Dutch adults (over 18) in possession of a driving license (n=853) during May to July 2014.

To identify the mobility and environmental effects of car sharing, TNS NIPO and PBL Netherlands Environmental Assessment Agency carried out a further questionnaire survey of 363 current car sharers in December 2014. Current car sharers were defined as adults who have used a shared car at least once in the past year. Within this group, a distinction is made between car sharers who rented a car from an organisation (such as Greenwheels and Car2Go) and car sharers who rented a private car (via an intermediary organisation such as Snappcar). Adults who indicated that they are seriously considering using a car sharing service within one year were also surveyed. Both surveys give further information of day they used a shared car.

To discover the motives behind people's decisions to use car sharing services (opportunities and constraints), two focus group sessions were held with car sharers and potential car sharers in Amsterdam.

The results of these focus groups sessions (Ter Borg & Schothorst, 2015) were used, among other purposes, for a study of 500 respondents to identify which demographic and social characteristics determine why people choose a certain car sharing scheme. The respondents were given various alternative car sharing schemes to choose from (stated preference). Discrete choice model techniques were used to obtain an understanding of the possible opportunities and constraints facing potential car sharers in their daily travel behaviour (Dieten, 2015).

DEMONSTRATE Project dataset in metropolitan area of Turin

A survey was implemented in the Turin metropolitan area, made by the Turin municipality, with about 800.000 inhabitants and 23 traffic analysis zones, and the municipalities surrounding the city, with about 544.000 inhabitants and 31 traffic analysis zones. A representative sample of the population

aged 18 and more was stratified according to gender, age, occupational status and traffic analysis zone where the individual lives.

The survey consisted of six sections:

A. Brief introduction and preliminary screening questions (gender, age, occupation and zone) to understand which stratum the interviewee belongs to.

B. Travel diary and related activity patterns spanning over the 24 hours before the interview; all activity locations were geocoded by embedding Google Maps APIs in the questionnaire to better estimate travel times and covered distances.

C. Focus on a randomly selected trip among those listed in the travel diary. In order to increase the degree of realism for the respondent related to car sharing services, trips longer that 50 km and/or carried out outside the study area were excluded from the draw. Additionally, if the selected trip was preceded or followed by an activity lasting less than 1 hour, a trip chain containing shorter activity durations was automatically selected for further analysis rather than the individual trip. Previous research (Diana 2010; Diana 2008), has shown that this helps in better matching the common understanding of a trip beyond the technical definition which is used in transport planning (i.e. a movement between any two activities) and it is again intended to help respondents in focusing on a trip chain that makes sense to them. Detailed questions were posed about this chained trip (e.g. travel times with all means, walk and wait times, travel contingencies, info on vehicles, on-trip activities), also considering modes used (e.g. cost, duration, presence of parking, number of persons, use of different modes in the past to complete the same trip).

D. Attitudinal questions on the chained trip (e.g. intention to use different modes in the future to complete the same trip, possible accidents, satisfaction levels through a valence and activation scale (Ettema et al. 2011; Ettema et al. 2010)).

E. Stated-preference experiments to investigate mode switching attitudes for the chained trip, which is not relevant to the present research.

F. Socio-economic questions at both household (e.g. number of members, cars, income) and individual (e.g. education, driving license) level.

The same survey was administered through both CATI (Computer Assisted Web Interviewing) and CAWI (Computer Assisted Telephone Interviewing) protocols 7 days a week in three different 4-weeks periods, to control for seasonal effects, to the following samples:

- September-October 2016 (1526 respondents);
- February 2017 (1460 respondents);
- June 2017 (1480 respondents).

Data obtained from the three waves were 1 aggregated (4466 interviews). Those interviewees that did not travel the day before the interview or had only trips longer than 50 km or travelled outside the study area were not considered, therefore 3280 interviews (73.4%) were retained.

WiMobil project

Within the project, a similar set of surveys (online, panel, focus groups) was carried out in two survey periods. In each survey period, both car sharing systems were analysed by interviewing customers of DriveNow and Flinkster. The spatial focus was set on the two cities Berlin and Munich. The analysis presented in this article is mainly based on data originating from online surveys, see description below. If another dataset is used, it is pointed out in the text. In March 2015, a randomized sample of 6,000 DriveNow customers living in Berlin and Munich received a link to an online survey by email. The only necessary condition to be potentially part of the sample was to have used DriveNow at least once within the last twelve months. In total, 819 DriveNow users (14%) participated in the survey. In the case of Flinkster, 3,077 randomly selected costumers of Berlin and Munich were contacted by email in March 2014. Flinkster customers who generally do not want to participate in surveys were excluded from the sample. Due to a high number of previous surveys, Flinkster customers were mostly unwilling to take part in the online survey. 227 people completed the questionnaire, equalling a return rate of 7%. The reason for comparing online surveys of DriveNow and Flinkster customers from two different points in time is the better comparability of the samples. In the first survey period, DriveNow customers who frequently use car sharing had a higher probability of selection due to the specific survey design. As the response rate of Flinkster customers dropped in the second survey period, the data of the first survey period were preferred. Comparing the sample with the basic population of all DriveNow and Flinkster customers living in Berlin and Munich, it can be seen that there are only small differences in terms of age and gender distribution. Thus, the datasets used give a good picture of the typical costumers of both systems.

APPENDIX 4

Mosaic profiles for UK car sharing members

Mosaic profile	% of England and Wales members	% of England and Wales population	% of Scottish members	% of Scottish population	% of London Roundtrip members	% of London population	% of London Free-floating members	% of London population living in the FF operational area	Description
Central pulse	11%	1%	23%	3%	2%	1%	1%	0%	Entertainment-seeking youngsters renting city centre flats in vibrant locations close to jobs and night life.
Uptown Elite	8%	0,2%	8%	1%	14%	9%	14%	10%	High status households owning elegant homes in accessible inner suburbs where they enjoy city life in comfort.
Metro High-Flyers	8%	0,2%	4%	0,3%	20%	10%	23%	18%	Ambitious 20 and 30-somethings renting expensive apartments in highly commutable areas of major cities (inner boroughs of London).
Ageing access	7%	1%	8%	1%	1%	2%	1%	2%	Older residents owning small inner suburban properties with good access to amenities.
Career Builders	6%	1%			1%	3%	1%	3%	Motivated singles and couples in their 20s and 30s progressing in their field of work from commutable properties.
Learners & Earners	5%	1%			<1%	<1%			Inhabitants of the university fringe where students and older residents mix in cosmopolitan locations.
Cafes & Catchments	3%	1%	3%	6,4%	2%	7%	2%	7%	Affluent families with growing children living in upmarket housing in city environments.
Primary Ambitions	3%	3%					<1%	0%	Forward-thinking younger families who sought affordable homes in good suburbs which they may now be out-growing.
Bus Route Renters			5%	4%					Singles renting affordable private flats away from central amenities and often on main roads.
Student Scene			3%	0,5%	<1%	<1%			Students living in high density accommodation close to universities and educational centres.
Streetwise Singles			2%	1%					Well-qualified older singles with incomes from successful professional careers in good quality housing.
Crowded Kaleidoscope			2%	0,1%	9%	8%	8%	15%	Multi-cultural households with children renting social flats in over-crowded conditions.
Penthouse Chic					8%	6%	4%	2%	Singletons living in flats in prestige central locations with high incomes and outgoings.
Flexible Workforce					8%	9%	10%	15%	Self-starting young renters ready to move to follow worthwhile incomes in service sector.
Inner City Stalwart					7%	6%	8%	11%	Longer-term renters of inner city social flats who have witnessed many changes.
World-Class Wealth					6%	7%	3%	3%	Global high flyers and privileged families living luxurious lifestyles.
Cultural Comfort					4%	8%	8%	12%	Thriving families with good incomes in multi-cultural urban communities.
Community Elders					2%	7%	3%	5%	Established older households owning city homes in diverse neighbourhoods.
New Foundations					1%	1%	1%	1%	Occupants of brand new homes who are often younger singles or couples with children
Solid Economy					1%	4%			Stable families with children renting better quality homes from social landlords

Table 111: Profiles of car sharing members in United Kingdom according to Mosaic profiling tool

APPENDIX 5

Additional tables and figures on car sharing profiles and use

City		Age profile										
		18 to 20	21 to 24	25 to 29	30 to 34	35 to 39	40 to 44	45 to 49	50 to 54	55 to 59	60 to 65	65+
Berlin and Munich	Roundtrip station-based members 2015	3%		6%	14%	13%	13%	15%	36%			
	Free-floating members 2015	12%		22%	19%	14%	9%	11%	13%			
	Driving Licence Holders in Germany	24%		64%				10%				3%
London	CS members in London 2016/17	0%	4%	17%	24%	32%		9%	6%	4%	4%	
	Driving Licence Holders in UK	3%	5%	7%	8%	20%		11%	10%	9%	27%	
Turin	CS members in Turin 2016/17	0,7%	6,5%	21%	19,6%	25,4%		7,2%	5,8%	7,2%	6,5%	
	Driving Licence Holders in Turin	3,1%	5,7%	8%	9,2%	21,3%		10,3%	10,1%	8,4%	24,1%	

Table 112: Age profile of car sharing members compared with the national average in different European cities (Source: own elaborations from data contained in Carplus Annual Survey 2016/17, LTDS 2016, WiMobil 2015, ZFER 2018, DEMONSTRATE 2017)

