What keeps us driving? Exploring sociodemographic patterns and underlying motives of mode choice in cities

Beatrice Hügler
University of St. Gallen
Beatrice.Huegler@unisg.ch

Rebecca Flynn
London School of Economics and Political Science
R.Flynn1@lse.ac.uk

Catarina Heeckt
London School of Economics and Political Science
C.L.Heeckt@lse.ac.uk

Nuno Ferreira Da Cruz
London School of Economics and Political Science
N.M.Ferreira-Da-Cruz@lse.ac.uk

Philipp Rode
London School of Economics and Political Science
P.Rode@lse.ac.uk

Abstract

Despite existing policy interventions increasing the cost of car ownership and the attractiveness of alternative modes of transport, car use remains high in many cities. This research explores the application of methodologies traditionally used in consumer research to assess underlying, factors influencing transport decisions, and perceptions of transport modes. Techniques of familiarisation and psychological projection were employed in an online survey. Findings show that motives for different mode choices vary significantly according to sociodemographic factors. Further, we found that most common motives for selecting a particular main mode were not necessarily the same motives that would most commonly influence others to switch to that particular mode. Lastly, we demonstrate that promotional measures based on increasing familiarisation are only effective for walking, cycling and carsharing. This research offers additional methodological approaches to the study of transport behaviour and provides further insights into individual mode choice, valuable for future car reduction initiatives.

Keywords: urban car use, sustainable mobility, mode choice, psychological projection, familiarisation

1. Introduction

The transport sector is responsible for nearly a quarter of the European Union's total greenhouse gas emissions (EEA, 2018). A large share of these emissions is related to urban transport and particularly the use of private cars, which accounts for 61% of total road transport CO_2 emissions in the EU (European Parliament, 2019). At the global level, 45% of transport-related CO_2 emissions stem from private vehicles (IEA 2019). In addition to CO_2, car use is a major contributor to air pollution, congestion, noise pollution and traffic accidents in cities around the globe (Douglas et al., 2011; Lauper et al., 2016; Ma et al., 2018; WHO, 2018). Reducing car use has therefore been a long-standing objective for urban policy makers. Existing policies aimed at reversing car dependency largely focus on increasing the instrumental costs of driving compared to other, more sustainable modes. Congestion charging and fuel taxes introduced in many cities aim to make driving more expensive than other alternatives, while restrictions on vehicle access, e.g. via car-free zones and limitations on parking spaces aim to make travelling by car less convenient. At the same time, many European cities have invested billions to improve access to alternative modes of transport (ECA, 2020). However, despite these policy measures and investments, the rate of car use and ownership across most European cities remains fairly high, particularly in more suburban areas (EEA,

2020). Therefore, focusing on instrumental motives for car use alone – such as economic cost, travel time and convenience – does not seem to be sufficient to reduce car use in cities to an acceptable level (Steg, 2005; Steg et al., 2001). There appear to be certain underlying and non-instrumental motives driving continued car use, such as emotional attachment and status-related considerations. This suggests that for some people, a car is not merely a means of getting from A to B efficiently, but something of a more profound importance to their lives.

Recognising the need to target non-instrumental motives for car use, policy makers in many cities have begun to design advertising campaigns that focus on the pleasurable experiences and positive cultural associations linked to more sustainable modes of transport. However, in order to design effective interventions to reduce car use, we need to develop a more nuanced understanding of the underlying motives shaping different individual preferences for certain modes, and the potential non-instrumental factors motivating a shift from car use to alternative modes. Policy interventions may be particularly impactful at the point where an individual is considering purchasing a car, as once they own their own car, the chances of them using this car over alternative modes is much higher (Paulley et al., 2006).

The aims of this research are to explore the underlying motives influencing individuals' mode choice, as well as to provide insights about what drives the perceived attractiveness of alternative mobility choices. To accomplish this, we draw on two separate exploratory studies that test the applicability and potential usefulness of marketing research methodologies in the realm of transport policy. Both studies are based on an online survey conducted in two urban settings. Prevalent in consumer and marketing research (e.g., Marshall & Barbour, 2015; Szollosy, 2017; Zervakis & Mazuka, 2013), the methodological approaches used in these studies have frequently been used by scholars to highlight the underlying factors that can help to promote car use and car sales (e.g., Carbon & Leder, 2005; Landwehr et al., 2013). This research subverts this pattern and applies the consumer-centric research methods traditionally used to understand and nudge purchasing behaviour to uncover mechanisms to achieve the opposite. In doing so, it broadens the research toolkit used to understand the underlying motives that shape the mobility behaviours of different segments of the population. This will provide new insights that could be relevant to efforts to reduce car dependency and increase alternative mode use in cities.

Study 1 assesses the motives for individual mode choice and explores motives for switching from one mode to another and how this varies for different sociodemographic groups. Study 2 tests the suitability of three promotional instruments based around consumer familiarisation to increase the level of attractiveness of alternative modes. In combination,

these two studies seek to provide new methodological approaches that can help urban policy makers to design more effective strategies to reduce car use and, eventually, ownership in cities. Understanding the motives underpinning transport choices is an important first step to devising policy interventions to promote the use of sustainable modes, and ultimately disrupt car purchase intention. The remainder of this paper is structured as follows: the next section provides a brief overview of the relevant literature framing this research. In the third section, the methods and results of the two studies are presented and discussed. The overall results are discussed in section four. The paper concludes with a brief outline of the policy implications of the findings as well as opportunities for future research.

2. Brief literature review

Factors influencing modal split

Several scholars have explored the drivers of continued car use, but most studies emphasise rational and economic motives such as safety, convenience and costs (De Groot & Steg, 2007; Hiscock et al., 2002; Gardner & Abraham, 2006; Kent, 2014; 2015; Sheller, 2004; Wells & Xenias, 2015). There have been some attempts, however, to broaden this discussion. Steg (2005) theorises that cars provide three sets of functions: instrumental, symbolic and affective functions. Instrumental functions for car use can roughly be defined as the convenience or inconvenience of car use: the speed, flexibility, comfort and safety it provides (Basmajian, 2010; Hagman, 2003). The symbolic functions of car use relate to the extent to which individuals can express their self-identity or social position through cars (Sheller & Urry, 2006). This is connected to how people compare their car use to others and to social norms, in particular prestige, empowerment and masculinity (Hiscock et al., 2002, Sheller, 2004, Bamberg & Schmidt, 2003). Lastly, the affective functions of car use refer to the emotions and feelings aroused through owning and driving a car. Steg (2005) found that symbolic and affective motives could account for the variance of car use frequency. The feeling of being in control over the car itself while driving, and the added sensory experience provided by contemporary cars with their built-in sound and thermal management systems, are often cited as affective motives for car use (Gardner & Abraham, 2006; Kent, 2014; 2015; Wells & Xenias, 2015).

Steg's categorisation can be applied to other forms of transport. According to Beirão and Cabral (2007), low costs and low emission levels are instrumental functions of using public transport. The authors also investigate car users' opinions towards public transport and

conclude that service quality and reliability are key factors for its use. In terms of symbolic motives, De Groot and Steg (2007) find that people were more inclined to travel by public transport rather than by car when they believed that others approved of this choice. Steg (2003) also noted that affective functions of public transport include its perceived attractiveness in comparison to cars, which increases the less a car is used as a main mode.

Concerning walking and cycling, (so-called 'active' modes), several studies show that travel satisfaction is stronger for walking and cycling than for using public transport (e.g., De Vos et al., 2013; Ye & Titheridge, 2017). Reasons for this preference include its instrumental functions such as physical and mental health benefits, an increased level of fitness with adaptable personal energy consumption, as well as the fact that these modes neither produce emissions nor contribute to congestion (Cavill & Watkins, 2007; Frank et al., 2006; Garrard et al., 2006; Gatersleben & Appleton, 2007; Giles-Corti et al., 2010; Haines et al., 2009; Lumsdon & Tolley, 2001). For cycling, speed over short distances is an additional instrumental function (Gatersleben & Appleton, 2007; Lumsdon & Tolley, 2001). In terms of affective functions, Gatersleben and Uzzel (2007) found that cyclists and walkers are more likely than car users to find their commute relaxing, and more likely than public transport users to describe it as exciting.

With regards to carsharing, convenience, time saving, flexibility, favourable pricing models, comfort, and safety are most cited instrumental factors (Schaefers, 2013). In addition, carsharing is considered an environmentally friendly mode of transport. Yet, environmental concerns are not considered to be the most prominent factor in influencing people to choose this mode (Costain et al. 2012). As carsharing is currently a lifestyle product, highly visible car brands and vehicle designs are symbolic functions of carsharing which relate to personal social status (Schaefers, 2013). Moreover, there is a sense of belonging to the carsharing community and members often identify as part of this car sharing community. Users of carsharing services often consider themselves to be tech-savvy and can exchange information about this new form of transport. This also relates to social status and is thus a symbolic function (Schaefers, 2013).

Methodological approaches to uncovering users' choices

There are various reasons why people may choose means of transport other than cars, and some modes such as active transport and carsharing are currently gaining in popularity. Yet, the stickiness towards cars in cities remains high. Motives for car use have been explored widely by applying either interviews or surveys (e.g., De Groot & Steg, 2007; Gardner & Abraham, 2006; Hiscock et al., 2002; Kent, 2014; 2015; Sheller, 2004; Wells & Xenias, 2015).

By using these methods, the studies mainly focus on instrumental or symbolic motives for car use and less on affective ones. While these methods were certainly appropriate for the aim of the studies, given the rapidly changing context surrounding mobility services, some may now be partly outdated. Furthermore, exploring and understanding symbolic and particularly affective motives for car use is more complex, as people may not be able to express these in a survey or interview situation or simply not want to fully reveal them. To a large extent, existing studies have also not analysed motives underpinning transport behaviour, broken down by sociodemographic factors. Although there are recent studies which consider sociodemographic differences (e.g., Herberz et al., 2020; Hoffmann et al., 2020), these studies do not explore the same range of mode choices and potential motives that this research is employing.

In light of this, firstly, this study applies a projection method which is designed to prompt respondents to project their own thoughts onto other people, reducing potential bias in their answers. Depending on how questions are asked, people tend to answer questions in a way they consider to be socially acceptable instead of revealing their true attitudes towards certain issues. This distortion is referred to as social desirability bias (Edwards, 1957; Fisher, 1993). One mechanism that can reduce social desirability bias is indirect questioning (Fisher, 1993). Indirect questioning is a projective approach in which respondents are asked to answer questions from another person's perspective (Anderson, 1978; Fisher, 1993; Haire, 1950). By making use of psychological projection[1] through indirect questioning, social desirability bias is reduced as less socially desirable attitudes are subconsciously projected onto others and are more likely to be revealed (Fisher, 1993; Krueger, 1998; Szollosy, 2017).

Secondly, to assess various strategies increasing the attractiveness of alternative modes, this study uses a repeated evaluation technique, which enables quick familiarisation with an object through repeated engagement (Carbon & Leder, 2005; Zajonc, 2001). While familiarisation with an object or setting usually takes weeks or months, the repeated evaluation technique accelerates this process by allowing survey respondents to engage with a certain object in a targeted manner during a short period of time. The method was combined with the phenomenon of observational learning which stems from social cognitive theory (SCT) as introduced by Bandura (1986; 1989). According to SCT, people learn by observing others being punished or rewarded for certain behaviours and are therefore more inclined to exhibit (or not exhibit) this observed behaviour themselves. Combining the task of repeatedly

[1] The psychological projection approach is based on psychological projection theory, according to which inner conflicts are subconsciously projected onto others (Katz et al., 1931; Szollosy, 2017).

evaluating an object by seeing someone being rewarded/punished for a certain behaviour associated with the object may increase familiarisation.

Research questions

As discussed above, understanding people's underlying attitude towards car use and alternative modes is an important precondition to the creation of successful policies to reduce car use. The question at the starting point of this research is: how can car use in cities be reduced? This research question can be fragmented into two core elements, static and dynamic, resulting in the following sub-questions:

Static

(1.1) What are people's current motives for using different means of transport and how do these motives differ according to sociodemographic factors?

Dynamic

(2.1) What are people's motives for switching to alternative means of transport and how do these motives differ according to sociodemographic factors?

