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Toward a reduction of car-based leisure travel: An analysis of determinants and potential measures

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ABSTRACT

Leisure travel is often highly car-based. In Switzerland, the research area of our study, more than 60% of all kilometers traveled for leisure purposes are traveled by car, and an increase is predicted. As traveling by car comes with many negative side-effects, a more sustainable transportation system calls for a shift to less car-based forms of (leisure) travel. This paper reports an online choice experiment, testing the effectiveness of two financial and three non-financial treatments to reduce car-based leisure travel, all which are currently being discussed in the research and political domains in Switzerland. Additionally, we control for a wide range of determinants proven to be relevant for mode choice. We asked 737 participants to imagine they are visiting family or friends living a short distance (5 km) and longer-distance (100 km) away and to report their mode choice for such trips. Findings show the tested treatments will likely have a limited effect on reducing car-based leisure travel. Results also show that car use is motivated by different reasons than public transport or bike usage. Car users mainly want to travel fast and see car travel as the only viable option. Public transport and bike users, however, attach more importance to enjoyment. Specifically, the availability of a car, bike or public transport card is significant for the mode choice and habitual use. To unfreeze existing lock-ins, we conclude that research needs to look at reasons for why drivers believe there is no alternative.

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1. Introduction

Leisure travel is one of the dominant reasons for individual travel and often highly car-based (Dütschke et al., 2022; Holden & Linnerud, 2011; van Goeverden et al., 2016). For example, in Switzerland, the area of our research, leisure mobility[1] is the most important reason for individual travel and exceeds commuting travel in distance and time (BFS & ARE, 2017). Moreover, 60% of all kilometers in leisure mobility are traveled by car (BFS & ARE, 2017) and this figure is predicted to increase even further (ARE, 2016). Car-based travel involves many negative side-effects. In particular, traveling by car not only contributes to climate change through CO_2 emissions, but also causes air pollution by emitting pollutants like PM2.5 or PM0.1. Moreover, it is also a source of noise pollution, requires land use, contributes to soil sealing (BFS, 2019b; Rodrigue, 2020) and causes congestion and accidents, leading to external societal cost (Van Essen et al., 2019).

Despite these negative side-effects, forecasts for 2050 predict that the demand for mobility will continue to grow and private vehicles will remain the preferred mode choice for personal travel worldwide (International Transport Forum, 2019). To meet policy goals like reducing CO_2 emissions, as set in the Glasgow or Paris agreement (UNCC, 2021; UNFCCC, 2015), a reduction of car-based travel is necessary. Given this need, there is a growing literature on determinants of mode choice as well as on the effectiveness of different policy measures. Depending on the discipline of the researchers, the studies differ on investigated determinants and, thus findings regarding mode choice and most appropriate policy measures. For example, economists often apply rational choice theory assuming that individuals weigh cost and benefits of different transport modes for each trip and calculate utilities (Scherer, 2010). Psychologists use models and theories to understand the underlying mechanism of mode choice decision-making as for example, the theory of planned behavior (Ajzen, 1985; Bamberg et al.,

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[1]We use the definition for leisure mobility as it is given in the Mikrozensus Verkehr (BFS & ARE, 2017, p. 47). Leisure activities include visiting friends or families (most important reason for leisure travel in Switzerland), going to restaurants, visiting culture events or leisure parcs, going to sports activities or watching sports activities, doing sports like hiking, cycling, running etc., going to religious activities, going to club activities and the like. Note that shopping activities are not part of leisure activities.

2003; Donald et al., 2014) or habit theories (Schwanen et al., 2012). Sociologists stress the role of mobility cultures and evaluate mode choice as a societal process (Götz et al., 2016). Urban planners see mode choice as a result of the planning process and focus on the built environment (Echiburú et al., 2021; Ingvardson & Nielsen, 2018). Since factors from various fields have proven to influence mode choice (Javaid et al., 2020), we apply a multi-disciplinary perspective of mode choice put forward by De Witte et al. (2013, p. 331) who define mode choice as "the decision process to choose between different transport alternatives, which is determined by a combination of individual socio-demographic factors and spatial characteristics, and influenced by socio-psychological factors."