Car sharing trip purpose	Purpose explanation (where listed)				
	France[35]	Germany[36]	Italy[37]	Netherlands[38]	United Kingdom[39]
Personal business	Access to services such as administrative, medical etc.	Care and services	-	Visiting doctor/hospital, going out, diverse etc.	Going to the bank, hairdresser, dentist etc.
Visiting friends/family	Visiting friends/family	-	Visiting friends/family	Visiting friends/family	Visiting friends/family
Leisure	Sport, culture, nature etc	Free time (Freizeit)	Leisure (Svago)	Leisure and other (also other activities are included)	Going swimming or to the cinema etc
Shopping	Shopping (des courses ou des achats)	Shopping (erledigungen)	Shopping	Shopping/ transport heavy objects	Shopping
Business	Business (un deplacement professionel)	Business (Dienstliche fahrt)	Business (uso per motivi di lavoro)	Business	A work-related trip that is not your commute
Education	-	-	-	-	Education including doing the school run
Commuting	-	Journey to/from job or school (zur Arbeit, Ausbildung)	Journey to/from job or school (tragitto scuola lavoro)	Journey to/from work/education & training	Journey to/from job
Escort	Escort (accompagner ou aller chercher quelqu'un)	Escort (Bringen, Holen von Personen)	Escort (accompagnamento)	Taking/collecting children	-
Back home	-	Back home (Nach hause)	-	-	-

Table 113: List of car sharing trip purposes found in literature

[35] Figure 29 (6t-bureau de recherche, Avril 2017)
[36] Figure 23 (Riegler, et al., September 2016)
[37] Figure 21 (Mastretta, et al., 2018)
[38] Figure 3.6 (KiM | Netherlands Institute for Transport Policy Analysis, 2015)
[39] Question 12 & Figure A.16 (Steer Davies Gleave, April 2016); Question 13 & Figure A.16 (Steer Davies Gleave, March 2017)

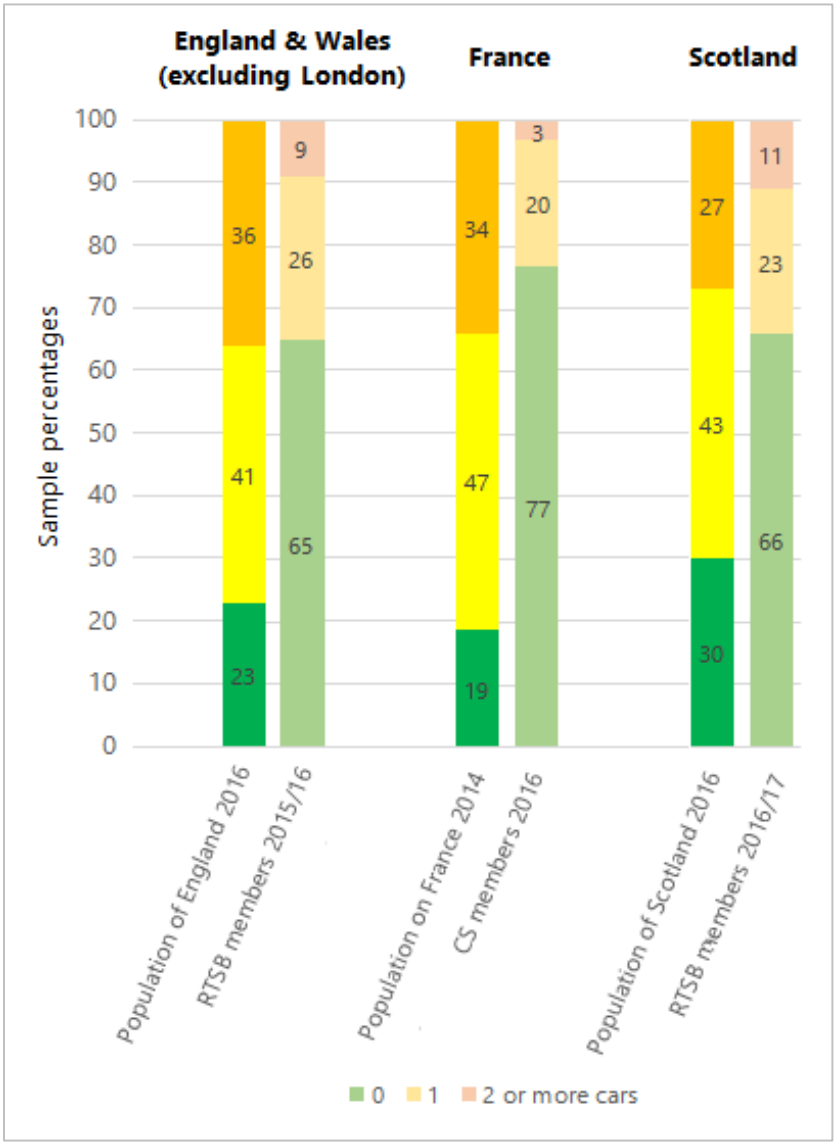

Figure 58: Car ownership percentages after joining car sharing services in different EU countries (Source: own elaborations from data contained in Carplus Annual Survey 2015/16 - 2016/17, NTS 2016, ENA 2016, INSEE 2014, SHS 2017)

APPENDIX 6

The German case study: Results of ANOVA and Bonferroni tests

Table 41: Driving a car is fun

Result of ANOVA: F(4, 894) = 24.743, p < .001

Bonferroni

Group (I)	Group (J)	Mean Difference (I-J)	Std. Error	Significance	95%-Confidence Interval	
					Lower Bound	Upper Bound
only roundtrip	only free-floating	-1,00	,112	,000	-1,31	-,68
	only Peer-to-peer	-,91	,127	,000	-1,27	-,55
	only combined	-,36	,119	,023	-,70	-2,86E-02
	roundtrip + free-floating	-,41	,119	,006	-,75	-7,71E-02
only combined	only roundtrip	,36	,119	,023	2,86E-02	,70
	only free-floating	-,63	,128	,000	-,99	-,27
	only Peer-to-peer	-,55	,141	,001	-,94	-,15
	roundtrip + free-floating	-4,78E-02	,133	1,000	-,42	,33
only free-floating	only roundtrip	1,00	,112	,000	,68	1,31
	only Peer-to-peer	8,72E-02	,135	1,000	-,29	,47
	only combined	,63	,128	,000	,27	,99
	roundtrip + free-floating	,59	,128	,000	,23	,94
only Peer-to-peer	only roundtrip	,91	,127	,000	,55	1,27
	only free-floating	-8,72E-02	,135	1,000	-,47	,29
	only combined	,55	,141	,001	,15	,94

	roundtrip + free-floating	,50	,141	,004	,10	,89
roundtrip + free-floating	only roundtrip	,41	,119	,006	7,71E-02	,75
	only free-floating	-,59	,128	,000	-,94	-,23
	only Peer-to-peer	-,50	,141	,004	-,89	-,10
	only combined	4,78E-02	,133	1,000	-,33	,42

Table 114: A car is a means to an end

Result of ANOVA: F(4, 897) = 23.167, p < .001

Bonferroni

Group (I)	**Group (J)**	**Mean Difference (I-J)**	**Std. Error**	**Significance**	**95%-Confidence Interval**	
					Lower Bound	Upper Bound
only roundtrip	only free-floating	,98	,111	,000	,67	1,29
	only Peer-to-peer	,58	,124	,000	,23	,93
	only combined	8,90E-02	,117	1,000	-,24	,42
	roundtrip + free-floating	,31	,117	,077	-1,67E-02	,64
only combined	only roundtrip	-8,90E-02	,117	1,000	-,42	,24
	only free-floating	,89	,126	,000	,54	1,25
	only Peer-to-peer	,49	,138	,004	,10	,88
	roundtrip + free-floating	,22	,131	,896	-,15	,59
only free-floating	only roundtrip	-,98	,111	,000	-1,29	-,67
	only Peer-to-peer	-,40	,133	,025	-,78	-2,89E-02
	only combined	-,89	,126	,000	-1,25	-,54
	roundtrip + free-floating	-,67	,126	,000	-1,02	-,32
	only roundtrip	-,58	,124	,000	-,93	-,23

only Peer-to-peer	only free-floating	,40	,133	,025	2,89E-02	,78
	only combined	-,49	,138	,004	-,88	-,10
	roundtrip + free-floating	-,27	,138	,536	-,65	,12
roundtrip + free-floating	only roundtrip	-,31	,117	,077	-,64	1,67E-02
	only free-floating	,67	,126	,000	,32	1,02
	only Peer-to-peer	,27	,138	,536	-,12	,65
	only combined	-,22	,131	,896	-,59	,15

Table 115: I feel strange travelling without a car

Result of ANOVA: F(4, 894) = 24.431, p < .001

Bonferroni

Group (I)	**Group (J)**	**Mean Difference (I-J)**	**Std. Error**	**Significance**	**95%-Confidence Interval**	
					Lower Bound	Upper Bound
only roundtrip	only free-floating	-,59	,086	,000	-,83	-,35
	only Peer-to-peer	-,71	,097	,000	-,98	-,43
	only combined	-1,44E-03	,091	1,000	-,26	,25
	roundtrip + free-floating	-8,22E-02	,090	1,000	-,34	,17
only combined	only roundtrip	1,44E-03	,091	1,000	-,25	,26
	only free-floating	-,59	,097	,000	-,86	-,31
	only Peer-to-peer	-,70	,107	,000	-1,00	-,40
	roundtrip + free-floating	-8,07E-02	,101	1,000	-,37	,20
only free-floating	only roundtrip	,59	,086	,000	,35	,83
	only Peer-to-peer	-,12	,103	1,000	-,40	,17
	only combined	,59	,097	,000	,31	,86

	roundtrip + free-floating	,51	,097	,000	,23	,78
only Peer-to-peer	only roundtrip	,71	,097	,000	,43	,98
	only free-floating	,12	,103	1,000	-,17	,40
	only combined	,70	,107	,000	,40	1,00
	roundtrip + free-floating	,62	,107	,000	,32	,92
roundtrip + free-floating	only roundtrip	8,22E-02	,090	1,000	-,17	,34
	only free-floating	-,51	,097	,000	-,78	-,23
	only Peer-to-peer	-,62	,107	,000	-,92	-,32
	only combined	8,07E-02	,101	1,000	-,20	,37