(2.2) Does increasing familiarity with alternative modes of transport have a positive impact on their attractiveness?

To tackle the research questions, we used an online survey to assess motives for mode choice via the mechanism of psychological projection (Study 1) and reveal changes in the level of attractiveness in terms of willingness to experience, comfort, safety and stress (Study 2) via a familiar technique. Overall, 1,400 population-representative respondents aged 18 to 69 from the area of Greater London (1,000 participants; 50.5% female) and the German-speaking urban area of Switzerland (400 participants; 51.7% female) participated in the online survey. These areas were selected due to their disproportionately high rate of car ownership that continues to persist despite their well-established public transport systems and plethora of policy interventions to promote more sustainable mode choices. Therefore, these two urban areas are suitable real-world examples of cities that continue to struggle to reduce car use to sustainable levels.

All respondents were pre-selected to ensure that they had intentions to buy a car within the next three years. This pre-screening was based on the fact that a car purchase is a crucially important moment in determining a person's future mobility habits. Car purchases have been shown to have strong long-term effects on transport behaviour: consumers invest large sums

of money at the point of purchase which in effect locks them into car use for years to come (Mattioli et al., 2020; Simma & Axhausen, 2001). Therefore, policies designed to disrupt car purchase intentions are likely to be particularly effective at reducing future car use. The survey was created on Unipark, a survey software, and was provided both in English and German.

Data collection took place during three weeks in June 2020. To avoid potential biases in peoples' responses as a result of Covid-19, all participants were directed to imagine a post-Covid-19 scenario in which there is a widely available, effective vaccine and chances of an infection are down to zero per cent. All participants gave their consent to take part in the survey and could withdraw at any time. No personal information that could have identified participants was collected. Respondents were paid for their participation in the survey.

3. Empirical research

3.1 Study 1: method

According to Ames (2004), projection is positively correlated with perceived similarity between oneself and the subject in question. Thus, the more the subject reflects personal characteristics, the higher the chance of actual projection instead of simply stereotyping while answering questions about the subject. To achieve this similarity of respondent and subject, we designed several fictional personas who resemble respondents in relation to gender, age, income and place of residence. In the end, we created 36 personas, 18 female and 18 male. Every respondent was shown a persona to match their sociodemographic characteristics, which they provided at the beginning of the survey. Further, every persona was depicted with an accompanying short text briefly describing the persona's background[2]. Respondents were not told that their persona was chosen based on their likeness, or that they should answer with any relation to their own attitudes.

Based on the information provided about the persona, respondents were asked to state which mode of transport they thought the persona uses most often out of the options: personal car, public transport, bicycle, motorbike, carsharing, scooter and walking. Subsequently, respondents had to provide motives why they thought the persona most often chooses the selected mode of transport[3]. Respondents could choose a maximum of three different motives.

[2] For instance, '*This is Anna. Anna lives in an apartment close to the city centre with her partner. She works in a large insurance firm in the city and travels in and out to work every day.'*

[3] Answer options included the motives *to save money, to be flexible, to be safe while travelling, to help reduce carbon emissions, conform to what others around her/him are doing, to be fit, to enhance her/his social status,*

Next, respondents were randomly shown three of the seven modes (excluding the mode they selected as the persona's main mode) and asked which factors would influence the persona to switch to this mode[4]. Then, respondents were asked how they would rate the persona's environmental attitude[5]. Finally, respondents indicated their own level of environmental concern via a 5-point-Likert scale ranging from not worried at all to extremely worried.

3.2 Study 1: results

Motives for persona main mode choice

To answer the first sub-question, we initially tested which main mode respondents selected for their persona which is shown in table 1. In the next step, the motives for the main mode choice were assessed. These are the motives respondents selected on the basis of what they considered most appropriate for their persona[6]. The results for both GL and uGS are shown in table 2. Chi-square tests revealed that all motives were significantly different for all modes in GL with $p < .05$, both with and without removing the modes with very few cases, i.e., motorbike, carsharing and scooter. The same mostly applied for uGS, with two exceptions: the motives *safety* and *conforming others,* (both with $p > .05$). There is no robust evidence that the different modes perform differently for these two criteria.

Table 1. Respondents' selection of main mode for their persona in %.

	Persona Main Mode Selection						
	Car	**Public Transport**	**Bike**	**Walking**	**Motorbike**	**Scooter**	**Carsharing**
GL	12.5	40.6	13.6	31.1	1.5	0.4	0.3
uGS	18.3	40.0	28.4	6.7	3.0	1.0	2.7

to have privacy when travelling, to be comfortable whilst travelling, to help reduce local traffic congestion, to have fun and *to be at her/his destination quickly.*

[4] For instance, '*If Anna switches to public transport as her main mode of transport, what are her most important motives?'.* The answer options provided were the same as those provided in the main mode question.

[5] Respondents were given the following answer options: The person …*believes that environmental concerns are overplayed, …accepts that the environment is in danger, and something should be done to protect it, but believes that individual behaviour does not make a difference, … is worried about the impact of environmental destruction and supports government action to protect the environment, but she/he has not changed her/his own behaviour to reduce her(his impact on the environment, … tries to make environmentally sustainable decisions in her/his everyday life, insofar as these decisions do not come at a significant personal cost, … is deeply concerned about environmental destruction and has considerably changed her/his lifestyle to reduce her/his impact on the environment.*

[6] The motives were saving money, flexibility, safety, reducing congestion, conforming with others, fitness, social status, privacy, comfort, reducing congestion, fun and fastest way.

Sociodemographic factors correlated with the motives for persona main mode choice

The motives respondents selected as influencing their persona's mode choice were analysed according to the respondents' sociodemographic characteristics. These motives were assessed via chi-square tests for all modes. The choice of the test was determined by the different levels of scale of the data as some of the data was nominally scaled. Further, the chosen tests allowed for the best comparability of the results across all cases as respondents indicated their top three motives and not just the main one. These potential influencing factors were age, gender, levels of income, and healthy lifestyle, the distance from the place of residence to the centre and the level of environmental concern[7]. In addition to the chi-square tests, the effect size Cramér's V was regarded for the variables as well as the bar charts showing the relations to identify their directions.

[7] For the environmental concern both the level of environmental concern of the respondent and of the persona were assessed. The latter is taken to represent the indirect and true level of the respondent's environmental concern.

Table 2. Motives for main mode choice in Greater London and in the urban German-speaking part of Switzerland in %.

	GL	uGS	GL	uGS	GL	uGS	GL	uGS	GL	uGS	GL	uGS	GL	uGS	GL	uGS	GL	uGS	GL	uGS	GL	uGS	GL	uGS
	Save Money		**Flexibility**		**Safety**		**Reduce CO_2**		**Conform with others**		**Fitness**		**Social Status**		**Privacy**		**Comfort**		**Reduce Congestion**		**Fun**		**Fastest Way**	
Car	4.23	8.60	16.29	25.81	14.66	6.45	1.95	2.69	2.93	2.69	3.91	4.30	5.86	6.45	15.31	10.75	17.26	11.83	0.00	3.76	1.63	5.91	15.96	10.75
Public Transport	17.59	21.01	12.47	11.90	6.18	5.06	10.02	12.91	3.41	2.53	2.24	5.32	0.53	1.01	0.21	1.01	7.14	5.06	14.61	15.19	0.11	1.52	25.48	17.47
Bike	18.36	17.75	9.04	19.57	3.67	2.54	16.95	7.97	1.98	2.54	21.75	20.65	3.39	1.81	1.69	1.81	3.95	2.17	6.78	5.43	2.26	6.52	10.17	11.23
Motorbike	11.43	7.41	22.86	14.81	2.86	14.81	5.71	7.41	0.00	7.41	5.71	7.41	8.57	3.70	0.00	7.41	5.71	0.00	5.71	3.70	11.43	11.11	20.00	14.81
Carsharing	11.11	9.09	22.22	9.09	11.11	9.09	0.00	9.09	0.00	27.27	0.00	9.09	11.11	0.00	11.11	18.18	11.11	9.09	0.00	0.00	0.00	0.00	22.22	0.00
Scooter	20.00	0.00	20.00	30.00	0.00	0.00	20.00	0.00	0.00	10.00	10.00	10.00	10.00	0.00	0.00	10.00	0.00	0.00	0.00	0.00	10.00	10.00	10.00	30.00
Walking	23.36	28.79	5.68	12.12	3.54	1.52	11.74	1.52	0.76	0.00	24.37	24.24	0.63	1.52	0.88	0.00	5.05	1.52	7.58	6.06	1.01	6.06	15.40	16.67

The motives selected by respondents as underpinning the personas' choice of car as the main mode were compared with respondents' sociodemographic characteristics and results are shown in table 3 for both GL and uGS. In GL, *comfort* was mostly selected as a motive for car use by respondents with high income levels. Further, the greater the importance respondents placed on having a healthy lifestyle, the less they chose *comfort* as a motive for using a car. The environmental concern of the persona also showed a significant relation with *comfort*, the more concerned the persona, the more *comfort* was chosen. *Fastest way* was less frequently selected by respondents who have an extremely healthy lifestyle. In uGS, *fastest way* was chosen more often by women and by those with moderate levels of income. *Saving money* was more relevant for respondents with higher environmental concern. Lastly, *fitness* showed a significant relation with the distance to the city centre as those living closest to the centre chose this motive most frequently.

The sociodemographic characteristics of those who selected public transport as their persona's main mode were compared with their selection of underpinning motives. Results are presented in table 4 for both GL and uGS. In GL, more women and people with high levels of environmental concern selected *fastest way* as the persona's main motive for public transport use. In addition, people with lower incomes were more likely to select *saving money*, *reducing congestion* and *fastest way* as motives. The motives *fastest way* and s*aving money* were also correlated with distance to city centre as those living far away from the centre chose this motive most often. *Reducing* CO_2 was correlated with the levels of environmental concern of both the respondent and of the persona and the higher the level of concern, the more frequently was the motive selected. In uGS, the motive *saving money* was chosen more often by younger respondents. In contrast, *safety* and *privacy* were most often selected by older respondents. Fitness and reducing congestion were both related to distance to city centre. Here, the closer respondents live to the centre, the more frequently they chose this motive. The motive to conform with others revealed a positive relation with environmental concern, both of the respondent and of the persona.

Table 3. Relations between underlying motives for personas' car use and respondents' sociodemographic characteristics.

		Save Money		Flexibility		Safety		Reduce CO_2		Conform with others		Fitness		Social status		Privacy		Comfort		Reduce congestion		Fun		Fastest Way	
		χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V
Age	GL	9.39	.28	4.24	.19	3.04	.16	4.08	.18	10.05	.29	8.27	.26	6.48	.23	5.95	.22	9.21	.28	-	-	9.51	.28	8.25	.26
	uGS	3.35	.21	3.75	.23	4.92	.26	4.80	.26	3.80	.23	1.19	.13	2.31	.18	5.54	.27	3.98	.23	3.35	.21	4.76	.25	8.69	.34
Gender	GL	3.81	.18	1.07	.94	.09	.03	4.29	.19	.21	.04	.28	.05	.79	.08	.15	.07	.89	.09	-	-	.91	.09	.66	.07
	uGS	1.16	.13	.59	.09	.06	.03	.03	.02	1.28	.13	.51	.08	.06	.03	.03	.02	.001	.003	.14	.04	.45	.08	4.05*	.23
Income	GL	5.39	.21	1.38	.11	2.85	.15	3.36	.17	1.15	.09	4.28	.19	1.55	.11	5.36	.21	8.91*	.27	-	-	2.18	.13	6.55	.23
	uGS	1.86	.16	1.78	.16	3.34	.21	4.16	.24	6.28	.29	1.14	.12	5.55	.27	.86	.11	1.88	.16	1.22	.13	1.69	.19	8.59*	.34
Distance to city centre	GL	1.39	.11	.48	.06	2.37	.14	.26	.05	.08	.03	4.90	.20	4.26	.19	1.25	.10	2.07	.13	-	-	.83	.08	3.75	.17
	uGS	1.81	.16	.22	.05	.28	.06	1.29	.13	4.45	.25	7.71*	.32	3.86	.23	2.21	.17	3.26	.21	.07	.03	.67	.09	1.47	.14
Healthy lifestyle	GL	1.02	.09	3.36	.17	3.96	.18	11.88	.31	4.37	.19	3.47	.17	2.49	.14	1.03	.09	10.42*	.29	-	-	17.02	.38	15.55**	.36
	uGS	3.78	.23	5.48	.27	.98	.12	3.23	.21	2.69	.19	2.72	.19	2.29	.18	8.73	.34	1.29	.13	1.26	.13	4.33	.24	6.26	.29
Environmental concern	GL	6.98	.24	5.19	.21	4.13	.18	3.65	.17	3.83	.18	7.71	.25	2.18	.13	2.19	.14	2.49	.14	-	-	1.6	.12	5.54	.21
	uGS	12.43*	.41	7.64	.32	8.69	.34	3.86	.23	3.86	.22	3.91	.23	2.25	.17	5.55	.27	5.99	.29	.93	.11	9.39	.36	5.55	.27
Environmental concern of the persona	GL	4.76	.19	1.67	.12	4.07	.18	2.71	.15	2.51	.14	8.77	.27	10.63	.29	1.09	.95	10.29*	.29	-	-	6.70	.24	6.61	.23
	uGS	1.01	.12	7.94	.33	1.61	.15	.88	.11	15.54	.46	5.50	.27	5.92	.28	2.01	.16	1.08	.12	12.27	.41	2.89	.19	1.59	.15

Note: Note: V refers to Cramér's V and shows the effect size between the relations. If – is shown, statistics could not be computed as the variable was a constant.
*$p < .05$ **$p < .01$ ***$p < .001$.