Moreover, the relevance of different determinants varies between different modes of travel (Hoffmann et al., 2017). Additionally, mode choice is not only an explicit decision but also an act of routinized behavior (Gutiérrez et al., 2020; Lanzini & Khan, 2017) which is hard to change (Klöckner & Verplanken, 2018). Reason for this is that larger investment choices, such as purchasing a car or travel pass, are often also habitual (e.g. Nayum and Klöckner (2014) on car brand choices).

In line with having different argumentative architectures on the importance of determinants, the literature distinguishes between two types of measures for successfully influencing mode choice. Non-financial measures such as provision of information or social comparison are directed to motivational, social, cognitive and contextual factors. They are often based on the assumption that individuals either lack knowledge or are unaware of prevalent salient social norms (Schubert et al., 2021) and are thus unable to make the right decisions. Evidence reveals that these non-financial measures can be effective in changing behavior (Abou-Zeid & Fujii, 2016; Anable, 2005; Fujii & Taniguchi, 2005; Geng et al., 2016). Also, financial measures (the second type of measures) such as taxes or transportation pricing, have been proven to be successful (Axhausen et al., 2021; Belgiawan et al., 2019; Conti, 2018; Landis et al., 2018). They can help, among others, to internalize negative externalities. However, such financial measures are often difficult to implement due to public opposition or high implementation cost. Another strand of literature suggests a combination of financial and non-financial measures, promoting a "carrot and stick" approach (Brög et al., 2009; Carroll et al., 2021; Queiroz et al., 2020; Washbrook et al., 2006). Although combinations of measures are likely to be more effective for any private vehicle demand reduction, it is also the most complicated to implement.

So far, most research on travel behavior focuses on commuting. Indeed, there is less research on mode choice reasons for leisure or testing interventions to reduce car-based leisure travel. This is surprising, especially because studies that compare commuting and leisure travel find that reasons for mode choice differ on e.g. safety or habitual factors (Nordfjaern et al., 2015), on aspects of the built environment (Piras et al., 2021) or on instrumental or affective aspects (Anable & Gatersleben, 2005).

Against this backdrop, we see two different research gaps. First, given the focus of existing research on commuting, we do not know if the sketched measures are also relevant for leisure travel. Second, picking up the habitual line whether determinants of explicit decision-making or habitual factors are more relevant for mode choice in leisure travel and how these vary among bike, car and public transport (PT) users is an open question. Our paper aims at contributing to fill both these gaps.

To pursue these two research lines, we developed a stated preference online choice experiment evaluating the effectiveness of two financial policy measures which are currently discussed (road pricing and CO_2 tax) as well as three non-financial measures (addressing social norms, information on health benefits, highlighting usable time in public transport) to reduce car-based leisure travel. In addition, we measure the influence of different determinants on respondents' mode choice and focus on aspects of explicit decision-making as well as aspects of habitual behavior. We define explicit decision-making as a more or less controlled, elaborated process that takes into account factors such as comfort, time, speed and is not based on implicit processes such as heuristics or habits (Gawronski & Creighton, 2013).

Following these two lines, the paper answers these research questions:

1. Are financial and/or non-financial policy measures that are currently discussed effective in reducing car-based leisure travel?
2. How do aspects of habitual behavior and explicit decision-making influence mode choice decisions (i.e., bike, car, PT) in leisure travel?

We test the effectiveness of the policy measures for three mode choices (car, public transport and bike[2]) across two distances (short/long). The study focuses on Switzerland, a country with a very good public transport infrastructure. Nevertheless, 78% of all households own at least one car (BFS & ARE, 2017). Thus, many Swiss inhabitants have access to a car but are also able to substitute car travel with trips by public transport, even for leisure travel. This makes it an ideal case to research policy measures aimed at reducing car use for leisure travel. A common approach to test future policies is the usage of stated preference methods, which we have applied. The experiment, conducted online, provided respondents with the hypothetical situation of visiting families or friends. We have chosen this scenario as it is one of the most important reasons for leisure travel in Switzerland (BFS & ARE, 2017). Given the frequency this type of travel is performed, we assume factors of explicit decision making and habitual behavior to apply. This assumption is in line with research by Fu (2021) who found that depending on how often a decision process is performed, aspects of "a habitual and automatic behavior" or "a deliberate and rational decision" are more important.