Table 116: It would require an effort for me not to use a car

Result of ANOVA: $F(4, 895) = 19.372$, $p < .001$

Bonferroni

Group (I)	**Group (J)**	**Mean Difference (I-J)**	**Std. Error**	**Significance**	**95%-Confidence Interval**	
					Lower Bound	Upper Bound
only roundtrip	only free-floating	-1,04	,130	,000	-1,40	-,67
	only Peer-to-peer	-,66	,146	,000	-1,08	-,25
	only combined	-,12	,137	1,000	-,51	,26
	roundtrip + free-floating	-,22	,137	1,000	-,61	,16
only combined	only roundtrip	,12	,137	1,000	-,26	,51
	only free-floating	-,91	,147	,000	-1,33	-,50
	only Peer-to-peer	-,54	,162	,009	-1,00	-8,45E-02
	roundtrip + free-floating	-,10	,154	1,000	-,53	,33
only free-floating	only roundtrip	1,04	,130	,000	,67	1,40
	only Peer-to-peer	,37	,156	,174	-6,74E-02	,81

	only combined	,91	,147	,000	,50	1,33
	roundtrip + free-floating	,81	,147	,000	,40	1,23
only Peer-to-peer	only roundtrip	,66	,146	,000	,25	1,08
	only free-floating	-,37	,156	,174	-,81	6,74E-02
	only combined	,54	,162	,009	8,45E-02	1,00
	roundtrip + free-floating	,44	,162	,066	-1,50E-02	,90
roundtrip + free-floating	only roundtrip	,22	,137	1,000	-,16	,61
	only free-floating	-,81	,147	,000	-1,23	-,40
	only Peer-to-peer	-,44	,162	,066	-,90	1,50E-02
	only combined	,10	,154	1,000	-,33	,53

Table 117: It would require an effort for me not to use a car

Result of ANOVA: $F(4, 894) = 30.276$, $p < .001$

Bonferroni

Group (I)	**Group (J)**	**Mean Difference (I-J)**	**Std. Error**	**Significance**	**95%-Confidence Interval**	
					Lower Bound	Upper Bound
only roundtrip	only free-floating	-1,14	,107	,000	-1,44	-,84
	only Peer-to-peer	-,53	,120	,000	-,87	-,19
	only combined	-,25	,113	,296	-,56	7,17E-02
	roundtrip + free-floating	-,35	,113	,020	-,67	-3,15E-02
only combined	only roundtrip	,25	,113	,296	-7,17E-02	,56
	only free-floating	-,90	,121	,000	-1,24	-,55
	only Peer-to-peer	-,28	,133	,343	-,66	9,26E-02
	roundtrip + free-floating	-,10	,126	1,000	-,46	,25
	only roundtrip	1,14	,107	,000	,84	1,44

only free-floating	only Peer-to-peer	,61	,128	,000	,25	,97
	only combined	,90	,121	,000	,55	1,24
	roundtrip + free-floating	,79	,121	,000	,45	1,13
only Peer-to-peer	only roundtrip	,53	,120	,000	,19	,87
	only free-floating	-,61	,128	,000	-,97	-,25
	only combined	,28	,133	,343	-9,26E-02	,66
	roundtrip + free-floating	,18	,133	1,000	-,19	,55
roundtrip + free-floating	only roundtrip	,35	,113	,020	3,15E-02	,67
	only free-floating	-,79	,121	,000	-1,13	-,45
	only Peer-to-peer	-,18	,133	1,000	-,55	,19
	only combined	,10	,126	1,000	-,25	,46

Table 118: I like travelling with public transport

Result of ANOVA: F(4, 896) = 18.969, p < .001

Bonferroni

Group (I)	**Group (J)**	**Mean Difference (I-J)**	**Std. Error**	**Significance**	**95%-Confidence Interval**	
					Lower Bound	Upper Bound
only roundtrip	only free-floating	,67	,109	,000	,36	,98
	only Peer-to-peer	,75	,123	,000	,40	1,09
	only combined	4,77E-02	,115	1,000	-,28	,37
	roundtrip + free-floating	-1,84E-02	,115	1,000	-,34	,31
only combined	only roundtrip	-4,77E-02	,115	1,000	-,37	,28
	only free-floating	,62	,124	,000	,27	,97
	only Peer-to-peer	,70	,137	,000	,32	1,08
	roundtrip + free-floating	-6,61E-02	,129	1,000	-,43	,30

only free-floating	only roundtrip	-,67	,109	,000	-,98	-,36
	only Peer-to-peer	7,60E-02	,131	1,000	-,29	,45
	only combined	-,62	,124	,000	-,97	-,27
	roundtrip + free-floating	-,69	,124	,000	-1,04	-,34
only Peer-to-peer	only roundtrip	-,75	,123	,000	-1,09	-,40
	only free-floating	-7,60E-02	,131	1,000	-,45	,29
	only combined	-,70	,137	,000	-1,08	-,32
	roundtrip + free-floating	-,77	,136	,000	-1,15	-,38
roundtrip + free-floating	only roundtrip	1,84E-02	,115	1,000	-,31	,34
	only free-floating	,69	,124	,000	,34	1,04
	only Peer-to-peer	,77	,136	,000	,38	1,15
	only combined	6,61E-02	,129	1,000	-,30	,43

Table 119: If a have the choice, I use a car rather than public transport

Result of ANOVA: $F(4, 892) = 47.478$, $p < .001$

Bonferroni

Group (I)	**Group (J)**	**Mean Difference (I-J)**	**Std. Error**	**Significance**	**95%-Confidence Interval**	
					Lower Bound	Upper Bound
only roundtrip	only free-floating	-1,42	,121	,000	-1,76	-1,08
	only Peer-to-peer	-1,24	,136	,000	-1,63	-,86
	only combined	-,23	,128	,774	-,59	,13
	roundtrip + free-floating	-,38	,127	,028	-,74	-2,30E-02
only combined	only roundtrip	,23	,128	,774	-,13	,59
	only free-floating	-1,19	,137	,000	-1,58	-,81
	only Peer-to-peer	-1,02	,151	,000	-1,44	-,59

	roundtrip + free-floating	-,16	,143	1,000	-,56	,25
only free-floating	only roundtrip	1,42	,121	,000	1,08	1,76
	only Peer-to-peer	,17	,145	1,000	-,23	,58
	only combined	1,19	,137	,000	,81	1,58
	roundtrip + free-floating	1,04	,136	,000	,65	1,42
only Peer-to-peer	only roundtrip	1,24	,136	,000	,86	1,63
	only free-floating	-,17	,145	1,000	-,58	,23
	only combined	1,02	,151	,000	,59	1,44
	roundtrip + free-floating	,86	,150	,000	,44	1,29
roundtrip + free-floating	only roundtrip	,38	,127	,028	2,30E-02	,74
	only free-floating	-1,04	,136	,000	-1,42	-,65
	only Peer-to-peer	-,86	,150	,000	-1,29	-,44
	only combined	,16	,143	1,000	-,25	,56

Table 120: Car Sharing is a useful service

Result of ANOVA: $F(4, 800) = 6.005$, $p < .001$

Bonferroni

Group (I)	**Group (J)**	**Mean Difference (I-J)**	**Std. Error**	**Significance**	**95%-Confidence Interval**	
					Lower Bound	Upper Bound
only roundtrip	only free-floating	,26	,060	,000	8,65E-02	,43
	only Peer-to-peer	,25	,068	,002	6,06E-02	,44
	only combined	,10	,061	,948	-7,02E-02	,28
	roundtrip + free-floating	,13	,063	,323	-4,20E-02	,31
	only roundtrip	-,10	,061	,948	-,28	7,02E-02

only combined	only free-floating	,15	,068	,233	-3,67E-02	,34
	only Peer-to-peer	,15	,074	,460	-6,06E-02	,36
	roundtrip + free-floating	3,13E-02	,070	1,000	-,16	,23
only free-floating	only roundtrip	-,26	,060	,000	-,43	-8,65E-02
	only Peer-to-peer	-5,25E-03	,073	1,000	-,21	,20
	only combined	-,15	,068	,233	-,34	3,67E-02
	roundtrip + free-floating	-,12	,069	,749	-,32	7,08E-02
only Peer-to-peer	only roundtrip	-,25	,068	,002	-,44	-6,06E-02
	only free-floating	5,25E-03	,073	1,000	-,20	,21
	only combined	-,15	,074	,460	-,36	6,06E-02
	roundtrip + free-floating	-,12	,075	1,000	-,33	9,44E-02
roundtrip + free-floating	only roundtrip	-,13	,063	,323	-,31	4,20E-02
	only free-floating	,12	,069	,749	-7,08E-02	,32
	only Peer-to-peer	,12	,075	1,000	-9,44E-02	,33
	only combined	-3,13E-02	,070	1,000	-,23	,16

Table 121: Car Sharing helps me to carry out activities which are important to me