Table 4. Relations between underlying motives for personas' use of public transport and respondents' sociodemographic characteristics.

		Save Money		Flexibility		Safety		Reduce CO_2		Conform with others		Fitness		Social status		Privacy		Comfort		Reduce congestion		Fun		Fastest Way	
		χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V
Age	GL	6.69	.13	2.87	.09	.92	.05	2.82	.09	5.98	.12	7.87	.14	6.96	.13	3.79	.09	4.56	.11	3.94	.10	3.32	.09	9.19	.15
	uGS	13.68*	0.29	1.89	.11	15.96**	.31	7.34	.21	1.99	.11	.69	.07	4.29	.16	14.86*	.30	1.01	.08	7.83	.22	4.96	.18	3.67	.15
Gender	GL	2.16	.07	1.07	.05	1.05	.05	.91	.05	.24	.02	2.78	.08	.25	.03	.001	.001	.10	.02	.06	.01	1.04	.05	9.73**	.16
	uGS	.25	.04	1.27	.09	.13	.03	.66	.06	.06	.02	.02	.01	.02	.01	.02	.01	1.17	.09	1.11	.08	.03	.02	.88	.07
Income	GL	62.86***	.40	1.39	.06	2.62	.08	4.14	.10	4.39	.11	1.17	.05	4.34	.11	1.73	.07	1.40	.06	22.00***	.28	3.01	.09	10.66*	.17
	uGS	5.34	.18	2.06	.11	4.11	.16	3.31	.14	2.58	.13	1.73	.10	1.69	.10	4.00	.16	2.04	.11	3.98	.16	1.58	.09	2.81	.13
Distance to city centre	GL	8.84*	.15	4.41	.11	.94	.05	.47	.04	.78	.05	2.88	.09	8.72	.15	1.43	.06	.02	.01	5.94	.12	3.36	.09	13.76**	.19
	uGS	13.76	.18	1.26	.09	.21	.04	.49	.06	.43	.05	11.66**	.27	3.28	.14	2.98	.14	.02	.01	7.21*	.21	1.14	.08	8.84	.15
Healthy lifestyle	GL	7.14	.14	4.17	.10	.62	.04	1.45	.06	.88	.05	1.21	.06	2.86	.09	1.79	.07	1.35	.06	1.93	.07	.89	.05	7.29	.17
	uGS	2.03	.11	3.25	.14	9.81	.25	2.31	.12	1.64	.10	5.62	.19	4.99	.18	2.65	.13	1.68	.10	3.91	.16	9.05	.24	1.35	.09
Environmental concern	GL	1.75	.07	2.71	.08	1.46	.06	12.43*	.41	1.67	.06	10.11	.02	10.76	.17	.99	.05	6.96	.13	5.97	.12	.9.34	.15	2.52	.80
	uGS	4.85	.17	3.00	.14	1.53	.09	4.01	.16	34.80***	.46	2.17	.12	20.02	.35	2.66	.13	2.12	.11	.76	.07	7.97	.22	2.93	.14
Environmental concern of the persona	GL	10.57	.16	7.59	.14	1.71	.07	20.05***	.23	3.49	.09	1.41	.06	4.55	.11	10.39	.16	1.79	.07	20.05	.23	3.32	.09	19.05**	.22
	uGS	2.38	.12	5.93	.19	6.69	.20	4.38	.16	10.14*	.25	4.26	.16	3.25	.14	4.40	.16	3.41	.15	4.56	.17	4.44	.17	7.19	.21

Note: V refers to Cramér's V and shows the effect size between the relations. *$p < .05$ **$p < .01$ ***$p < .001$.

The relations between respondents' sociodemographic characteristics with the motives they chose as underpinning the choice of cycling as the persona's main mode are shown in table 5 for both GL and uGS. In GL, the motives *reducing CO_2* and *privacy* were more prevalent among older respondents. Moreover, *reducing CO_2* showed a strong positive correlation with income. In contrast, the motive *safety*, was more important for respondents with lower income. Further, results revealed that the motive *fitness* was mostly selected by respondents with a moderately healthy lifestyle. Lastly, the motive *social status* showed a relation with distance to city centre and only respondents living close to the centre selected this motive. In uGS, the motive *fun* was more prevalent among men and the motive *saving money* was increasingly selected with lower levels of income. Further, the latter motive had a significant relation with the environmental concern of the persona, i.e., for levels of moderate concern, the motive was chosen least. In addition, the motive was positively related with a healthy lifestyle. *Fitness* showed a significant correlation with higher incomes and the motive *fastest way* was chosen more often among respondents with high levels of environmental concern.

For the respondents who chose walking as the persona's main mode, results of sociodemographic factors correlated with motives for the mode choice are shown in table 6. In GL, the motives *saving money* and *fitness* differed across age groups with younger people chosing the first motive more frequently, and the second motive was mostly chosen more commonly among middle-aged respondents. Unsurprisingly, the motive *reducing CO_2* revealed a positive relation with environmental concern – both the respondents' and the personas'. *Reducing CO_2* also differed across income groups, with lower income groups choosing this motive less frequently. The motive *reducing congestion* was also positively related with the environmental concern of the persona. In uGS, there were no statistically significant correlations between motives for walking and the sociodemographic characteristics that could be detected via a chi-square or Fisher's exact test. For the modes motorbike, carsharing and scooter, neither chi-square nor Fisher's exact tests could be conducted to test any significant relations with demographic factors and motives due to the small case number in both locations. Therefore, these modes were not further considered in the discussion.

Table 5. Relations between underlying motives for personas' bike use and respondents' sociodemographic characteristics.

		Save Money		Flexibility		Safety		Reduce CO_2		Conform with others		Fitness		Social status		Privacy		Comfort		Reduce congestion		Fun		Fastest Way	
		χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V
Age	GL	2.73	.14	6.47	.22	3.29	.16	11.44*	.29	4.64	.19	5.46	.20	5.37	.20	14.35*	.33	1.93	.12	11.04	.29	8.89	.26	10.31	.28
	uGS	6.03	.23	5.36	.22	12.29	.33	3.25	.17	3.53	.18	1.56	.12	6.23	.23	5.86	.23	4.37	.19	8.94	.28	3.43	.17	1.88	.13
Gender	GL	1.50	.11	.001	.001	2.43	.14	.02	.01	.11	.03	1.66	.11	.01	.01	.87	.82	3.61	.17	.01	.01	.04	.20	.95	.09
	uGS	1.29	.11	.38	.06	1.01	.09	.39	.06	1.79	.13	.21	.04	.36	.07	.10	.03	2.33	.14	.001	.002	5.47*	.22	.06	.02
Income	GL	.53	.06	2.98	.15	12.61**	.31	16.08**	.35	.81	.08	3.55	.16	1.11	.09	4.94	.19	6.39	.22	1.31	.10	5.12	.19	.95	.09
	uGS	11.01*	.31	4.96	.21	5.89	.23	5.01	.21	2.17	.14	9.53*	.29	3.26	.17	4.29	.19	3.63	.18	1.68	.12	2.29	.14	1.26	.11
Distance to city centre	GL	.28	.05	1.09	.09	2.66	.14	.14	.03	.24	.04	1.89	.12	13.16**	.32	.11	.03	1.76	.12	4.81	.19	1.12	.09	2.08	.13
	uGS	3.86	.18	5.36	.22	1.79	.13	2.05	.13	1.79	.13	.25	.05	.64	.08	.64	.08	.16	.04	1.19	.10	1.14	.10	1.47	.11
Healthy lifestyle	GL	.53	.06	3.12	.15	5.26	.20	1.48	.11	.87	.08	16.41*	.35	3.87	.17	5.09	.19	1.15	.09	1.79	.12	.80	.08	3.91	.17
	uGS	8.24*	.27	1.16	.10	2.14	.14	2.32	.14	1.19	.10	4.84	.21	3.85	.18	3.31	.17	2.02	.13	3.88	.18	1.72	.12	2.21	.14
Environmental concern	GL	6.74	.23	5.88	.21	4.51	.19	.47	.06	11.07	.29	3.53	.16	.88	.08	1.22	.09	13.45	.32	3.48	.16	2.37	.13	3.27	.16
	uGS	5.29	.22	7.74	.26	1.47	.11	7.09	.25	6.62	.24	3.32	.17	24.01	.46	3.28	.17	3.33	.17	2.99	.16	.70	.08	3.19	.17
Environmental concern of the persona	GL	2.52	.14	3.59	.17	9.19	.27	5.21	.19	1.89	.12	3.56	.17	4.62	.19	5.32	.20	2.06	.13	4.54	.19	4.29	.18	4.09	.18
	uGS	11.34*	.31	1.78	.12	4.47	.19	2.52	.15	3.05	.16	4.36	.19	1.75	.12	12.19	.33	2.86	.16	5.86	.23	6.32	.23	16.44**	.38

Note: V refers to Cramér's V and shows the effect size between the relations. *$p < .05$ **$p < .01$ ***$p < .001$.

Table 6. Relations between underlying motives for personas' walking and respondents' sociodemographic characteristics.

		Save Money		Flexibility		Safety		Reduce CO_2		Conform with others		Fitness		Social status		Privacy		Comfort		Reduce congestion		Fun		Fastest Way	
		χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V
Age	GL	18.36**	.25	4.97	.13	3.11	.10	2.52	.09	6.89	.15	11.55*	.19	7.54	.16	6.59	.15	2.74	.09	3.17	.10	.69	.05	5.79	.14
	uGS	7.18	.52	2.94	.33	4.57	.41	3.64	.37	10.09	.61	5.97	.47	-	-	-	-	3.64	.37	1.51	.24	1.51	.24	4.98	.43
Gender	GL	.06	.01	.45	.04	.93	.06	.003	.003	3.77	.11	.02	.01	.04	.01	.01	.01	.60	.05	2.65	.10	.11	.12	2.10	.08
	uGS	.22	.09	1.74	.25	1.29	.22	.83	.18	-	-	.01	.02	1.29	.22	-	-	.83	.18	1.78	.26	3.76	.37	.01	.02
Income	GL	.91	.06	1.75	.08	.24	.03	8.78*	.17	7.79	.16	4.44	.12	1.49	.07	1.14	.06	2.72	.90	4.88	.13	1.39	.07	3.47	.11
	uGS	2.74	.32	2.21	.29	4.57	.41	1.12	.20	-	-	4.76	.42	1.12	.20	-	-	5.97	.47	1.31	.22	1.31	.22	1.45	.23
Distance to city centre	GL	2.06	.08	3.50	.11	1.50	.07	1.99	.08	1.32	.07	2.27	.09	17.02	.24	1.27	.07	.80	.05	.50	.04	.61	.05	4.75	.13
	uGS	1.55	.24	.62	.15	12.98	.69	.71	.16	-	-	1.49	.24	2.08	.28	-	-	2.08	.28	.64	.15	3.72	.37	1.92	.27
Healthy lifestyle	GL	3.80	.11	3.97	.12	4.07	.12	3.66	.11	1.13	.07	3.42	.11	2.81	.10	3.19	.10	8.53	.17	1.92	.08	1.04	.06	3.48	.11
	uGS	1.53	.24	1.53	.24	.52	.14	.52	.14	-	-	1.13	.20	.52	.14	-	-	.52	.14	.85	.18	3.40	.36	9.28	.59
Environmental concern	GL	3.85	.11	6.75	.15	5.03	.13	17.24**	.24	1.77	.08	2.92	.10	6.57	.15	3.69	.11	.91	.06	6.05	.14	18.99	.25	2.91	.09
	uGS	7.29	.52	2.89	.33	2.47	.30	12.98	.69	-	-	3.20	.34	2.47	.30	-	-	4.57	.41	5.80	.46	.76	.17	2.63	.31
Environmental concern of the persona	GL	5.19	.13	5.17	.13	4.59	.12	13.03*	.21	2.72	.09	7.29	.16	2.31	.09	3.63	.11	.56	.04	16.49**	.23	2.99	.10	.81	.05
	uGS	5.10	.43	6.34	.49	1.12	.20	2.47	.30	-	-	2.75	.32	1.12	.20	-	-	1.12	.20	1.89	.26	7.80	.54	3.26	.35

Note: V refers to Cramér's V and shows the effect size between the relations. If – is shown, statistics could not be computed as the variable was a constant.
*$p < .05$ **$p < .01$ ***$p < .001$.