The novelty of this paper is the systematic investigation of, first, financial versus non-financial measures, so far mostly discussed in the context of commuting, to shift mode choice away from car-based leisure travel to more sustainable transport modes. Second, the evaluation of a wide

[2]The mode choice bike was only tested for the short-distance option.

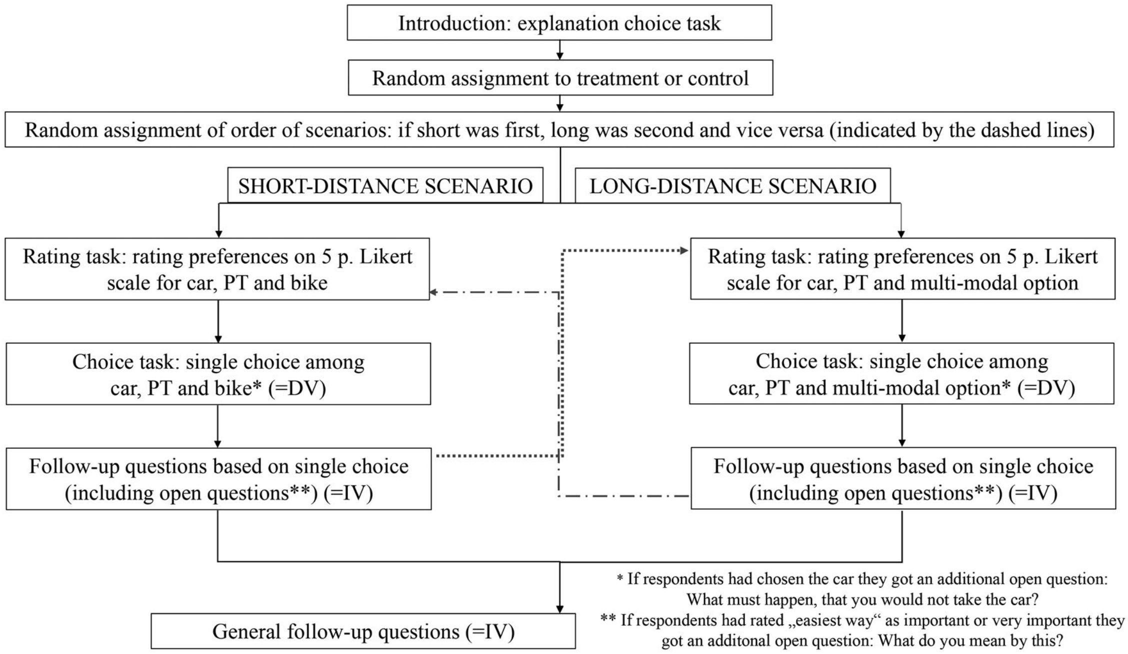


Figure 1. Experiment flow. DV stands for dependent variable and IV for independent variable. For further explanations see Table 1.

range of explicit decision-making and habitual determinants for mode choice in leisure travel and how these determinants vary among different travel options, namely, car, public transport and bike. This study, thus, provides new insights and could help formulate policy measures addressing leisure travel appropriately.

2. Methods and materials

2.1. Data

The experiment[3] was run within the annual "Swiss Household Energy Demand Survey (SHEDS)" (Weber et al., 2017). This survey collects information on approximately 5,000 Swiss households' energy consumption as well as data on a large set of interdisciplinary determinants. It is representative of the Swiss population with quotas for gender, age, tenants and owners, as well as the two linguistic regions of German and French. This survey was established by the Swiss Competence Center for Research in Energy, Society and Transition (SCCER CREST) and is undertaken by the survey company Intervista. It was constructed as a rolling panel. SHEDS contains several parallel online-experiments and returning participants are randomly distributed to one of these studies. The experiment reported in this paper was included in SHEDS 2018. 750 respondents were allocated to this online experiment and 737 filled-in the experiment. This is a response rate of 98% given the number of respondents who were assigned to this experiment.