Result of ANOVA: $F(4, 802) = 18.309$, $p < .001$

Bonferroni

Group (I)	**Group (J)**	**Mean Difference (I-J)**	**Std. Error**	**Significance**	**95%-Confidence Interval**	
					Lower Bound	Upper Bound
only roundtrip	only free-floating	,89	,108	,000	,58	1,19
	only Peer-to-peer	,28	,121	,228	-6,46E-02	,62
	only combined	,12	,110	1,000	-,19	,43

	roundtrip + free-floating	,19	,112	,860	-,12	,51
only combined	only roundtrip	-,12	,110	1,000	-,43	,19
	only free-floating	,76	,121	,000	,42	1,10
	only Peer-to-peer	,15	,133	1,000	-,22	,53
	roundtrip + free-floating	7,06E-02	,124	1,000	-,28	,42
only free-floating	only roundtrip	-,89	,108	,000	-1,19	-,58
	only Peer-to-peer	-,61	,131	,000	-,98	-,24
	only combined	-,76	,121	,000	-1,10	-,42
	roundtrip + free-floating	-,69	,123	,000	-1,04	-,35
only Peer-to-peer	only roundtrip	-,28	,121	,228	-,62	6,46E-02
	only free-floating	,61	,131	,000	,24	,98
	only combined	-,15	,133	1,000	-,53	,22
	roundtrip + free-floating	-8,40E-02	,134	1,000	-,46	,29
roundtrip + free-floating	only roundtrip	-,19	,112	,860	-,51	,12
	only free-floating	,69	,123	,000	,35	1,04
	only Peer-to-peer	8,40E-02	,134	1,000	-,29	,46
	only combined	-7,06E-02	,124	1,000	-,42	,28

Table 122: Car Sharing is a full replacement for a private car

Result of ANOVA: $F(4, 790) = 17.410$, $p < .001$

Bonferroni

Group (I)	**Group (J)**	**Mean Difference (I-J)**	**Std. Error**	**Significance**	**95%-Confidence Interval**	
					Lower Bound	Upper Bound
only roundtrip	only free-floating	,93	,125	,000	,57	1,28
	only Peer-to-peer	,25	,142	,830	-,15	,64

	only combined	-8,76E-02	,129	1,000	-,45	,27
	roundtrip + free-floating	,17	,130	1,000	-,20	,54
only combined	only roundtrip	8,76E-02	,129	1,000	-,27	,45
	only free-floating	1,01	,141	,000	,62	1,41
	only Peer-to-peer	,33	,155	,322	-,10	,77
	roundtrip + free-floating	,26	,145	,779	-,15	,66
only free-floating	only roundtrip	-,93	,125	,000	-1,28	-,57
	only Peer-to-peer	-,68	,153	,000	-1,11	-,25
	only combined	-1,01	,141	,000	-1,41	-,62
	roundtrip + free-floating	-,76	,142	,000	-1,16	-,36
only Peer-to-peer	only roundtrip	-,25	,142	,830	-,64	,15
	only free-floating	,68	,153	,000	,25	1,11
	only combined	-,33	,155	,322	-,77	,10
	roundtrip + free-floating	-7,71E-02	,157	1,000	-,52	,36
roundtrip + free-floating	only roundtrip	-,17	,130	1,000	-,54	,20
	only free-floating	,76	,142	,000	,36	1,16
	only Peer-to-peer	7,71E-02	,157	1,000	-,36	,52
	only combined	-,26	,145	,779	-,66	,15

Table 123: Car Sharing is more of an add-on to a private car

Result of ANOVA: $F(4, 761) = 38.813$, $p < .001$

Bonferroni

Group (I)	**Group (J)**	**Mean Difference (I-J)**	**Std. Error**	**Significance**	**95%-Confidence Interval**	
					Lower Bound	Upper Bound
	only free-floating	-1,52	,136	,000	-1,90	-1,14

only roundtrip	only Peer-to-peer	-,66	,153	,000	-1,09	-,23
	only combined	5,62E-02	,138	1,000	-,33	,45
	roundtrip + free-floating	-,46	,141	,011	-,86	-6,49E-02
only combined	only roundtrip	-5,62E-02	,138	1,000	-,45	,33
	only free-floating	-1,58	,152	,000	-2,01	-1,15
	only Peer-to-peer	-,72	,168	,000	-1,19	-,24
	roundtrip + free-floating	-,52	,157	,010	-,96	-7,67E-02
only free-floating	only roundtrip	1,52	,136	,000	1,14	1,90
	only Peer-to-peer	,86	,166	,000	,40	1,33
	only combined	1,58	,152	,000	1,15	2,01
	roundtrip + free-floating	1,06	,154	,000	,63	1,49
only Peer-to-peer	only roundtrip	,66	,153	,000	,23	1,09
	only free-floating	-,86	,166	,000	-1,33	-,40
	only combined	,72	,168	,000	,24	1,19
	roundtrip + free-floating	,20	,170	1,000	-,28	,68
roundtrip + free-floating	only roundtrip	,46	,141	,011	6,49E-02	,86
	only free-floating	-1,06	,154	,000	-1,49	-,63
	only Peer-to-peer	-,20	,170	1,000	-,68	,28
	only combined	,52	,157	,010	7,67E-02	,96

Table 124: Car Sharing is cheaper than the maintenance of a private car

Result of ANOVA: $F(4, 757) = 13.878$, $p < .001$

Bonferroni

Group (I)	**Group (J)**	**Mean Difference (I-J)**	**Std. Error**	**Significance**	**95%-Confidence Interval**	
					Lower Bound	Upper Bound

only roundtrip	only free-floating	,72	,107	,000	,41	1,02
	only Peer-to-peer	,37	,120	,022	3,15E-02	,71
	only combined	1,58E-02	,107	1,000	-,29	,32
	roundtrip + free-floating	,10	,109	1,000	-,20	,41
only combined	only roundtrip	-1,58E-02	,107	1,000	-,32	,29
	only free-floating	,70	,119	,000	,36	1,03
	only Peer-to-peer	,35	,131	,071	-1,49E-02	,72
	roundtrip + free-floating	8,75E-02	,121	1,000	-,25	,43
only free-floating	only roundtrip	-,72	,107	,000	-1,02	-,41
	only Peer-to-peer	-,35	,130	,080	-,71	2,06E-02
	only combined	-,70	,119	,000	-1,03	-,36
	roundtrip + free-floating	-,61	,121	,000	-,95	-,27
only Peer-to-peer	only roundtrip	-,37	,120	,022	-,71	-3,15E-02
	only free-floating	,35	,130	,080	-2,06E-02	,71
	only combined	-,35	,131	,071	-,72	1,49E-02
	roundtrip + free-floating	-,27	,132	,447	-,64	,11
roundtrip + free-floating	only roundtrip	-,10	,109	1,000	-,41	,20
	only free-floating	,61	,121	,000	,27	,95
	only Peer-to-peer	,27	,132	,447	-,11	,64
	only combined	-8,75E-02	,121	1,000	-,43	,25

Table 125: ... I know that Car Sharing is a reliable service

Result of ANOVA: $F(4, 794) = 16.561$, $p < .001$

Bonferroni

Group (I)	Group (J)	Mean Difference (I-J)	Std. Error	Significance	95%-Confidence Interval

					Lower Bound	Upper Bound
only roundtrip	only free-floating	,61	,084	,000	,38	,85
	only Peer-to-peer	,55	,094	,000	,28	,81
	only combined	,25	,085	,039	6,92E-03	,49
	roundtrip + free-floating	,30	,087	,007	5,25E-02	,54
only combined	only roundtrip	-,25	,085	,039	-,49	-6,92E-03
	only free-floating	,37	,094	,001	,10	,63
	only Peer-to-peer	,30	,103	,034	1,25E-02	,59
	roundtrip + free-floating	5,03E-02	,096	1,000	-,22	,32
only free-floating	only roundtrip	-,61	,084	,000	-,85	-,38
	only Peer-to-peer	-6,60E-02	,102	1,000	-,35	,22
	only combined	-,37	,094	,001	-,63	-,10
	roundtrip + free-floating	-,32	,096	,010	-,59	-4,81E-02
only Peer-to-peer	only roundtrip	-,55	,094	,000	-,81	-,28
	only free-floating	6,60E-02	,102	1,000	-,22	,35
	only combined	-,30	,103	,034	-,59	-1,25E-02
	roundtrip + free-floating	-,25	,104	,160	-,54	4,17E-02
roundtrip + free-floating	only roundtrip	-,30	,087	,007	-,54	-5,25E-02
	only free-floating	,32	,096	,010	4,81E-02	,59
	only Peer-to-peer	,25	,104	,160	-4,17E-02	,54
	only combined	-5,03E-02	,096	1,000	-,32	,22

Table 126: I will continue travelling like today

Result of ANOVA: $F(4, 794) = 12.326$, $p < .001$

Bonferroni

Group (I)	Group (J)	Mean Difference (I-J)	Std. Error	Significance	95%-Confidence Interval	
					Lower Bound	Upper Bound
only roundtrip	only free-floating	,60	,101	,000	,32	,89
	only Peer-to-peer	,30	,113	,070	-1,24E-02	,62
	only combined	-8,33E-02	,102	1,000	-,37	,20
	roundtrip + free-floating	,14	,104	1,000	-,15	,44
only combined	only roundtrip	8,33E-02	,102	1,000	-,20	,37
	only free-floating	,69	,113	,000	,37	1,01
	only Peer-to-peer	,39	,123	,017	4,05E-02	,74
	roundtrip + free-floating	,23	,116	,503	-9,90E-02	,55
only free-floating	only roundtrip	-,60	,101	,000	-,89	-,32
	only Peer-to-peer	-,30	,123	,147	-,64	4,55E-02
	only combined	-,69	,113	,000	-1,01	-,37
	roundtrip + free-floating	-,46	,115	,001	-,78	-,14
only Peer-to-peer	only roundtrip	-,30	,113	,070	-,62	1,24E-02
	only free-floating	,30	,123	,147	-4,55E-02	,64
	only combined	-,39	,123	,017	-,74	-4,05E-02
	roundtrip + free-floating	-,16	,125	1,000	-,51	,19
roundtrip + free-floating	only roundtrip	-,14	,104	1,000	-,44	,15
	only free-floating	,46	,115	,001	,14	,78
	only Peer-to-peer	,16	,125	1,000	-,19	,51
	only combined	-,23	,116	,503	-,55	9,90E-02