Table 7. Motives for switching to other modes in Greater London and in the urban German-speaking part of Switzerland in %.

	GL	uGS	GL	uGS	GL	uGS	GL	uGS	GL	uGS	GL	uGS	GL	uGS	GL	uGS	GL	uGS	GL	uGS	GL	uGS	GL	uGS
	Save money		**Gain flexibility**		**More safety**		**Help reduce CO_2**		**Conform with others**		**Become fitter**		**Increase social status**		**Gain privacy**		**Increase comfort**		**Help reduce congestion**		**Have more fun**		**Have a faster journey**	
Switch to Car	4.23	4.62	14.17	24.62	12.87	6.15	1.63	1.92	2.12	3.46	1.47	3.08	7.82	7.69	19.71	17.31	19.87	13.46	0.65	2.31	2.12	5.00	15.96	10.38
Switch to Public transport	17.59	13.46	9.82	9.62	9.82	9.62	10.49	14.74	7.59	7.05	4.46	5.77	2.46	4.49	2.01	1.28	11.16	9.62	10.27	10.26	1.34	1.92	21.65	12.18
Switch to Bike	18.36	17.30	6.82	16.03	2.23	1.69	17.06	12.24	1.63	5.06	25.07	18.99	1.78	2.95	0.89	1.27	1.93	1.27	8.16	9.28	4.30	5.06	10.68	8.86

Note: the highlighted boxes indicate identical top motives for choosing main mode and switching to this mode.

Motives for personas switching to other modes

Results revealed that the most commonly chosen motive for each main mode in the static scenario were not necessarily the same as the most common switching motives for the same modes in the dynamic scenario. For example, comfort was most commonly selected as the main motive for car use, but speed was most commonly selected as the factor that would most likely influence personas to switch to cars from other modes. The motives for GL for uGS are shown in table 7. For switching to car, the main motives in GL were to *increase comfort,* to *gain privacy* and to *have a faster journey*. In uGS, the main motives were to *gain flexibility*, to *gain privacy* and to *increase comfort*. For switching to public transport, the motives in GL were to *have a faster journey,* to *increase comfort* and to *help reduce* CO_2. The motives for switching to public transport in uGS were to *help reduce* CO_2, to *save money* and to *have a faster journey.* In GL, the main motives for switching to bike are to *become fitter,* to *save money* and to *reduce more* CO_2. In uGS, they were also to *become fitter,* to *save money* and to *gain flexibility.* It is notable, that the motives for switching to bike are the same as using bike as a main mode in both locations. Lastly, for switching to carsharing the predominant motives in GL were to *save money,* to *increase comfort* and to *help reduce congestion*. In uGS, the main motives for switching to carsharing were to *gain flexibility,* to *save money* and to *increase comfort.*

Sociodemographic factors influencing the motives for personas switching to other modes

To assess potential sociodemographic influences on the respondents' selection of motives for the personas to switch modes, again, chi-square tests were conducted for all modes and motives. Further, Cramér's V was regarded for all variables as well as the bar charts indicating the direction of the relations. Sociodemographic factors compared with motives for switching to car use are presented in table 8 for both GL and uGS. In GL, lower income groups chose the motive to *have a faster journey* more often than others. Health-conscious respondents chose the motive to *conform with others* less often than the others. Moreover, healthy lifestyles were also correlated with the motive to *increase social status*. The motive *comfort* was chosen most often by those with low to moderate levels of environmental concern. In uGS, the motive to *have a faster journey* was more often chosen by women than by men. Moreover, the motive to *conform with others* was related with persona's environmental concern; those who assumed that their persona was not particularly concerned about the environment chose this motive whereas those who assumed their persona had a high to very high concern did not.

Sociodemographic factors correlated with motives for switching to public transport are presented in table 9 for both GL and uGS. In GL, the motive to *have a faster journey* was most often chosen by women. Moreover, this motive showed a negative correlation with income, respondents with low incomes were more likely to select this motive. The motive *help reduce* CO_2 showed a higher prevalence among those with high levels of health-consciousness and high levels of income. Further, among health-conscious respondents, the motive to *gain flexibility* was chosen more often. In contrast, to *increase comfort* negatively correlated with health-consciousness. To *increase social status* also showed a correlation with health-consciousness, and respondents with healthier lifestyles selected this motive more often. Further, this motive was chosen more often by respondents who live two to five kilometres from the city centre and by those with high levels of concern for the environment. In uGS, the motive to *become fitter* was particularly relevant for respondents up to the age of 24 and older than 55. Further, the lower the respondent's income, the more prevalent the motive to *increase comfort*. To *gain flexibility* had a significant relation with healthy lifestyle and, lastly, for respondents with higher levels of health-consciousness the motive to *gain flexibility* was more important than for others.

Sociodemographic factors compared with motives to switch to cycling are presented in table 10 for both GL and uGS. In GL, the motive to *increase social status* was chosen more often by men. In turn, the motive *to have a faster journey* was selected more frequently by women and by those living close to the city centre. For respondents living far away from the city centre, the motive *saving money* became more relevant. The motive to *have a faster journey* was more prevalent among the lower income groups. To *help reduce* CO_2 and to *become fitter* were further motives with significant correlation to income, with increasing importance of these motives the higher the income. To *help reduce* CO_2, to *become fitter* and to *help reduce congestion* all revealed a correlation with the environmental concern of the persona, i.e., the higher the concern, the greater the importance of these motives. In addition, respondents who were moderately or highly health-conscious chose the motives to *gain flexibility* and *become fitter* more often. In uGS, the motive to *have a faster journey* was surprisingly more relevant for older age groups. Moreover, this was more common among those living close to the city centre. Further, this motive was positively correlated with the persona's environmental concern. The motive to *become fitter* was selected more often among respondents with moderate to low levels of concern for a healthy lifestyle.

Sociodemographic factors correlated with motives to switch to carsharing are presented in table 11 for both GL and uGS. In GL, men and the ones older than 65 years chose the motive to *conform others* more often than others. The motive to *gain privacy* was also selected more

often by men than by women. The motive to *have a faster journey*, in turn, was most prevalent among women and those in lower income groups. The motive to *help reduce* CO_2 was most often selected by respondents in moderate income groups. Both motives s*aving money* and *more safety* were most prevalent among those with moderate levels of health-consciousness. The two motives were also significantly related with distance to the city centre; the further away respondents live from the city centre, the more important the motive *saving money*, and with a moderate distance to the city centre *more safety* was less important. Further, *to increase comfort* was most often selected by respondents who were concerned about the environment, and *saving money* was least often selected by these respondents. In uGS, the motive *more safety* was only relevant for respondents aged 35-44 and older. Further, respondents with healthy lifestyles selected the motive to *become fitter* more often than others. The motives to *gain privacy* and to *increase comfort* both revealed a correlation with the distance to the city centre: those who lived further from the city, chose these motives most often.

Table 8. Relations between respondents' **s**ociodemographic characteristics and motives for personas switching to car use.

		Save money		Gain flexibility		More safety		Help reduce CO_2		Conform with others		Become fitter		Increase social status		Gain privacy		Increase comfort		Help reduce congestion		Have more fun		Have a faster journey	
		χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V
Age	GL	3.22	.12	7.19	.18	3.82	.13	4.43	.14	7.90	.19	9.56	.20	9.58	.20	7.31	1.8	4.79	.14	5.71	.16	7.32	.18	6.81	.17
	uGS	9.88	.31	3.45	.19	4.86	.22	3.54	.19	1.25	.11	4.38	.21	1.82	.13	9.06	.30	6.69	.26	4.25	.21	7.38	.27	6.84	.26
Gender	GL	4.27	.14	.36	.04	1.21	.07	.59	.05	.02	.01	3.32	.12	.91	.06	.001	.002	3.05	.12	1.18	.07	1.00	.07	2.63	.11
	uGS	1.79	.13	.65	.08	.02	.01	.28	.05	2.74	.17	2.44	.16	.72	.08	.54	.07	.17	.04	2.60	.16	3.87	.20	4.86*	.29
Income	GL	2.20	.09	.69	.06	2.86	.11	3.84	1.3	1.88	.09	2.39	.10	3.02	.11	.75	.06	.24	.03	.41	.04	2.15	.09	8.70*	.19
	uGS	4.49	.21	6.35	.25	.43	.07	1.69	.13	.63	.08	.99	.10	3.71	.19	3.97	.20	1.44	.12	1.55	.12	3.00	.17	2.86	.17
Distance to city centre	GL	.01	.01	.39	.04	.29	.04	2.39	.10	.58	.05	3.69	.13	2.03	.09	.01	.01	.17	.03	3.93	.13	.48	.05	1.93	.10
	uGS	.28	.05	3.84	.19	.78	.09	.47	.07	1.71	.13	.14	.04	1.03	.10	.61	.08	5.55	.23	.02	.02	.42	.06	.58	.08
Healthy lifestyle	GL	10.31	.21	2.39	.10	1.00	.07	5.75	.16	15.93**	.26	8.69	.19	13.21**	.24	7.08	.18	6.52	.17	2.31	.10	1.78	.09	5.83	.16
	uGS	.65	.08	5.63	.24	5.04	.22	3.04	.17	4.17	.20	2.11	.14	2.62	.16	2.95	.17	6.02	.24	1.82	.13	5.36	.23	2.83	.17
Environmental concern	GL	6.56	.17	4.47	.14	.93	.06	1.34	.08	8.18	.19	.37	.04	5.24	.15	6.42	.17	10.44*	.21	1.37	.08	2.99	.11	3.30	.12
	uGS	.89	.94	.56	.08	3.52	.19	8.38	.29	4.01	.20	5.65	.24	7.78	.28	2.15	.15	7.32	.27	1.67	.13	3.05	.17	2.64	.16
Environmental concern of the persona	GL	9.43	.20	3.95	.13	5.18	.15	8.32	.19	11.11	.22	4.77	.144	1.22	.07	3.98	.13	22.48***	.21	9.76	.21	6.86	.17	1.95	.09
	uGS	5.13	.23	4.84	.22	2.02	.14	3.81	.19	13.71**	.37	2.28	.15	1.54	.12	2.75	.17	3.99	.20	4.24	.21	1.69	.13	3.51	.19

Note: V refers to Cramér's V and shows the effect size between the relations. *$p < .05$ **$p < .01$ ***$p < .001$.

Table 9. Relations between respondents' sociodemographic characteristics and motives for personas switching to public transport.