2.2. Experimental design and dependent variables

The online choice experiment started with a short introduction, explaining that the experiment was about traveling options and asking respondents to imagine that they would visit a website to see different traveling alternatives (see Figures 2–7 for the interfaces shown to the respondents). Based on the information displayed, they were asked to make their choice (for the experiment flow, see Figure 1). Respondents had to imagine that they wanted to visit friends or family who live close to a city on a day trip that was either 5 km or 100 km long (for exact wording, see the Appendix). The reason for travel and the distances were based on Mikrozensus Verkehr data (BFS & ARE, 2017), a survey conducted every five years by the Swiss Government, covering travel behavior of Swiss inhabitants. It shows that visiting friends or family is among the most important reasons for leisure travel. It also states that 61% of all leisure trips taken by Swiss households are on average 5 km long and the average distance for inland day trips is 113 km.

Respondents were randomly assigned to one of the five treatments or the control group. Each respondent answered the short (5 km)- and longer (100 km)-distance scenario questions (which one appeared first was randomized).

First, respondents had to do three rating tasks. For the short and long-distance scenarios, participants were presented with three different modes of transportation and had to rate the likelihood of choosing each presented mode of transport, on a five-point Likert scale. For longer distances these were car, public transport (train + bus), and a multi-modal option consisting of train + carsharing. For the short distance, the modes displayed were car, public transport, and bike. Second, was a choice task.[4] Respondents had to

[3]Ethical review and approval as well as written informed consent was not required for this type of study with human participants in accordance with local and national legislation and institutional requirements. Participation was voluntary and participants could terminate their participation at any time without giving a reason.

[4]These choices were used as dependent variables for the regression analysis, see Section 2.6.

Table 1. List of variables.

Variable name	DV/IV[I]	Indicator[II]	Coding
Mode choice short	DV		Car = 1, PT = 2, Bike =3
Mode choice long	DV		Car = 1, PT and Multi-modal = 0
Age	IV	SDI	Years
Sex	IV	SDI	Dummy coded with female = 1, male = 0
Income	IV	SDI	Monthly gross income (CHF) of the household: 3,000 or less (1); 3,000–4,499 (2), 4,500–5,999 (3); 6,000–8,999 (4)[d]; 9,000–12,000 (5), 12,000 or more (6)
General travel card[a]	IV	SDI	Availability of general travel card in household= 1, otherwise = 0
Half-price travel card[b]	IV	SDI	Availability of half-price travel card in household= 1, otherwise = 0
Car	IV	SDI	Availability of car in household = 1, otherwise = 0
Bike	IV	SDI	Availability of bike in household = 1, otherwise = 0
Thinking of a travel partner	IV	SDI	Yes = 1, otherwise = 0
Choosing the cheapest option	IV	SDI	Yes = 1, otherwise = 0
City and agglomeration	IV	SI	Respondent was living in urban (city and agglomeration) area =1 or rural (countryside) area = 0
Habit	IV	SPI	Respondents' rating of importance on the five-point LS[III] of the statement: I am used to taking this mode of transport
Enjoyment	IV	SPI	Respondents' rating of importance on the five-point LS of the statement: I enjoy this way of traveling
Ease of use	IV	SPI	Respondents' rating of importance on the five-point LS of the statement: It is the easiest way
Making use of travel time	IV	SPI	Respondents who chose car or PT's rating of importance on the five-point LS of the statement: Making use of travel time. for bike users rating of the statement: Being physically active.
Traveling fast[c]	IV	JCI	Respondents' rating of importance on the five-point LS of the statement: Traveling as fast as possible

[a] Travel pass for which the customer pays a fixed price and can use all PT in Switzerland without extra charge in a certain time period (mostly one year).
[b] Travel pass which allows the holder to use all PT in Switzerland for half of the normal price in a certain time period (mostly one year).
[c] Travelling fast referred to the trip time and not to the "experience of speed." For that reason, it is listed as a journey characteristic indicator.
[d] Contains median income in Switzerland in 2018 and therefore used as reference category.

imagine that they would actually take this trip the next day and had to choose one transport mode.