Table 127: I will continue to use Car Sharing

Result of ANOVA: $F(4, 790) = 6.783$, $p < .001$

Bonferroni

Group (I)	Group (J)	Mean Difference (I-J)	Std. Error	Significance	95%-Confidence Interval	
					Lower Bound	Upper Bound
only roundtrip	only free-floating	,30	,083	,003	6,94E-02	,54
	only Peer-to-peer	,42	,092	,000	,16	,68
	only combined	,11	,084	1,000	-,13	,34
	roundtrip + free-floating	,11	,085	1,000	-,13	,35
only combined	only roundtrip	-,11	,084	1,000	-,34	,13
	only free-floating	,20	,093	,337	-6,37E-02	,46
	only Peer-to-peer	,31	,101	,020	2,85E-02	,60
	roundtrip + free-floating	4,76E-03	,095	1,000	-,26	,27
only free-floating	only roundtrip	-,30	,083	,003	-,54	-6,94E-02
	only Peer-to-peer	,12	,100	1,000	-,17	,40
	only combined	-,20	,093	,337	-,46	6,37E-02
	roundtrip + free-floating	-,19	,094	,407	-,46	7,18E-02
only Peer-to-peer	only roundtrip	-,42	,092	,000	-,68	-,16
	only free-floating	-,12	,100	1,000	-,40	,17
	only combined	-,31	,101	,020	-,60	-2,85E-02
	roundtrip + free-floating	-,31	,102	,026	-,60	-2,07E-02
roundtrip + free-floating	only roundtrip	-,11	,085	1,000	-,35	,13
	only free-floating	,19	,094	,407	-7,18E-02	,46
	only Peer-to-peer	,31	,102	,026	2,07E-02	,60
	only combined	-4,76E-03	,095	1,000	-,27	,26

Table 128: I plan to use Car Sharing more than I do today

Result of ANOVA: $F(4, 792) = 5.817$, $p < .001$

Bonferroni

Group (I)	Group (J)	Mean Difference (I-J)	Std. Error	Significance	95%-Confidence Interval	
					Lower Bound	Upper Bound
only roundtrip	only free-floating	-,47	,114	,000	-,79	-,15
	only Peer-to-peer	-,44	,126	,005	-,80	-8,38E-02
	only combined	-,11	,115	1,000	-,44	,21
	roundtrip + free-floating	-,23	,117	,512	-,56	,10
only combined	only roundtrip	,11	,115	1,000	-,21	,44
	only free-floating	-,36	,127	,053	-,71	2,71E-03
	only Peer-to-peer	-,33	,139	,189	-,72	6,44E-02
	roundtrip + free-floating	-,12	,130	1,000	-,48	,25
only free-floating	only roundtrip	,47	,114	,000	,15	,79
	only Peer-to-peer	2,92E-02	,138	1,000	-,36	,42
	only combined	,36	,127	,053	-2,71E-03	,71
	roundtrip + free-floating	,24	,129	,629	-,12	,60
only Peer-to-peer	only roundtrip	,44	,126	,005	8,38E-02	,80
	only free-floating	-2,92E-02	,138	1,000	-,42	,36
	only combined	,33	,139	,189	-6,44E-02	,72
	roundtrip + free-floating	,21	,140	1,000	-,18	,61
roundtrip + free-floating	only roundtrip	,23	,117	,512	-,10	,56
	only free-floating	-,24	,129	,629	-,60	,12
	only Peer-to-peer	-,21	,140	1,000	-,61	,18
	only combined	,12	,130	1,000	-,25	,48

Table 129: I believe that using the car causes many environmental problems

Result of ANOVA: $F(4, 779) = 18.376$, $p < .001$

Bonferroni

Group (I)	Group (J)	Mean Difference (I-J)	Std. Error	Significance	95%-Confidence Interval	
					Lower Bound	Upper Bound
only roundtrip	only free-floating	,73	,098	,000	,45	1,00
	only Peer-to-peer	,60	,109	,000	,29	,91
	only combined	,16	,099	1,000	-,12	,43
	roundtrip + free-floating	,15	,100	1,000	-,13	,43
only combined	only roundtrip	-,16	,099	1,000	-,43	,12
	only free-floating	,57	,110	,000	,26	,88
	only Peer-to-peer	,44	,120	,002	,11	,78
	roundtrip + free-floating	-7,25E-03	,112	1,000	-,32	,31
only free-floating	only roundtrip	-,73	,098	,000	-1,00	-,45
	only Peer-to-peer	-,13	,119	1,000	-,46	,21
	only combined	-,57	,110	,000	-,88	-,26
	roundtrip + free-floating	-,58	,111	,000	-,89	-,27
only Peer-to-peer	only roundtrip	-,60	,109	,000	-,91	-,29
	only free-floating	,13	,119	1,000	-,21	,46
	only combined	-,44	,120	,002	-,78	-,11
	roundtrip + free-floating	-,45	,121	,002	-,79	-,11
roundtrip + free-floating	only roundtrip	-,15	,100	1,000	-,43	,13
	only free-floating	,58	,111	,000	,27	,89
	only Peer-to-peer	,45	,121	,002	,11	,79
	only combined	7,25E-03	,112	1,000	-,31	,32

Table 130: Driving a car is fun

Result of ANOVA: $F(6, 1075) = 23.718$, $p < .001$

Bonferroni

Group (I)	Group (J)	Mean Difference (I-J)	Std. Error	Significance	95%-Confidence Interval	
					Lower Bound	Upper Bound
Non-user with car	only roundtrip	,22	,123	1,000	-,15	,59
	only free-floating	-,78	,131	,000	-1,18	-,38
	only Peer-to-peer	-,69	,144	,000	-1,13	-,25
	only combined	-,14	,137	1,000	-,56	,27
	Non-user without car	,87	,203	,000	,25	1,49
	roundtrip + free-floating	-,19	,137	1,000	-,61	,22
Non-user without car	only roundtrip	-,65	,191	,015	-1,23	-6,81E-02
	only free-floating	-1,65	,197	,000	-2,25	-1,05
	only Peer-to-peer	-1,56	,205	,000	-2,19	-,93
	only combined	-1,01	,201	,000	-1,62	-,40
	Non-user with car	-,87	,203	,000	-1,49	-,25
	roundtrip + free-floating	-1,06	,200	,000	-1,67	-,45
only roundtrip	only free-floating	-1,00	,112	,000	-1,34	-,66
	only Peer-to-peer	-,91	,126	,000	-1,29	-,52
	only combined	-,36	,118	,045	-,72	-3,44E-03
	Non-user with car	-,22	,123	1,000	-,59	,15
	Non-user without car	,65	,191	,015	6,81E-02	1,23
	roundtrip + free-floating	-,41	,118	,011	-,77	-5,20E-02
only combined	only roundtrip	,36	,118	,045	3,44E-03	,72
	only free-floating	-,63	,127	,000	-1,02	-,25
	only Peer-to-peer	-,55	,140	,002	-,97	-,12

	Non-user with car	,14	,137	1,000	-,27	,56
	Non-user without car	1,01	,201	,000	,40	1,62
	roundtrip + free-floating	-4,78E-02	,132	1,000	-,45	,36
only free-floating	only roundtrip	1,00	,112	,000	,66	1,34
	only Peer-to-peer	8,72E-02	,135	1,000	-,32	,50
	only combined	,63	,127	,000	,25	1,02
	Non-user with car	,78	,131	,000	,38	1,18
	Non-user without car	1,65	,197	,000	1,05	2,25
	roundtrip + free-floating	,59	,127	,000	,20	,97
only Peer-to-peer	only roundtrip	,91	,126	,000	,52	1,29
	only free-floating	-8,72E-02	,135	1,000	-,50	,32
	only combined	,55	,140	,002	,12	,97
	Non-user with car	,69	,144	,000	,25	1,13
	Non-user without car	1,56	,205	,000	,93	2,19
	roundtrip + free-floating	,50	,140	,008	7,28E-02	,92
roundtrip + free-floating	only roundtrip	,41	,118	,011	5,20E-02	,77
	only free-floating	-,59	,127	,000	-,97	-,20
	only Peer-to-peer	-,50	,140	,008	-,92	-7,28E-02
	only combined	4,78E-02	,132	1,000	-,36	,45
	Non-user with car	,19	,137	1,000	-,22	,61
	Non-user without car	1,06	,200	,000	,45	1,67