		Save money		Gain flexibility		More safety		Help reduce CO_2		Conform with others		Become fitter		Increase social status		Gain privacy		Increase comfort		Help reduce congestion		Have more fun		Have a faster journey	
		χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V
Age	GL	8.25	.21	8.65	.21	7.66	.20	5.70	.17	4.58	.15	8.19	.21	7.10	.19	2.66	.12	2.80	.12	2.28	.11	7.80	.19	10.17	.23
	uGS	3.47	.22	1.64	.15	7.89	.33	7.76	.32	3.32	.21	12.69*	.41	3.58	.22	7.45	.32	8.77	.34	2.09	.17	2.80	.19	6.28	.29
Gender	GL	.33	.04	2.18	.11	2.18	.11	.74	.06	.65	.06	.67	.06	.97	.07	.26	.04	.58	.06	.13	.03	4.48	.15	3.94*	.14
	uGS	1.39	.14	2.91	.19	.44	.08	.27	.06	2.39	.18	1.24	.13	.04	.02	.10	.04	1.58	.15	.54	.09	2.02	.17	.09	.04
Income	GL	5.22	.16	1.80	.10	.66	.06	17.79***	.30	1.32	.08	2.85	.12	6.86	.19	2.49	.11	10.62*	.24	5.39	.17	.11	.02	21.34***	.33
	uGS	1.91	.16	3.15	.21	2.67	.19	5.47	.27	2.29	.18	1.01	.12	6.82	.30	4.56	.25	9.22	.35	1.45	.14	2.09	.17	9.22*	.35
Distance to city centre	GL	.98	.07	3.77	.14	.02	.01	.69	.06	1.67	.09	2.91	1.2	11.20**	.24	.36	.04	1.48	.09	1.79	.10	.39	.05	5.27	.17
	uGS	5.29	.27	4.63	.25	1.11	.12	2.99	.20	2.66	.19	2.62	.19	4.13	.24	1.41	.14	3.58	.22	.20	.05	3.17	.21	.60	.09
Healthy lifestyle	GL	1.92	.10	9.47*	.22	4.60	.15	8.21*	.21	4.53	.15	7.19	.19	10.22*	.26	1.97	.10	10.22*	23	1.57	.09	5.05	.16	13.84	.27
	uGS	5.75	.28	20.03***	.52	1.63	.15	2.99	.20	5.19	.27	5.67	.28	7.29	.31	1.59	.15	2.87	.20	2.82	.20	12.30	.41	6.91	.31
Environmental concern	GL	4.42	.15	1.47	.09	7.34	.20	5.09	.16	.82	.07	2.32	.11	12.94	.26	3.79	.14	5.90	.18	4.40	.15	1.54	.09	4.58	.15
	uGS	6.43	.29	4.28	.24	1.03	.12	8.43	.30	7.99	.33	2.96	.20	1.42	.14	.55	.09	1.05	.12	4.70	.25	1.72	.15	1.72	.15
Environmental concern of the persona	GL	5.68	.17	.47	.05	2.89	.12	6.71	.19	6.52	.18	3.99	.14	8.26	.21	1.44	.09	7.08	.19	8.11	.21	1.97	.10	9.11	.22
	uGS	6.73	.30	6.02	.29	.98	.12	.98	.12	3.33	.21	.87	.11	4.45	.25	1.99	.16	2.53	.19	2.93	.20	3.89	.23	2.69	.19

Note: V refers to Cramér's V and shows the effect size between the relations. *$p < .05$ **$p < .01$ ***$p < .001$.

Table 10. Relations between respondents' sociodemographic characteristics and motives for personas switching to cycling.

		Save money		Gain flexibility		More safety		Help reduce CO_2		Conform with others		Become fitter		Increase social status		Gain privacy		Increase comfort		Help reduce congestion		Have more fun		Have a faster journey	
		χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V
Age	GL	4.18	.13	3.24	.12	3.57	.12	3.22	.11	5.02	.14	5.75	.15	11.38	.22	8.76	.19	16.67	.26	3.47	.12	4.29	.13	1.95	.09
	uGS	7.04	.28	3.43	.19	2.36	.16	7.10	.28	3.27	.19	4.78	.23	7.90	.30	3.87	.21	2.10	.15	7.79	.29	5.52	.25	13.35*	.38
Gender	GL	2.45	.10	.18	.03	.002	.002	.10	.02	.25	.03	1.03	.07	6.63**	.16	.02	.01	.42	.04	.11	.02	.28	.03	4.98*	.14
	uGS	.60	.08	1.02	.11	1.19	.11	.21	.05	.02	.01	.27	.06	1.62	.13	3.31	.19	.42	.07	.64	.08	.25	.05	2.47	.17
Income	GL	3.99	.13	1.27	.07	8.24	.18	12.88**	.23	2.68	.10	8.87*	.19	1.38	.08	.66	.05	4.71	.14	1.90	.09	7.21	.17	21.18***	.29
	uGS	2.48	.17	1.50	.13	2.22	.16	1.69	.14	4.87	.23	3.49	.20	3.99	.21	1.42	.13	2.49	.17	4.90	.23	1.42	.13	4.12	.21
Distance to city centre	GL	7.16*	.17	1.39	.08	.17	.03	1.88	.09	1.28	.07	1.51	.08	.81	.06	.20	.03	1.51	.08	.20	.03	.93	.06	11.60**	.22
	uGS	3.50	.20	5.20	.24	.96	.10	2.09	.15	5.90	.26	.61	.08	3.55	.20	.83	.10	.44	.07	1.07	.11	2.14	.15	6.02*	.26
Healthy lifestyle	GL	2.60	.10	11.83**	.22	10.74	.21	3.07	.11	.86	.06	9.55*	.19	5.43	.15	2.63	.10	2.92	.11	4.48	.14	2.20	.10	2.32	.10
	uGS	4.09	.21	1.00	.11	3.40	.19	.91	.10	1.70	.14	11.02*	.35	1.07	.11	.94	.10	.94	.10	.66	.09	5.97	.26	5.01	.26
Environmental concern	GL	2.59	.10	6.77	.17	2.66	.10	4.56	.14	4.31	.13	3.74	.12	2.45	.10	1.61	.08	5.11	.14	.88	.06	5.14	.15	1.25	.07
	uGS	2.98	.18	.59	.08	2.38	.16	1.74	.14	2.56	.16	12.88	.38	5.38	.24	4.14	.21	6.66	.27	4.55	.22	11.34	.35	5.60	.25
Environmental concern of the persona	GL	9.40	.20	1.86	.09	4.34	.13	16.48**	.26	13.87	.24	17.52**	.27	1.57	.08	1.66	.08	14.87	.25	17.08**	.26	1.51	.08	5.77	.15
	uGS	2.26	.16	5.27	.24	8.02	.30	5.06	.24	3.71	.20	3.61	.20	3.86	.21	.72	.09	6.31	.26	1.02	.11	2.10	.15	11.64*	.36

Note: V refers to Cramér's V and shows the effect size between the relations. *$p < .05$ **$p < .01$ ***$p < .001$.

Table 11. Relations between respondents' **s**ociodemographic characteristics and motives for personas switching to carsharing.

		Save money		Gain flexibility		More safety		Help reduce CO_2		Conform with others		Become fitter		Increase social status		Gain privacy		Increase comfort		Help reduce congestion		Have more fun		Have a faster journey	
		χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V	χ^2	V
Age	GL	1.42	.07	7.43	.16	8.52	.17	2.49	.09	22.03**	.27	5.40	.14	6.16	.14	3.20	.10	3.90	.12	9.66	.18	10.08	.19	5.52	.14
	uGS	8.29	.24	3.46	.16	14.06*	.32	2.32	.13	10.35	.27	3.99	.17	2.66	.14	2.90	.14	7.35	.23	6.97	.22	1.69	.11	4.46	.18
Gender	GL	.01	.01	.003	.003	1.56	.07	.01	.01	3.93*	.12	.22	.03	1.99	.08	11.29**	.19	2.00	.08	3.13	.10	.07	.02	6.39*	.15
	uGS	.13	.03	2.43	.13	.01	.01	.02	.01	.03	.01	.44	.06	.97	.08	.12	.03	.03	.01	3.31	.02	.94	.08	.53	.06
Income	GL	.63	.05	4.99	.13	4.99	.13	14.66**	.22	.97	.06	3.67	.11	1.38	.07	2.44	.09	1.45	.07	7.81	.16	5.21	.13	14.26**	.22
	uGS	2.01	.12	1.49	.10	.11	.03	3.44	.16	4.08	.17	1.47	.10	4.34	.18	3.42	.16	7.55	.23	1.69	.11	2.81	.14	1.29	.10
Distance to city centre	GL	9.94**	.18	1.23	.07	13.05**	.21	1.90	.08	5.49	.14	5.63	.14	2.05	.08	1.50	.02	3.17	.10	1.55	.07	.04	.01	1.27	.07
	uGS	3.06	.15	.88	.08	3.53	.16	.87	.08	.46	.06	6.47	.22	.93	.08	6.89*	.22	9.74**	.27	1.34	.10	.86	.08	.78	.08
Healthy lifestyle	GL	8.45*	.17	3.37	.11	13.81**	.22	6.86	.15	4.86	.13	1.40	.07	2.93	.10	8.75	.17	3.48	.11	4.99	.13	4.90	.13	9.60	.18
	uGS	2.88	.14	4.68	.18	3.59	.16	.27	.04	1.63	.11	11.46*	.29	2.67	.14	1.98	.12	1.06	.09	1.51	.10	3.47	.16	.42	.06
Environmental concern	GL	9.17*	.18	4.16	.12	3.26	.11	.62	.05	1.93	.08	2.52	.09	1.81	.08	10.65	.19	9.71*	.18	5.72	.14	2.21	.09	4.16	.12
	uGS	.90	.08	4.12	.17	.34	.05	4.02	.17	6.38	.21	2.13	.12	3.91	.17	4.16	.17	4.64	.18	5.31	.20	3.40	.16	.60	.07
Environmental concern of the persona	GL	3.34	.11	7.37	.16	2.74	.10	3.14	.10	9.29	.18	7.73	.16	3.38	.11	6.99	.15	4.23	.12	2.45	.09	6.99	.15	2.03	.08
	uGS	4.24	.18	1.62	.11	.28	.05	3.28	.15	3.29	.15	4.01	.17	5.05	.19	3.72	.16	1.33	.10	2.67	.14	.91	.08	5.06	.19

Note: V refers to Cramér's V and shows the effect size between the relations. *$p < .05$ **$p < .01$ ***$p < .001$.

3.3 Study 1: discussion

Results of study 1 revealed the motives why various modes of transport are chosen and how these motives differ according to sociodemographic characteristics. We assume that by answering on behalf of a persona who is similar to them, respondents actually reveal their own and true opinions. An overall pattern emerged from the data across the regions of GL and uGS. For cycling and walking, the main motives across all age and income groups were health- and environment-related, i.e., *fitness* and *reducing CO_2 emissions*. The motive *saving money* was common, too, however, mostly for young respondents in lower-income groups. For public transport, the main motives *saving money, reducing congestion* and *fastest way* were all mostly chosen by middle-aged respondents in lower income groups. The motives *flexibility*, *comfort* and *fastest journey* for car use were clearly more frequently selected by respondents in higher income groups who are less health- and environmentally-conscious. These main motives support existing findings from other studies (e.g., De Groot & Steg, 2007; Gardner & Abraham, 2006; Hiscock et al., 2002; Kent, 2014; 2015; Sheller, 2004; Steg 2003; 2005; Wells & Xenias, 2015). Further, carsharing has previously been described as a lifestyle product which creates a sense of belonging to a social group by Schaefers (2013). The results for carsharing can also be seen to be in line with this description, given that *conforming with others* was one of the main motives to choose carsharing as a main mode. In addition to supporting existing findings, our results revealed further sociodemographic correlations with motives underpinning mode choice. For instance, the motive *fastest way* was predominantly chosen by women, regardless of the mode and the motive *reducing CO_2* varied in significance according to the mode selected.