After choosing a mode of transport for each trip (short and longer-distance) each respondent was asked to answer a number of tailored follow-up questions. If participants chose the car, they were asked to answer the following open-ended question "Under what conditions would you choose not to take the car but an alternative form of transport and which one?" The aim of this open-ended question was to learn more about the different motives of car usage as well as about possible barriers to car-usage.

Another follow-up question focused on reasons for their mode choice. Listed reasons varied slightly for each mode choice, due to plausibility. Participants were asked to rate (on a five-point Likert scale) how important the displayed reasons were for their choice (see complete list of reasons in the Appendix, Table A.2). For example, one of the reasons listed referred to "ease of use," and if respondents ascribed high importance (a 4 or 5 on the Likert scale) to this reason. If this was the case, they were presented with this open-ended question: "In the question before you said you have chosen the 'car/public transport/bike/multi-modal'[5] option because it was the easiest way. What do you mean by this?" This question was based on previous research (BFS & ARE, 2017), which found that choosing "the easiest/most comfortable option" was the most commonly mentioned reason for people's mode choice for day trips, irrespective of whether respondents took public transport or motorized individual travel (like car or motorbike). Sivasubramaniyam et al. (2020) found ease-of-use also to be an important determinant for commuters intention to drive, cycle or walk.

At the end of the experiment, we included two short questions asking if people thought of travel partners and what kind of luggage[6] they had in mind while answering the mode choice questions. Data on socio-economic (e.g. age, sex, income; see Table 3) factors were taken from the main part of SHEDS (Weber et al., 2017).

2.3. Determinants

We included a number of determinants of mode choice which have been found to significantly influence mode choice (De Witte et al., 2013; Javaid et al., 2020; Van Acker et al., 2011; Wu et al., 2020). Included were determinants relevant to individuals who choose their travel mode based on an informed, explicit decision as well as determinants explaining mode choice of individuals as an act of routinized behavior since previous research has shown that both aspects are important (Abou-Zeid & Fujii, 2016; Axhausen et al., 2021; Dütschke et al., 2022; Geng et al., 2016; Hoffmann et al., 2017). For example, De Witte et al. (2013), evaluated a large number of determinants and grouped them into four different sets of indicators: socio-demographic, spatial, journey attributes, and socio-psychological indicators. Socio-demographic indicators cover factors like

[5]The chosen mode choice was automatically filled in.

[6]We have included the question on luggage since this has been found to be a relevant determinant in some articles. Nevertheless, we could not find any significant effect of it and have therefore decided on not to display it in the results section to have more room to discuss the other determinants.

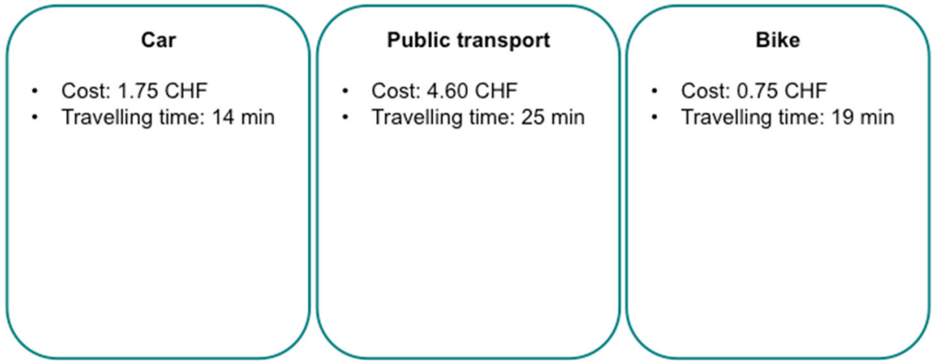


Figure 2. Interface of the experiment shown to respondents. This is an example of the information displayed in the short-distance scenario to the control group.

Table 2. Overview of travel cost and travel time.