Table 131: A car is a means to an end

Result of ANOVA: $F(6, 1078) = 16.779$, $p < .001$

Bonferroni

Group (I)	Group (J)	Mean Difference (I-J)	Std. Error	Significance	95%-Confidence Interval	
					Lower Bound	Upper Bound
Non-user with car	only roundtrip	-,37	,121	,040	-,74	-7,66E-03
	only free-floating	,61	,129	,000	,21	1,00
	only Peer-to-peer	,20	,141	1,000	-,23	,63
	only combined	-,29	,134	,704	-,70	,12
	Non-user without car	-,46	,200	,452	-1,07	,15
	roundtrip + free-floating	-6,30E-02	,134	1,000	-,47	,35
Non-user without car	only roundtrip	8,45E-02	,188	1,000	-,49	,66
	only free-floating	1,07	,193	,000	,48	1,65
	only Peer-to-peer	,66	,201	,021	5,00E-02	1,28
	only combined	,17	,197	1,000	-,43	,77
	Non-user with car	,46	,200	,452	-,15	1,07
	roundtrip + free-floating	,40	,197	,926	-,20	1,00
only roundtrip	only free-floating	,98	,110	,000	,65	1,31
	only Peer-to-peer	,58	,123	,000	,20	,95
	only combined	8,90E-02	,116	1,000	-,26	,44
	Non-user with car	,37	,121	,040	7,66E-03	,74
	Non-user without car	-8,45E-02	,188	1,000	-,66	,49
	roundtrip + free-floating	,31	,116	,150	-4,05E-02	,66
only combined	only roundtrip	-8,90E-02	,116	1,000	-,44	,26
	only free-floating	,89	,125	,000	,51	1,27
	only Peer-to-peer	,49	,137	,008	7,28E-02	,91
	Non-user with car	,29	,134	,704	-,12	,70

	Non-user without car	-,17	,197	1,000	-,77	,43
	roundtrip + free-floating	,22	,130	1,000	-,17	,62
only free-floating	only roundtrip	-,98	,110	,000	-1,31	-,65
	only Peer-to-peer	-,40	,131	,048	-,80	-1,81E-03
	only combined	-,89	,125	,000	-1,27	-,51
	Non-user with car	-,61	,129	,000	-1,00	-,21
	Non-user without car	-1,07	,193	,000	-1,65	-,48
	roundtrip + free-floating	-,67	,124	,000	-1,05	-,29
only Peer-to-peer	only roundtrip	-,58	,123	,000	-,95	-,20
	only free-floating	,40	,131	,048	1,81E-03	,80
	only combined	-,49	,137	,008	-,91	-7,28E-02
	Non-user with car	-,20	,141	1,000	-,63	,23
	Non-user without car	-,66	,201	,021	-1,28	-5,00E-02
	roundtrip + free-floating	-,27	,137	1,000	-,68	,15
roundtrip + free-floating	only roundtrip	-,31	,116	,150	-,66	4,05E-02
	only free-floating	,67	,124	,000	,29	1,05
	only Peer-to-peer	,27	,137	1,000	-,15	,68
	only combined	-,22	,130	1,000	-,62	,17
	Non-user with car	6,30E-02	,134	1,000	-,35	,47
	Non-user without car	-,40	,197	,926	-1,00	,20

Table 132: I feel strange travelling without a car

Result of ANOVA: $F(6, 1076) = 19.428$, $p < .001$

Bonferroni

Group (I)	Group (J)	Mean Difference (I-J)	Std. Error	Significance	95%-Confidence Interval

					Lower Bound	Upper Bound
Non-user with car	only roundtrip	,66	,098	,000	,36	,96
	only free-floating	6,86E-02	,105	1,000	-,25	,39
	only Peer-to-peer	-4,65E-02	,115	1,000	-,40	,30
	only combined	,66	,109	,000	,32	,99
	Non-user without car	,61	,161	,003	,12	1,10
	roundtrip + free-floating	,58	,109	,000	,24	,91
Non-user without car	only roundtrip	4,83E-02	,152	1,000	-,41	,51
	only free-floating	-,54	,156	,011	-1,02	-6,69E-02
	only Peer-to-peer	-,66	,163	,001	-1,15	-,16
	only combined	4,69E-02	,159	1,000	-,44	,53
	Non-user with car	-,61	,161	,003	-1,10	-,12
	roundtrip + free-floating	-3,39E-02	,159	1,000	-,52	,45
only roundtrip	only free-floating	-,59	,089	,000	-,86	-,32
	only Peer-to-peer	-,71	,101	,000	-1,01	-,40
	only combined	-1,44E-03	,095	1,000	-,29	,29
	Non-user with car	-,66	,098	,000	-,96	-,36
	Non-user without car	-4,83E-02	,152	1,000	-,51	,41
	roundtrip + free-floating	-8,22E-02	,094	1,000	-,37	,21
only combined	only roundtrip	1,44E-03	,095	1,000	-,29	,29
	only free-floating	-,59	,102	,000	-,90	-,28
	only Peer-to-peer	-,70	,112	,000	-1,04	-,36
	Non-user with car	-,66	,109	,000	-,99	-,32
	Non-user without car	-4,69E-02	,159	1,000	-,53	,44
	roundtrip + free-floating	-8,07E-02	,106	1,000	-,40	,24

only free-floating	only roundtrip	,59	,089	,000	,32	,86
	only Peer-to-peer	-,12	,107	1,000	-,44	,21
	only combined	,59	,102	,000	,28	,90
	Non-user with car	-6,86E-02	,105	1,000	-,39	,25
	Non-user without car	,54	,156	,011	6,69E-02	1,02
	roundtrip + free-floating	,51	,101	,000	,20	,82
only Peer-to-peer	only roundtrip	,71	,101	,000	,40	1,01
	only free-floating	,12	,107	1,000	-,21	,44
	only combined	,70	,112	,000	,36	1,04
	Non-user with car	4,65E-02	,115	1,000	-,30	,40
	Non-user without car	,66	,163	,001	,16	1,15
	roundtrip + free-floating	,62	,112	,000	,28	,96
roundtrip + free-floating	only roundtrip	8,22E-02	,094	1,000	-,21	,37
	only free-floating	-,51	,101	,000	-,82	-,20
	only Peer-to-peer	-,62	,112	,000	-,96	-,28
	only combined	8,07E-02	,106	1,000	-,24	,40
	Non-user with car	-,58	,109	,000	-,91	-,24
	Non-user without car	3,39E-02	,159	1,000	-,45	,52

Table 133: It would require an effort for me to not use a car

Result of ANOVA: $F(6, 1077) = 26.699$, $p < .001$

Bonferroni

Group (I)	Group (J)	Mean Difference (I-J)	Std. Error	Significance	95%-Confidence Interval	
					Lower Bound	Upper Bound

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	only roundtrip	1,33	,141	,000	,90	1,76

Non-user with car	only free-floating	,29	,151	1,000	-,17	,75
	only Peer-to-peer	,66	,165	,001	,16	1,16
	only combined	1,20	,157	,000	,72	1,68
	Non-user without car	1,77	,232	,000	1,07	2,48
	roundtrip + free-floating	1,10	,157	,000	,62	1,58
Non-user without car	only roundtrip	-,45	,218	,831	-1,11	,21
	only free-floating	-1,48	,224	,000	-2,17	-,80
	only Peer-to-peer	-1,11	,234	,000	-1,83	-,40
	only combined	-,57	,228	,261	-1,27	,12
	Non-user with car	-1,77	,232	,000	-2,48	-1,07
	roundtrip + free-floating	-,67	,228	,070	-1,37	2,31E-02
only roundtrip	only free-floating	-1,04	,128	,000	-1,43	-,64
	only Peer-to-peer	-,66	,145	,000	-1,11	-,22
	only combined	-,12	,136	1,000	-,54	,29
	Non-user with car	-1,33	,141	,000	-1,76	-,90
	Non-user without car	,45	,218	,831	-,21	1,11
	roundtrip + free-floating	-,22	,136	1,000	-,64	,19
only combined	only roundtrip	,12	,136	1,000	-,29	,54
	only free-floating	-,91	,146	,000	-1,36	-,47
	only Peer-to-peer	-,54	,161	,016	-1,03	-5,22E-02
	Non-user with car	-1,20	,157	,000	-1,68	-,72
	Non-user without car	,57	,228	,261	-,12	1,27
	roundtrip + free-floating	-,10	,152	1,000	-,56	,36
	only roundtrip	1,04	,128	,000	,64	1,43

only free-floating	only Peer-to-peer	,37	,154	,341	-9,85E-02	,84
	only combined	,91	,146	,000	,47	1,36
	Non-user with car	-,29	,151	1,000	-,75	,17
	Non-user without car	1,48	,224	,000	,80	2,17
	roundtrip + free-floating	,81	,146	,000	,37	1,26
only Peer-to-peer	only roundtrip	,66	,145	,000	,22	1,11
	only free-floating	-,37	,154	,341	-,84	9,85E-02
	only combined	,54	,161	,016	5,22E-02	1,03
	Non-user with car	-,66	,165	,001	-1,16	-,16
	Non-user without car	1,11	,234	,000	,40	1,83
	roundtrip + free-floating	,44	,160	,127	-4,73E-02	,93
roundtrip + free-floating	only roundtrip	,22	,136	1,000	-,19	,64
	only free-floating	-,81	,146	,000	-1,26	-,37
	only Peer-to-peer	-,44	,160	,127	-,93	4,73E-02
	only combined	,10	,152	1,000	-,36	,56
	Non-user with car	-1,10	,157	,000	-1,58	-,62
	Non-user without car	,67	,228	,070	-2,31E-02	1,37