Going beyond understandings of static mode choice, this study examined the factors that would motivate a switch from one mode to another and analysed these factors against respondents' sociodemographic characteristics. Besides cycling, not all motives commonly chosen for each main mode choice in the static scenario corresponded with the most common motives for switching to the respective modes. Yet, the same pattern across modes emerged: switching to public transport, cycling or carsharing was associated with health- and environment-promoting motives, such as to *help reduce CO_2* and *congestion* as well as to *become fitter*. In contrast, the factors *privacy* and *comfort* were more relevant for motivating a switch to car use, especially among respondents who are not particularly concerned about the environment. Interestingly, however, a major motive for switching to public transport was to *increase comfort*, also. This predominantly applied for low-income respondents who are not particularly health-conscious. Thus, in comparison to cycling and carsharing, switching to public transport was associated with higher levels of comfort among this group of people. Overall, results from study 1 uncovered that motives for using a certain mode as the main

transport mode are different from the motives that might explain switching to this mode. Therefore, measures or policies promoting a switch from one mode to another should consider these differences and apply them appropriately.

3.4 Study 2: method

Having assessed the motives underpinning modes of choice in study 1, study 2 explored the application of promotional strategies based on mechanisms traditionally used in consumer research to enhance the attractiveness of alternatives to car use. The study was conducted using the same online survey and sample as study 1, and respondents answered the questions for study 2 directly after the questions for study 1. The survey was designed in a way that respondents were unaware of any direct relationships between the questions of the studies.

Figure 1. Repeated Evaluation Technique Phases Overview

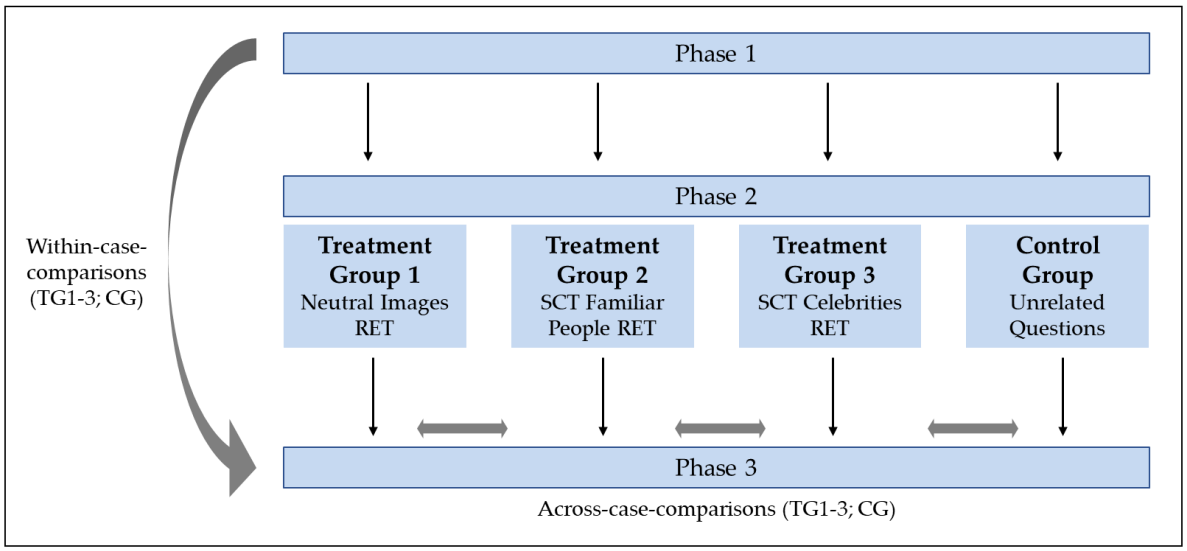


Figure 1 depicts the design of study 2. In phase 1, respondents answered questions regarding their attitude towards various modes of transport (train, bus, carpooling, cycling, walking) which were shown in pictures. Four dimensions were explored with 5-point-Likert scale answer options: willingness to experience (*How likely are you to experience this situation yourself, i.e., how willing would you be to enter into the depicted scenario?*); comfort (*How comfortable would you feel in this situation?*); stress (*How stressed would you feel in this situation?*) and safety (*How safe would you feel in this situation?*). Together, these dimensions reflect the level of perceived attractiveness towards the modes. For reliability analysis,

Cronbach's alpha was calculated to assess the internal consistency of the scale which resulted in $\alpha = .87$ for the German and $\alpha = .88$ for the English survey.

After phase 1, respondents were randomly assigned to one of four treatment groups (phase 2). In treatment group 1, respondents were shown further pictures similar to the ones in phase 1 with the task to rate them in terms of how pleasant, overwhelming, convenient, entertaining and annoying they perceive the depicted travel scenario is on a 5-point-Likert scale (from strongly disagree to strongly agree). Treatment group 1 therefore served to increase the perceived attractiveness of different modes of transport by increasing familiarisation with them via repeated engagement (Carbon & Leder, 2005; Zajonc, 2001).

In treatment group 2 and 3, people were shown pictures of either celebrities or a person familiar to them with an accompanying text indicating the person on the picture is your brother, sister, father, neighbour, boss, friend or colleague, varying by pictures. In every displayed scenario in which a celebrity or familiar person drove a car, a negative consequence was shown on a second picture. A text indicated the consequence for driving the car, e.g. *Your father/Robert de Niro was driving home, tired after his nightshift. He fell asleep momentarily and caused an accident*. The opposite was depicted for alternative modes: *Your brother/Eddie Redmayne started taking the train home from work, avoiding the city traffic. He arrives home early and enjoys spending more time with his child*. Thus, seeing someone using an alternative mode was followed by a positive consequence. After every scenario, respondents were asked how this made them feel with answer options being positive, negative or neutral[8]. By showing positive or negative consequences after a certain behaviour, treatment groups 2 and 3 made use of SCT. The aim of treatment groups 2 and 3 thus were to test if SCT also applies to mobility behaviours and whether the effect is stronger for observing familiar people or celebrities.

Treatment group 4 served as a control group, in which respondents were engaged in mobility-unrelated content, as endorsed by Carbon and Leder (2005). Respondents in this group were instructed to answer questions concerning European geography. Regardless of which treatment group respondents were in, they all had to answer the same questions in phase 3 after their treatments. These questions were identical to the ones in phase 1, bar minimal differences in the pictures, without changing their overall message. This was intended to provide variation for the respondents and avoid potential confusion.

[8] In the celebrity condition, respondents had to initially indicate – after every scenario - whether they knew who the celebrity was.

3.5 Study 2: results

For study 2, paired-sample t-tests were conducted to reveal changes in the level of attractiveness assessed via the four criteria (*willingness to experience*, *comfort*, *safety* and *stress*) between phase 1 and phase 3. The data was normally distributed which was revealed by Shapiro-Wilk tests. The paired-sample t-tests were applied for all three treatment groups and the control group. Results are shown in tables 12a-d. In GL, in the first treatment group (neutral images), results for train revealed a significant decrease in the perception of *comfort* and *safety* and an increase in the perception of *stress* between phase 1 and 3. For the mode bus, the level of all evaluation criteria showed a significant negative change from phase 1 to phase 3. For carpooling, the perception of *willingness to experience*, *comfort* and *safety* significantly increased from phase 1 to phase 3. For cycling, all but one criterion, *stress*, showed a significant positive change. For walking, no significant changes occurred. In uGS, results for train revealed significant negative changes for *comfort* and *stress*. The same applied for bus transportation with, again, *comfort* and *stress* showing significant changes. For carpooling, all criteria had a positive change from phase 1 to phase 3 with results for *willingness to experience* and *comfort* being significant. For cycling, all criteria showed a significant positive change with increased levels of *willingness to experience*, *comfort* and *safety* and decreased level of *stress*. Results for walking had a slightly different pattern where the only significant result was an increase in the level of *safety*, while the other criteria did not show significant changes.

For the second treatment group (familiar people based on SCT), significant results in GL for the mode train conveyed a decrease in the perception of *comfort* and *safety* and an increase in the perception of *stress* between phase 1 and 3. Regarding the mode bus, results revealed a negative change from phase 1 to 3 for the criteria *comfort* and *safety*. For carpooling, the level of *willingness to experience* and *comfort* showed a positive change. Results for cycling showed a significant positive change for all criteria. Results for walking showed a positive change from phase 1 to phase 3 for the criteria *willingness to experience*, *comfort* and *safety* and a decreased level of *stress*. Results for uGS mostly follow the same pattern.

In treatment group 3 (celebrities based on SCT), results in GL for train showed a significant negative change for all criteria but for the level of *willingness to experience*. For the mode bus the same pattern of results emerged. In contrast, only three criteria for carpooling showed a positive change from phase 1 to phase 3, with a significant increase of the level of *willingness to experience* and *safety* and a significant decrease in the level of *stress*. In regard to cycling and walking, all criteria showed a significant positive change from phase 1 to 3. Again, in uGS, results mostly follow the same pattern.

The results of the control group in both GL and uGS both reflected the overarching results of all treatment groups in the respective location: a negative change of the criteria for train and bus and a positive change of the criteria for carpool, bike and walking. This effect was unexpected and is further analysed in the discussion.

3.6 Study 2: discussion

Study 2 examined different strategies for promotional campaigns for increasing the level of attractiveness regarding the modes train, bus, bike, walking and carpooling via the criteria *willingness to experience*, *comfort*, *safety* and *stress*. By means of the repeated evaluation technique, three different promotional treatments were tested to increase familiarity and, eventually, enhance attractiveness of the modes. Overall, results of study 2 disclosed a clear pattern across both regions GL and uGS. For the treatment groups, there was a negative change in the level of attractiveness from pre-treatment in phase 1 to post-treatment in phase 3 for the modes train and bus. In contrast, for cycling, walking and carpooling there was a positive change in the level of attractiveness from phase 1 to phase 3 across all treatment groups. Hence, train and bus were perceived more negatively after all promotional treatments while cycling, walking and carpooling were perceived more positively after all treatments. Although not all changes were significant, this pattern of changes was clearly evident across cases. Therefore, it may be assumed that encouraging the modes train and bus with the applied promotional strategies should be avoided while an encouragement of the modes bike, walking and carpool should be increased. Yet, notably, the control group showed the same pattern of results as the treatment groups. This could be due to the fact that simple engagement with the modes, i.e., assessing them according to several criteria as happened in phase 1 and 3, was sufficient to stimulate respondents' repeated evaluation process. Therefore, familiarisation with the modes occurred and resulted in an increase in the level of attractiveness for some of them. In relation to public transport, however, the repeated evaluation technique did not lead to an increase in the level of attractiveness towards bus travel and train travel. Rather, the engagement resulted in a more negative assessment of these modes. However, the level of significance in the results of the control group was not particularly lower than for the treatment groups. This implies that the change in the level of attractiveness may be due to the variance in pictures shown in phase 3 in relation to phase 1. Thus, regardless of any treatment in phase 2 (or non-treatment as for respondents in control group) the depicted pictures in phase 1 and 3 resulted in an increase or decrease in the perceived level of attractiveness towards various modes. This finding stresses the importance of choosing suitable images for all types of promotions in the context of mobility.

Table 12a. Treatment Group 1 Neutral Images paired sample t-test results

		GL			uGS		
Mode	**Criteria**	**M_{Phase1}**	**M_{Phase2}**	**Delta M_{Phase1}-M_{Phase2}**	**M_{Phase1}**	**M_{Phase2}**	**Delta M_{Phase1}-M_{Phase2}**
Train	Willingness to Experience	3.58	3.59	0.01	3.73	3.61	-0.12
	Comfort	3.18	2.87	-0.31***	2.79	2.53	-0.25*
	Stress	3.18	2.88	-0.30***	3.05	2.80	-0.25*
	Safety	3.46	3.27	-0.20***	3.11	2.97	-0.14
Bus	Willingness to Experience	3.67	3.51	-0.15**	3.70	3.69	-0.01
	Comfort	3.03	2.48	-0.56***	2.97	2.60	-0.37***
	Stress	2.98	2.58	-0.40***	3.07	2.76	-0.31**
	Safety	3.27	3.04	-0.24***	3.14	2.96	-0.17
Carpool	Willingness to Experience	3.44	3.61	0.17**	3.59	3.85	0.26**
	Comfort	3.64	3.83	0.18**	3.49	3.67	0.18*
	Stress	3.47	3.58	0.11	3.46	3.54	0.09
	Safety	3.66	3.83	0.17**	3.53	3.70	0.17
Cycling	Willingness to Experience	2.27	2.25	-0.01	2.95	3.30	0.35**
	Comfort	2.31	2.65	0.35***	2.73	3.33	0.60***
	Stress	2.26	2.55	0.29***	2.82	3.52	0.71***
	Safety	2.15	2.67	0.52***	2.73	3.41	0.68***
Walking	Willingness to Experience	4.14	4.13	-0.01	4.07	4.04	-0.03
	Comfort	3.92	3.97	0.05	3.50	3.66	0.16
	Stress	3.79	3.82	0.03	3.61	3.67	0.06
	Safety	3.78	3.81	0.02	3.56	3.79	0.22**

Note: *$p < .05$ **$p < .01$ ***$p < .001$.

Table 12b. Treatment Group 2 Familiar People paired sample t-test results

		GL			uGS		
Mode	**Criteria**	**M_{Phase1}**	**M_{Phase2}**	**Delta M_{Phase1}-M_{Phase2}**	**M_{Phase1}**	**M_{Phase2}**	**Delta M_{Phase1}-M_{Phase2}**
Train	Willingness to Experience	3.66	3.59	-0.07	3.55	3.23	-0.33**
	Comfort	3.39	3.03	-0.36***	2.82	2.63	-0.19*
	Stress	3.30	3.00	-0.30***	3.03	2.85	-0.18*
	Safety	3.52	3.36	-0.16***	3.31	3.06	-0.25**
Bus	Willingness to Experience	3.64	3.59	-0.06	3.49	3.39	-0.10
	Comfort	3.08	2.58	-0.50***	2.86	2.57	-0.29**
	Stress	3.12	2.71	-0.41***	3.17	2.70	-0.47***
	Safety	3.28	3.10	-0.18**	3.28	3.06	-0.22**
Carpool	Willingness to Experience	3.43	3.67	0.24**	3.44	3.70	0.27**
	Comfort	3.70	3.81	0.11*	3.40	3.50	0.11
	Stress	3.53	3.54	0.01	3.39	3.61	0.23*
	Safety	3.67	3.76	0.09	3.44	3.56	0.13
Cycling	Willingness to Experience	2.10	2.24	0.14*	2.81	3.02	0.21
	Comfort	2.33	2.68	0.35***	2.64	3.41	0.76***
	Stress	2.20	2.64	0.44***	2.74	3.59	0.85***
	Safety	2.13	2.67	0.54***	2.68	3.54	0.86***
Walking	Willingness to Experience	4.07	4.15	0.09	4.03	4.10	0.07
	Comfort	3.99	4.07	0.08	3.63	3.90	0.27**
	Stress	3.80	3.96	0.16**	3.82	4.02	0.20*
	Safety	3.85	3.96	0.11**	3.69	3.95	0.26**

Note: *$p < .05$ **$p < .01$ ***$p < .001$.

Table 12c. Treatment Group 3 Celebrities paired sample t-test results

		GL			uGS		
Mode	**Criteria**	**M_{Phase1}**	**M_{Phase2}**	**Delta M_{Phase1}-M_{Phase2}**	**M_{Phase1}**	**M_{Phase2}**	**Delta M_{Phase1}-M_{Phase2}**
Train	Willingness to Experience	3.69	3.64	-0.05	3.64	3.50	-0.14
	Comfort	3.24	3.05	-0.19**	2.81	2.66	-0.14
	Stress	3.30	3.01	-0.29***	3.14	2.84	-0.31**
	Safety	3.52	3.34	-0.17***	3.20	2.95	-0.26*
Bus	Willingness to Experience	3.74	3.73	-0.01	3.65	3.59	-0.06
	Comfort	3.01	2.65	-0.36***	2.83	2.70	-0.12
	Stress	3.14	2.81	-0.33***	3.11	2.85	-0.27*
	Safety	3.40	3.22	-0.18**	3.15	2.89	-0.27**
Carpool	Willingness to Experience	3.41	3.71	0.30***	3.59	3.84	0.24*
	Comfort	3.71	3.80	0.09	3.54	3.63	0.09
	Stress	3.51	3.64	0.14*	3.53	3.56	0.03
	Safety	3.79	3.91	0.12*	3.56	3.66	0.10
Cycling	Willingness to Experience	2.30	2.46	0.16*	2.70	3.14	0.44**
	Comfort	2.28	2.76	0.47***	2.53	3.36	0.83***
	Stress	2.32	2.68	0.37***	2.72	3.49	0.77***
	Safety	2.20	2.77	0.56***	2.58	3.46	0.88***
Walking	Willingness to Experience	4.22	4.34	0.11*	4.03	4.00	-0.03
	Comfort	3.96	4.12	0.16***	3.66	3.74	0.08
	Stress	3.85	4.01	0.16*	3.70	3.79	0.08
	Safety	3.86	4.05	0.19**	3.64	3.82	0.17

Note: *$p < .05$ **$p < .01$ ***$p < .001$.

Table 12d. Control Group paired sample t-test results

		GL			uGS		
Mode	**Criteria**	**M_{Phase1}**	**M_{Phase2}**	**Delta M_{Phase1}-M_{Phase2}**	**M_{Phase1}**	**M_{Phase2}**	**Delta M_{Phase1}-M_{Phase2}**
Train	Willingness to Experience	3.62	3.61	-0.01	3.57	3.38	-0.19*
	Comfort	3.27	2.96	-0.31***	2.86	2.72	-0.15***
	Stress	3.17	2.96	-0.21***	3.14	2.82	-0.32**
	Safety	3.43	3.27	-0.16***	3.23	3.06	-0.17*
Bus	Willingness to Experience	3.73	3.57	-0.16**	3.62	3.49	-0.14
	Comfort	3.16	2.62	-0.54***	2.85	2.73	-0.13
	Stress	3.14	2.76	-0.38***	3.15	2.73	-0.42***
	Safety	3.35	3.06	-0.29***	3.21	3.03	-0.18
Carpool	Willingness to Experience	3.33	3.67	0.34***	3.52	3.77	0.24*
	Comfort	3.72	3.87	0.15*	3.45	3.68	0.23*
	Stress	3.50	3.66	0.16**	3.41	3.68	0.27*
	Safety	3.70	3.90	0.20***	3.47	3.72	0.25**
Cycling	Willingness to Experience	2.27	2.38	0.11*	2.76	3.11	0.35**
	Comfort	2.43	2.79	0.36***	2.64	3.39	0.75***
	Stress	2.34	2.66	0.32***	2.61	3.59	0.98***
	Safety	2.31	2.84	0.53***	2.70	3.58	0.88***
Walking	Willingness to Experience	4.12	4.14	0.02	3.95	4.07	0.12
	Comfort	3.91	4.01	0.10*	3.50	3.82	0.32***
	Stress	3.83	3.88	0.06	3.64	3.83	0.19*
	Safety	3.74	3.84	0.10*	3.62	3.78	0.16*

Note: *$p < .05$ **$p < .01$ ***$p < .001$.

4. General discussion

In the present research, we explored underlying motives influencing people's mode choice and the perceived attractiveness of alternative modes to provide a basis for policy measures to reduce car use. Understanding the motives underpinning people's transport choices is an important first step to devising policy interventions to promote the use of sustainable modes of transport, and ultimately disrupt the car purchase intention. Through study 1, we sought to provide answers for the first two sub-research questions. We ascertained motives for main mode choice and for switching from one mode to another while considering people's sociodemographic backgrounds by means of psychological projection onto personas. Through study 2, answering the third sub-research question, we then tested promotional instruments to ascertain their ability to raise the level of perceived attractiveness of alternative modes via a repeated evaluation technique.

While the main motives for car use identified via study 1 support existing findings (e.g., De Groot & Steg, 2007; Gardner & Abraham, 2006; Hiscock et al., 2002; Steg 2003; 2005), the study results provided an analysis of motives underpinning transport choices, segmented by sociodemographic groups. Intersecting the various groups, it becomes clear that changing the preference for private cars for middle-aged to elderly people with high income levels and low levels of concern for the environment will be extremely difficult. With regards to alternative, active modes such as cycling and walking as well as public transport, they are mainly driven by economic and environmental motives. These findings echo existing literature (e.g., Cavill & Watkins, 2007; Frank et al., 2006; Garrard et al., 2006) and provide further details about transport preferences among different groups. The findings show that individuals who do not travel by car as their main mode of transport are mostly relatively young with low to middle incomes and those who are health- and environmentally-conscious. While these findings may seem intuitive, they were lacking empirical confirmation. Our findings confirmed that this phenomenon applies. Moreover, the results of study 1 showed that the motives for each main mode were not necessarily the motives that people selected for switching to these modes.

Results for study 2 showed that promotional strategies based on a familiarisation process led to an increase in the level of perceived attractiveness for walking, cycling and carpooling, regardless of the actual promotional treatment applied. In contrast, the familiarisation process actually led to a more negative assessment of train and bus travel across all treatment groups. Thus, results of study 2 suggest that the use of public transport, particularly train and bus, may be more difficult to promote. Similar results of the control group must be considered in this context, as discussed above. Although study 2 did not explore why the applied repeated evaluation technique differed in its ability to increase the perceived level of attractiveness

across modes, there are two potential explanations for this finding. Firstly, there is the issue of Covid-19 and the related increase in the acceptance of cycling and walking. Even though respondents were instructed at the beginning of the survey to imagine a post-Covid-19 era, it is possible that the current pandemic still biased their results against public transport. As the chances of infection are lower when cycling or walking compared to being on a train or bus, people may currently prefer these active modes. However, this does not explain the positive shift in carpooling. Secondly, busses and trains are very established modes in the areas GL and uGS, but in recent years there has been a revival of interest in more active travel modes due to their environmental and health benefits (e.g., Cavill & Watkins, 2007; Haines et al., 2009). Carpooling, in particular, is an emerging mode gaining in popularity. It appears that becoming more aware of the benefits associated with cycling, walking and carpooling via promotional messages increases the likelihood that someone might choose these modes in the future. In contrast, buses and trains are more established modes of transport in both GL and uGS and promotions for these modes seem to have a mostly negative effect.

By combining the findings from both studies, implications for policy makers to reduce car use and, eventually, ownership in cities can be identified. First, the high level of 'stickiness' towards cars is clear. Not all groups in society are equally responsive to promotions of other modes. Identifying the more responsive groups of people in society can help more targeted policy-making efforts. In the case of both GL and uGS, the group most likely to consider changing mode choice were relatively young people with low to medium incomes who are health- and environmentally-conscious. Our research suggests that it may be particularly effective to specifically target this segment of society as these are the ones who are already using alternative means of transport and are open to switch to these modes as their main mode. Effective targeting can be achieved by highlighting the advantages of these modes and aligning them with the preferences of this particular segment. The fact that younger people appear to be more open to mode switching is also relevant given that the survey respondents were selected for their existing intention to purchase a car in the coming three years, which could potentially lock them into car use for a lifetime. Ensuring that the advantages of the use of alternative modes are effectively promoted to younger urban residents before they purchase a car could therefore have a strong impact on their longer-term travel behaviour. It could also shape other policies that may target this particular segment of the population, such as offering free or subsidised public transport passes for people under 30 to continue to incentivise the use of this mode. For the groups of people who are not responsive to these soft nudges, policy makers may need to use other mechanisms to restrict car use in cities, including economic and regulatory instruments to limit car use.

Second, policy makers may want to note that encouraging the use of alternative modes via familiarisation is particularly suitable for cycling, walking and carpooling. The more these sustainable modes are promoted successfully, the less cars will be impacting the environment, health and space consumption in cities. In contrast, the familiarisation process turned out to have a negative impact on individual's evaluation of public transport. Alternative approaches, such as improved service frequency, modernisation of the vehicle fleet and lower fares may need to be used in conjunction with promotional campaigns to increase the attractiveness of public transport. More research will also be needed to understand the push and pull factors that may explain public transport use. In addition, findings reveal that careful picture selection is critical to the success of repeated evaluation experiments as any slight change in the pictures between phase 1 and phase 3 could be reflected in the results. Thus, future research may further explore this finding to add to the process of selecting suitable pictures which may be valuable for policy makers.

Third, policy makers should differentiate between motives for main mode choice, and motives for switching to other modes. For instance, the choice to travel by public transport as a main mode is often justified by the fact that it is the fastest and cheapest way. However, our research suggests that actively switching from any mode to public transport would most commonly be motivated by helping to reduce CO_2. Carsharing, as another example, is often chosen as a main mode to conform with others and for privacy. In contrast, actively switching to carsharing is likely to be motivated by enhanced flexibility and cost savings. These differences should be noted by policy makers as they may require differentiated promotional strategies.