Table 134: Using a car is something that I do automatically

Result of ANOVA: F(6, 1076) = 27.475, p < .001

Bonferroni

Group (I)	**Group (J)**	**Mean Difference (I-J)**	**Std. Error**	**Significance**	**95%-Confidence Interval**	
					Lower Bound	Upper Bound
Non-user with car	only roundtrip	1,05	,121	,000	,68	1,42
	only free-floating	-9,41E-02	,129	1,000	-,49	,30

	only Peer-to-peer	,52	,141	,005	9,01E-02	,95
	only combined	,80	,134	,000	,39	1,21
	Non-user without car	1,20	,198	,000	,60	1,81
	roundtrip + free-floating	,70	,134	,000	,29	1,11
Non-user without car	only roundtrip	-,16	,186	1,000	-,72	,41
	only free-floating	-1,30	,191	,000	-1,88	-,72
	only Peer-to-peer	-,69	,199	,013	-1,29	-7,79E-02
	only combined	-,40	,195	,819	-1,00	,19
	Non-user with car	-1,20	,198	,000	-1,81	-,60
	roundtrip + free-floating	-,51	,195	,202	-1,10	8,77E-02
only roundtrip	only free-floating	-1,14	,110	,000	-1,48	-,81
	only Peer-to-peer	-,53	,124	,000	-,91	-,15
	only combined	-,25	,116	,713	-,60	,11
	Non-user with car	-1,05	,121	,000	-1,42	-,68
	Non-user without car	,16	,186	1,000	-,41	,72
	roundtrip + free-floating	-,35	,116	,056	-,70	3,70E-03
only combined	only roundtrip	,25	,116	,713	-,11	,60
	only free-floating	-,90	,124	,000	-1,27	-,52
	only Peer-to-peer	-,28	,137	,822	-,70	,13
	Non-user with car	-,80	,134	,000	-1,21	-,39
	Non-user without car	,40	,195	,819	-,19	1,00
	roundtrip + free-floating	-,10	,130	1,000	-,50	,29
only free-floating	only roundtrip	1,14	,110	,000	,81	1,48
	only Peer-to-peer	,61	,132	,000	,21	1,01
	only combined	,90	,124	,000	,52	1,27

	Non-user with car	9,41E-02	,129	1,000	-,30	,49
	Non-user without car	1,30	,191	,000	,72	1,88
	roundtrip + free-floating	,79	,124	,000	,42	1,17
only Peer-to-peer	only roundtrip	,53	,124	,000	,15	,91
	only free-floating	-,61	,132	,000	-1,01	-,21
	only combined	,28	,137	,822	-,13	,70
	Non-user with car	-,52	,141	,005	-,95	-9,01E-02
	Non-user without car	,69	,199	,013	7,79E-02	1,29
	roundtrip + free-floating	,18	,137	1,000	-,24	,60
roundtrip + free-floating	only roundtrip	,35	,116	,056	-3,70E-03	,70
	only free-floating	-,79	,124	,000	-1,17	-,42
	only Peer-to-peer	-,18	,137	1,000	-,60	,24
	only combined	,10	,130	1,000	-,29	,50
	Non-user with car	-,70	,134	,000	-1,11	-,29
	Non-user without car	,51	,195	,202	-8,77E-02	1,10

Table 135: I like travelling with public transport

Result of ANOVA: $F(6, 1078) = 13.285$, $p < .001$

Bonferroni

Group (I)	**Group (J)**	**Mean Difference (I-J)**	**Std. Error**	**Significance**	**95%-Confidence Interval**	
					Lower Bound	Upper Bound
Non-user with car	only roundtrip	-,48	,122	,002	-,85	-,11
	only free-floating	-,19	,130	1,000	-,20	,59
	only Peer-to-peer	-,27	,142	1,000	-,16	,70
	only combined	-,43	,135	,031	-,84	-1,87E-02

	Non-user without car	-,38	,199	1,000	-,99	,23
	roundtrip + free-floating	-,50	,135	,005	-,91	-8,54E-02
Non-user without car	only roundtrip	-9,71E-02	,187	1,000	-,67	,47
	only free-floating	,57	,193	,062	-1,27E-02	1,16
	only Peer-to-peer	,65	,201	,027	3,77E-02	1,26
	only combined	-4,94E-02	,197	1,000	-,65	,55
	Non-user with car	,38	,199	1,000	-,23	,99
	roundtrip + free-floating	-,12	,196	1,000	-,71	,48
only roundtrip	only free-floating	,67	,110	,000	,34	1,01
	only Peer-to-peer	,75	,125	,000	,37	1,13
	only combined	4,77E-02	,117	1,000	-,31	,40
	Non-user with car	,48	,122	,002	,11	,85
	Non-user without car	9,71E-02	,187	1,000	-,47	,67
	roundtrip + free-floating	-1,84E-02	,117	1,000	-,37	,34
only combined	only roundtrip	-4,77E-02	,117	1,000	-,40	,31
	only free-floating	,62	,126	,000	,24	1,01
	only Peer-to-peer	,70	,138	,000	,28	1,12
	Non-user with car	,43	,135	,031	1,87E-02	,84
	Non-user without car	4,94E-02	,197	1,000	-,55	,65
	roundtrip + free-floating	-6,61E-02	,131	1,000	-,47	,33
only free-floating	only roundtrip	-,67	,110	,000	-1,01	-,34
	only Peer-to-peer	7,60E-02	,133	1,000	-,33	,48
	only combined	-,62	,126	,000	-1,01	-,24

	Non-user with car	-,19	,130	1,000	-,59	,20
	Non-user without car	-,57	,193	,062	-1,16	1,27E-02
	roundtrip + free-floating	-,69	,125	,000	-1,07	-,31
only Peer-to-peer	only roundtrip	-,75	,125	,000	-1,13	-,37
	only free-floating	-7,60E-02	,133	1,000	-,48	,33
	only combined	-,70	,138	,000	-1,12	-,28
	Non-user with car	-,27	,142	1,000	-,70	,16
	Non-user without car	-,65	,201	,027	-1,26	-3,77E-02
	roundtrip + free-floating	-,77	,138	,000	-1,19	-,35
roundtrip + free-floating	only roundtrip	1,84E-02	,117	1,000	-,34	,37
	only free-floating	,69	,125	,000	,31	1,07
	only Peer-to-peer	,77	,138	,000	,35	1,19
	only combined	6,61E-02	,131	1,000	-,33	,47
	Non-user with car	,50	,135	,005	8,54E-02	,91
	Non-user without car	,12	,196	1,000	-,48	,71

Table 136: If I have the choice, I use a car rather than public transport

Result of ANOVA: $F(6, 1074) = 34.214$, $p < .001$

Bonferroni

Group (I)	**Group (J)**	**Mean Difference (I-J)**	**Std. Error**	**Significance**	**95%-Confidence Interval**	
					Lower Bound	Upper Bound
Non-user with car	only roundtrip	1,00	,134	,000	,59	1,40
	only free-floating	-,42	,143	,068	-,86	1,36E-02

	only Peer-to-peer	-,25	,156	1,000	-,72	,23
	only combined	,77	,149	,000	,32	1,22
	Non-user without car	,85	,219	,002	,18	1,52
	roundtrip + free-floating	,61	,149	,001	,16	1,07
Non-user without car	only roundtrip	,14	,206	1,000	-,48	,77
	only free-floating	-1,27	,212	,000	-1,92	-,63
	only Peer-to-peer	-1,10	,221	,000	-1,77	-,43
	only combined	-8,16E-02	,216	1,000	-,74	,58
	Non-user with car	-,85	,219	,002	-1,52	-,18
	roundtrip + free-floating	-,24	,216	1,000	-,89	,42
only roundtrip	only free-floating	-1,42	,122	,000	-1,79	-1,05
	only Peer-to-peer	-1,24	,137	,000	-1,66	-,83
	only combined	-,23	,129	1,000	-,62	,17
	Non-user with car	-1,00	,134	,000	-1,40	-,59
	Non-user without car	-,14	,206	1,000	-,77	,48
	roundtrip + free-floating	-,38	,128	,065	-,77	1,02E-02
only combined	only roundtrip	,23	,129	1,000	-,17	,62
	only free-floating	-1,19	,138	,000	-1,61	-,77
	only Peer-to-peer	-1,02	,152	,000	-1,48	-,56
	Non-user with car	-,77	,149	,000	-1,22	-,32
	Non-user without car	8,16E-02	,216	1,000	-,58	,74
	roundtrip + free-floating	-,16	,144	1,000	-,59	,28
only free-floating	only roundtrip	1,42	,122	,000	1,05	1,79
	only Peer-to-peer	,17	,146	1,000	-,27	,62

	only combined	1,19	,138	,000	,77	1,61
	Non-user with car	,42	,143	,068	-1,36E-02	,86
	Non-user without car	1,27	,212	,000	,63	1,92
	roundtrip + free-floating	1,04	,138	,000	,62	1,46
only Peer-to-peer	only roundtrip	1,24	,137	,000	,83	1,66
	only free-floating	-,17	,146	1,000	-,62	,27
	only combined	1,02	,152	,000	,56	1,48
	Non-user with car	,25	,156	1,000	-,23	,72
	Non-user without car	1,10	,221	,000	,43	1,77
	roundtrip + free-floating	,86	,152	,000	,40	1,33
roundtrip + free-floating	only roundtrip	,38	,128	,065	-1,02E-02	,77
	only free-floating	-1,04	,138	,000	-1,46	-,62
	only Peer-to-peer	-,86	,152	,000	-1,33	-,40
	only combined	,16	,144	1,000	-,28	,59
	Non-user with car	-,61	,149	,001	-1,07	-,16
	Non-user without car	,24	,216	1,000	-,42	,89

Table 137: Car Sharing is a full replacement for a private car

Result of ANOVA: $F(6, 950) = 17.890$, $p < .001$

Bonferroni

Group (I)	**Group (J)**	**Mean Difference (I-J)**	**Std. Error**	**Significance**	**95%-Confidence Interval**	
					Lower Bound	Upper Bound
Non-user with car	only roundtrip	-,89	,135	,000	-1,30	-,48
	only free-floating	3,63E-02	,146	1,000	-,41	,48
	only Peer-to-peer	-,64	,160	,001	-1,13	-,16
	only combined	-,98	,149	,000	-1,43	-,52

	Non-user without car	-1,02	,223	,000	-1,70	-,34
	roundtrip + free-floating	-,72	,150	,000	-1,18	-,26
Non-user without car	only roundtrip	,13	,210	1,000	-,51	,77
	only free-floating	1,06	,217	,000	,39	1,72
	only Peer-to-peer	,37	,227	1,000	-,32	1,07
	only combined	4,13E-02	,219	1,000	-,63	,71
	Non-user with car	1,02	,223	,000	,34	1,70
	roundtrip + free-floating	,30	,220	1,000	-,37	,97
only roundtrip	only free-floating	,93	,124	,000	,55	1,31
	only Peer-to-peer	,25	,140	1,000	-,18	,67
	only combined	-8,76E-02	,127	1,000	-,48	,30
	Non-user with car	,89	,135	,000	,48	1,30
	Non-user without car	-,13	,210	1,000	-,77	,51
	roundtrip + free-floating	,17	,129	1,000	-,22	,56
only combined	only roundtrip	8,76E-02	,127	1,000	-,30	,48
	only free-floating	1,01	,140	,000	,59	1,44
	only Peer-to-peer	,33	,154	,642	-,14	,80
	Non-user with car	,98	,149	,000	,52	1,43
	Non-user without car	-4,13E-02	,219	1,000	-,71	,63
	roundtrip + free-floating	,26	,144	1,000	-,18	,69
only free-floating	only roundtrip	-,93	,124	,000	-1,31	-,55
	only Peer-to-peer	-,68	,151	,000	-1,14	-,22
	only combined	-1,01	,140	,000	-1,44	-,59

	Non-user with car	-3,63E-02	,146	1,000	-,48	,41
	Non-user without car	-1,06	,217	,000	-1,72	-,39
	roundtrip + free-floating	-,76	,141	,000	-1,19	-,33
only Peer-to-peer	only roundtrip	-,25	,140	1,000	-,67	,18
	only free-floating	,68	,151	,000	,22	1,14
	only combined	-,33	,154	,642	-,80	,14
	Non-user with car	,64	,160	,001	,16	1,13
	Non-user without car	-,37	,227	1,000	-1,07	,32
	roundtrip + free-floating	-7,71E-02	,155	1,000	-,55	,40
roundtrip + free-floating	only roundtrip	-,17	,129	1,000	-,56	,22
	only free-floating	,76	,141	,000	,33	1,19
	only Peer-to-peer	7,71E-02	,155	1,000	-,40	,55
	only combined	-,26	,144	1,000	-,69	,18
	Non-user with car	,72	,150	,000	,26	1,18
	Non-user without car	-,30	,220	1,000	-,97	,37

Table 138: Car Sharing is more of an add-on to a private car

Result of ANOVA: $F(6, 914) = 27.641$, $p < .001$

Bonferroni

Group (I)	**Group (J)**	**Mean Difference (I-J)**	**Std. Error**	**Significance**	**95%-Confidence Interval**	
					Lower Bound	Upper Bound
Non-user with car	only roundtrip	,54	,146	,004	9,94E-02	,99
	only free-floating	-,98	,159	,000	-1,46	-,49

	only Peer-to-peer	-,12	,174	1,000	-,65	,41
	only combined	,60	,161	,004	,11	1,09
	Non-user without car	,74	,247	,061	-1,52E-02	1,49
	roundtrip + free-floating	8,25E-02	,163	1,000	-,42	,58
Non-user without car	only roundtrip	-,19	,232	1,000	-,90	,52
	only free-floating	-1,71	,240	,000	-2,45	-,98
	only Peer-to-peer	-,85	,251	,015	-1,62	-8,82E-02
	only combined	-,14	,242	1,000	-,87	,60
	Non-user with car	-,74	,247	,061	-1,49	1,52E-02
	roundtrip + free-floating	-,65	,244	,155	-1,40	8,78E-02
only roundtrip	only free-floating	-1,52	,135	,000	-1,93	-1,11
	only Peer-to-peer	-,66	,153	,000	-1,13	-,19
	only combined	5,62E-02	,138	1,000	-,36	,48
	Non-user with car	-,54	,146	,004	-,99	-9,94E-02
	Non-user without car	,19	,232	1,000	-,52	,90
	roundtrip + free-floating	-,46	,141	,022	-,89	-3,37E-02
only combined	only roundtrip	-5,62E-02	,138	1,000	-,48	,36
	only free-floating	-1,58	,151	,000	-2,04	-1,12
	only Peer-to-peer	-,72	,167	,000	-1,23	-,21
	Non-user with car	-,60	,161	,004	-1,09	-,11
	Non-user without car	,14	,242	1,000	-,60	,87
	roundtrip + free-floating	-,52	,156	,020	-,99	-4,20E-02
only free-floating	only roundtrip	1,52	,135	,000	1,11	1,93
	only Peer-to-peer	,86	,165	,000	,36	1,37

	only combined	1,58	,151	,000	1,12	2,04
	Non-user with car	,98	,159	,000	,49	1,46
	Non-user without car	1,71	,240	,000	,98	2,45
	roundtrip + free-floating	1,06	,154	,000	,59	1,53
only Peer-to-peer	only roundtrip	,66	,153	,000	,19	1,13
	only free-floating	-,86	,165	,000	-1,37	-,36
	only combined	,72	,167	,000	,21	1,23
	Non-user with car	,12	,174	1,000	-,41	,65
	Non-user without car	,85	,251	,015	8,82E-02	1,62
	roundtrip + free-floating	,20	,170	1,000	-,32	,71
roundtrip + free-floating	only roundtrip	,46	,141	,022	3,37E-02	,89
	only free-floating	-1,06	,154	,000	-1,53	-,59
	only Peer-to-peer	-,20	,170	1,000	-,71	,32
	only combined	,52	,156	,020	4,20E-02	,99
	Non-user with car	-8,25E-02	,163	1,000	-,58	,42
	Non-user without car	,65	,244	,155	-8,78E-02	1,40

Table 139: Car Sharing is (possibly) cheaper than the maintenance of a private car

Result of ANOVA: $F(6, 902) = 10.573$, $p < .001$

Bonferroni

Group (I)	**Group (J)**	**Mean Difference (I-J)**	**Std. Error**	**Significance**	**95%-Confidence Interval**	
					Lower Bound	Upper Bound
Non-user with car	only roundtrip	-,50	,117	,000	-,86	-,14
	only free-floating	-,21	,128	1,000	-,17	,60
	only Peer-to-peer	-,13	,139	1,000	-,55	,29
	only combined	-,48	,128	,003	-,87	-9,45E-02

	Non-user without car	-,25	,194	1,000	-,84	,34
	roundtrip + free-floating	-,40	,129	,047	-,79	-2,70E-03
Non-user without car	only roundtrip	-,25	,182	1,000	-,81	,30
	only free-floating	,46	,189	,300	-,11	1,04
	only Peer-to-peer	,12	,196	1,000	-,48	,71
	only combined	-,24	,189	1,000	-,81	,34
	Non-user with car	,25	,194	1,000	-,34	,84
	roundtrip + free-floating	-,15	,190	1,000	-,73	,43
only roundtrip	only free-floating	,72	,107	,000	,39	1,04
	only Peer-to-peer	,37	,120	,046	3,23E-03	,73
	only combined	1,58E-02	,107	1,000	-,31	,34
	Non-user with car	,50	,117	,000	,14	,86
	Non-user without car	,25	,182	1,000	-,30	,81
	roundtrip + free-floating	,10	,109	1,000	-,23	,44
only combined	only roundtrip	-1,58E-02	,107	1,000	-,34	,31
	only free-floating	,70	,119	,000	,34	1,06
	only Peer-to-peer	,35	,131	,149	-4,57E-02	,75
	Non-user with car	,48	,128	,003	9,45E-02	,87
	Non-user without car	,24	,189	1,000	-,34	,81
	roundtrip + free-floating	8,75E-02	,121	1,000	-,28	,46
only free-floating	only roundtrip	-,72	,107	,000	-1,04	-,39
	only Peer-to-peer	-,35	,131	,170	-,74	5,14E-02
	only combined	-,70	,119	,000	-1,06	-,34

	Non-user with car	-,21	,128	1,000	-,60	,17
	Non-user without car	-,46	,189	,300	-1,04	,11
	roundtrip + free-floating	-,61	,121	,000	-,98	-,24
only Peer-to-peer	only roundtrip	-,37	,120	,046	-,73	-3,23E-03
	only free-floating	,35	,131	,170	-5,14E-02	,74
	only combined	-,35	,131	,149	-,75	4,57E-02
	Non-user with car	,13	,139	1,000	-,29	,55
	Non-user without car	-,12	,196	1,000	-,71	,48
	roundtrip + free-floating	-,27	,132	,945	-,67	,14
roundtrip + free-floating	only roundtrip	-,10	,109	1,000	-,44	,23
	only free-floating	,61	,121	,000	,24	,98
	only Peer-to-peer	,27	,132	,945	-,14	,67
	only combined	-8,75E-02	,121	1,000	-,46	,28