Finally, it should be noted that there are some limitations to the studies and findings within this research. To start with, only two cases were explored: Greater London and the urban German-speaking parts of Switzerland. While these areas have been chosen with care, we do not generalise our findings to all regions; these methods applied in other contexts may result in different findings. Future research could explore whether the current findings hold true in other contexts. Moreover, the studies did not test whether the lack of adequate infrastructure, for instance the unpredictability of train services, might be making some groups less willing to switch. This is another factor which could be considered in future research. Lastly, although we took care to account for the impact of the Covid-19 pandemic in the design of the study, it may still have influenced attitudes towards different transportation modes. Regarding study 2, another limitation is the choice of pictures in phases 1 and 3. Our aim was to display neutral, non-influential images. However, as the impression of these images is inevitably subjective, a different selection of images might have led to different results, especially in the case of the control group.

Despite these limitations, there are various aspects revealed by the current research that provide a greater understanding of motives for using or switching to different modes and suitable strategies to further increase their perceived attractiveness. The application of consumer and marketing methodologies in a sustainable mobility behaviour context generated new and valuable insights. These insights may serve policy makers in their efforts to successfully implement additional measures that can help to reduce car use in cities and increase the uptake of alternative travel modes.

5. Conclusion

In this article, we sought to explore underlying motives influencing people's mode choice and the perceived attractiveness of alternative modes via an online survey employing two methodological approaches that are novel to this research context. Firstly, we demonstrated that motives for different mode choices vary significantly across sociodemographic lines. Secondly, we showed that the motives for choosing a specific main mode are not necessarily the motives to switch to this particular mode. Thirdly, we showed that promotional measures based on increasing familiarisation were only successful for walking, cycling and carsharing. These findings expand existing knowledge by adding further insights about individual behaviours and preferences. The results should be of high value for policy makers to consider in future car-reducing initiatives.

References

Ames, D. R. (2004). Strategies for social inference: a similarity contingency model of projection and stereotyping in attribute prevalence estimates. *Journal of Personality and Social Psychology, 87*(5), 573.

Anderson, J. C. (1978). The validity of Haire's shopping list projective technique. *Journal of Marketing Research, 15*(4), 644-649.

Bamberg, A., & Schmidt, P. (2003). Incentives, Morality or Habit? Predicting students' car use for university routes with the models of Ajzen, Schwartz and Triandis. *Environment and Behavior, 35*(2), 264-285.

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ, US: Prentice-Hall, Inc.

Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist, 44*(9), 1175-1184.

Basmajian, C. (2010). "Turn on the radio, bust out a song": the experience of driving to work. *Transportation, 37*(1), 59-84.

Beirão, G., & Cabral, J. S. (2007). Understanding attitudes towards public transport and private car: A qualitative study. *Transport Policy, 14*(6), 478-489.

Carbon, C. C., & Leder, H. (2005). The repeated evaluation technique (RET). A method to capture dynamic effects of innovativeness and attractiveness. *Applied Cognitive Psychology: The Official Journal of the Society for Applied Research in Memory and Cognition, 19*(5), 587-601.

Cavill, N., & Watkins, F. (2007). Cycling and health. *Health Education, 107*(5), 404-420.

Costain, C., Ardron, C., & Habib, K. N. (2012). Synopsis of users' behaviour of a carsharing program: A case study in Toronto. *Transportation Research Part A: Policy and Practice, 46*(3), 421-434.

De Groot, J. I., & Steg, L. (2007). Value orientations and environmental beliefs in five countries: Validity of an instrument to measure egoistic, altruistic and biospheric value orientations. *Journal of Cross-Cultural Psychology, 38*(3), 318-332.

De Vos, J., Schwanen, T., Van Acker, V., & Witlox, F. (2013). Travel and subjective well-being: a focus on findings, methods and future research needs. *Transport Reviews, 33*(4), 421-442.

Douglas, M. J., Watkins, S. J., Gorman, D. R., & Higgins, M. (2011). Are cars the new tobacco?.*Journal of Public Health, 33*(2), 160-169.

ECA (2020). EU transport infrastructures: more speed needed in megaproject implementation to deliver network effects on time. https://www.eca.europa.eu/lists/ecadocuments/sr20_10/sr_transport_flagship_infrastructures_en.pdf

Edwards, A. L. (1957). The social desirability variable in personality assessment and research. New York: Dryden, 1957.

EEA (2018). Progress of EU transport sector towards its environment and climate objectives. https://www.eea.europa.eu/publications/progress-of-eu-transport-sector-1

EEA (2020). Transport statistics at regional level. https://ec.europa.eu/eurostat/statistics-explained/pdfscache/14273.pdf

European Parliament (2019). CO2 emissions from cars: facts and figures (infographics). https://www.europarl.europa.eu/news/en/headlines/society/20190313STO31218/co2-emissions-from-cars-facts-and-figures-infographics#:~:text=Passenger%20cars%20are%20a%20major,from%20road%20transport%20in%20Europe

Fisher, R. J. (1993). Social desirability bias and the validity of indirect questioning. *Journal of Consumer Research, 20*(2), 303-315.

Frank, L. D., Sallis, J. F., Conway, T. L., Chapman, J. E., Saelens, B. E., & Bachman, W. (2006). Many pathways from land use to health: associations between neighborhood walkability and active transportation, body mass index, and air quality. *Journal of the American Planning Association, 72*(1), 75-87.

Gardner, B., & Abraham, C. (2007). What drives car use? A grounded theory analysis of commuters' reasons for driving. *Transportation Research Part F: Traffic Psychology and Behaviour*, *10*(3), 187–200.

Garrard, J., Crawford, S., & Hakman, N. (2006). Revolutions for Women: Increasing women's participation in cycling. *Department for Victorian Communities Sport and Recreation* (Ed.), 78.

Gatersleben, B., & Appleton, K. M. (2007). Contemplating cycling to work: Attitudes and perceptions in different stages of change. *Transportation Research Part A: Policy and Practice*, *41*(4), 302-312.

Gatersleben, B., & Uzzell, D. (2007). Affective appraisals of the daily commute: Comparing perceptions of drivers, cyclists, walkers and users of public transport. *Environment and Behavior, 39*(3), 414-431.

Giles-Corti, B., Foster, S., Shilton, T., & Falconer, R. (2010). The co-benefits for health of investing in active transportation. *New South Wales Public Health Bulletin*, *21*(6), 122-127.

Hagman, O. (2003). Mobilizing meanings of mobility: car users' constructions of the goods and bads of car use. *Transportation Research Part D: Transport and Environment, 8*, 1–9.

Haines, A., McMichael, A. J., Smith, K. R., Roberts, I., Woodcock, J., Markandya, A., & Bruce, N. (2009). Public health benefits of strategies to reduce greenhouse-gas emissions: overview and implications for policy makers. *The Lancet*, *374*(9707), 2104-2114.

Haire, M. (1950). Projective techniques in marketing research. *Journal of Marketing*, *14*(5), 649-656.

Herberz, M., Hahnel, U. J., & Brosch, T. (2020). The importance of consumer motives for green mobility: A multi-modal perspective. *Transportation Research Part A: Policy and Practice, 139,* 102-118.

Hiscock, R. Macintyre, S. Kearns, A., & Ellaway, A. (2002). Means of transport and ontological security: Do cars provide psycho-social benefits to their users? *Transportation Research Part D: Transport and Environment*, *7*(2), 119–135.

Hoffmann, C., Abraham, C., White, M. P., & Skippon, S. M. (2020). Ambivalent about travel mode choice? A qualitative investigation of car user and non-car user attitudes. *Transportation Research Part A: Policy and Practice, 141*, 323-338.

IEA (2019). Global CO2 emissions in transport by mode in the Sustainable Development Scenario, 2000-2070. https://www.iea.org/data-and-statistics/charts/global-co2-emissions-in-transport-by-mode-in-the-sustainable-development-scenario-2000-2070

Katz, D., Allport, F. H., & Jenness, M. B. (1931). Students' attitudes; a report of the Syracuse University reaction study. Craftsman Press.

Kent, J. L. (2014). Driving to save time or saving time to drive? The enduring appeal of the private car. *Transportation Research Part A: Policy and Practice, 65,* 103-115.

Kent, J. L. (2015). Still feeling the car–The role of comfort in sustaining private car use. *Mobilities, 10*(5), 726-747.

Krueger, J. (1998). On the perception of social consensus. *Advances in Experimental Social Psychology, 30*, 163-240.

Landwehr, J. R., Wentzel, D., & Herrmann, A. (2013). Product design for the long run: Consumer responses to typical and atypical designs at different stages of exposure. *Journal of Marketing, 77*(5), 92-107.

Lauper, E., Moser, S., Fischer, M., & Matthies, E. (2016). Explaining car drivers' intention to prevent road-traffic noise: An application of the norm activation model. *Environment and Behavior, 48*(6), 826-853.

Lumsdon, L., & Tolley, R. (2001). The National Cycle Strategy in the UK: to what extent have local authorities adopted its model strategy approach?.*Journal of Transport Geography, 9*(4), 293-301.

Ma, J., Li, C., Kwan, M. P., & Chai, Y. (2018). A multilevel analysis of perceived noise pollution, geographic contexts and mental health in Beijing. *International Journal of Environmental Research and Public Health, 15*(7), 1479.

Marshall, P. D., & Barbour, K. (2015). Making intellectual room for persona studies: A new consciousness and a shifted perspective. *Persona Studies, 1*(1), 1-12.

Mattioli, G., Roberts, C., Steinberger, J. K., & Brown, A. (2020). The political economy of car dependence: A systems of provision approach. *Energy Research & Social Science, 66*, 101486.

Paulley, N., Balcombe, R., Mackett, R., Titheridge, H., Preston, J., Wardman, M., Shires, J., & White, P. (2006). The demand for public transport: The effects of fares, quality of service, income and car ownership. *Transport Policy, 13*(4), 295-306.

Schaefers, T. (2013). Exploring carsharing usage motives: A hierarchical means-end chain analysis. *Transportation Research Part A: Policy and Practice*, *47*, 69-77.

Sheller, M. (2004). Automotive emotions: Feeling the car. *Theory, Culture & Society, 21*(4-5), 221-242.

Sheller, M., & Urry, J. (2006). The new mobilities paradigm. *Environment and Planning A, 38*(2), 207-226.

Simma, A., & Axhausen, K. W. (2001). Structures of commitment in mode use: a comparison of Switzerland, Germany and Great Britain. *Transport Policy, 8*(4), 279-288.

Steg, L. Vlek, C., & Slotegraaf, G. (2001). Instrumental–Reasoned and Symbolic–Affective Motives for Using a Motorcar. *Transportation Research Part F: Traffic Psychology and Behaviour*, *4*(3), 151–169.

Steg, L. (2003). Can public transport compete with the private car?. *Iatss Research*, *27*(2), 27-35.

Steg, L. (2005). Car use: lust and must. Instrumental, symbolic and affective motives for car use. *Transportation Research Part A: Policy and Practice*, *39*(2-3), 147-162.

Szollosy, M. (2017). Freud, Frankenstein and our fear of robots: projection in our cultural perception of technology. *AI & Society*, *32*(3), 433-439.

Wells, P., & Xenias, D. (2015). From 'freedom of the open road' to 'cocooning': Understanding resistance to change in personal private automobility. *Environmental Innovation and Societal Transitions*, *16*, 106-119.

WHO (2018). Global status report on road safety 2018. Geneva: World Health Organization; 2018. Licence: CC BYNC-SA 3.0 IGO. https://www.who.int/publications/i/item/9789241565684

Ye, R., & Titheridge, H. (2017). Satisfaction with the commute: The role of travel mode choice, built environment and attitudes. *Transportation Research Part D: Transport and Environment*, *52*, 535-547.

Zajonc, R. B. (2001). Mere exposure: A gateway to the subliminal. *Current Directions in Psychological Science*, *10*(6), 224-228.

Zervakis, J., & Mazuka, R. (2013). Effect of repeated evaluation and repeated exposure on acceptability ratings of sentences. *Journal of Psycholinguistic Research*, *42*(6), 505-525.