Scenario	Car	Public transport (Train + Bus)	Bike	Multi-modal option (Train + Carsharing)
Short distance	C: 1.75 CHF T: 14 Min.	C: 4.60 CHF T: 25 Min.	C: 0.75 CHF T: 19 Min.	Not displayed in this scenario
Longer distance	C: 35 CHF T: 70 Min.	C: 24.30 CHF T: 90 Min.	Not displayed in this scenario	C: 31.80 CHF T: 80 Min.

C = Cost in Swiss Francs (CHF), T = Time.

age, gender, and income, but also car-availability and have been found to be significant predictors of mode choice (e.g., Büchs & Schnepf, 2013; Kleinhückelkotten et al., 2016). Spatial indicators refer to aspects like proximity to infrastructure (Echiburú et al., 2021; Piras et al., 2021) and services or parking (Emberger & Pfaffenbichler, 2017; Habib et al., 2013; Hess & Schubert, 2019). Journey attributes describe factors like travel time (Ohnmacht & Scherer, 2010; Vande Walle & Steenberghen, 2006), travel motive (An et al., 2021), trip length (Gutiérrez et al., 2020; Rubin et al., 2014), trip cost (Axhausen et al., 2021) and comfort (de Oña et al., 2015). The final category, socio-psychological indicators, cover aspects like habits, and perceptions (Hoffmann et al., 2017; Kent, 2015; Prato et al., 2017; Van Acker et al., 2011). Indeed, habit or routinized travel behavior aspects have been shown to play an important role in mode choice (Klöckner & Verplanken, 2018; Lanzini & Khan, 2017; Moniruzzaman & Farber, 2018; Schubert et al., 2022). The investigated determinants are listed in Table 1.

2.4. Treatments

We tested five policy-relevant treatments against a control group in an online stated preference randomized controlled experiment with a 6×2 experimental design (i.e., across 2 different distances). The financial treatments aimed at reducing the attractiveness of car-usage by increasing the cost of traveling by car. The non-financial treatments aimed at fostering the use of alternative travel modes by highlighting their benefits (compared to traveling by car).

2.4.1. Treatment 0: control group (cg)

Respondents in the control group were shown travel time and travel cost information for the trips. Travel cost and time for public transport were calculated based on the website of the Swiss Railway Company SBB (SBB, 2017). Cost for the multi-modal option were calculated based on the website of the carsharing provider Mobility (mobility, 2017), and travel cost for cars were based on information by the Swiss Touring Club (TCS, 2017). This agency provides the reference for the car cost as they can be claimed in the annual tax declaration and includes insurance, fuel and depreciation. The cost used in the experiment are based on the cost of a VW Golf, the most common car in Switzerland in the year 2018. Travel times for the multi-modal option and for car travel were based on Google Maps. To get plausible travel times we looked at different 5 and 100 km trips entering the cities of Geneva, Basel, Zurich and St. Gallen (so for larger cities across Switzerland) and took the average travel time. For bikes, cost were based on an Austrian study that calculated the actual cost of using a bike per km (Trunk, 2010), and travel times were based on Google Maps (same procedure as with cars). Figure 2 shows the experiment interface as it was presented to the control group and Table 2 gives an overview on the applied cost and travel times.

2.4.2. Treatment 1: road pricing (rp)

Road pricing is applied to reduce overall traffic inflow or to reduce traffic load in peak hours in many big cities, such as London, Oslo, and Stockholm (Santos & Fraser, 2006). A study on behalf of the Swiss Federal Roads Office examined a possible road pricing solution for the region of the capital of Bern. The study concludes that an area-pricing model with a day rate of CHF 5.00 will bring a reduction in cars entering the city zone together with a positive cost-benefit ratio (Suter et al., 2015). Therefore, we set the road-pricing fee to CHF 5.00 for entering the city, which led to total cost of CHF 6.75 (i.e., including the cost of driving 5 km) for the short-distance trip and CHF 40.00 (i.e., including the cost of driving 100 km) for the longer-distance trip. The cost increase in the road pricing treatment for the short distance

Table 3. Respondents (household) characteristics.

Variable	Experiment	TO: cg	T1: sn	T2: rp	T3: ut	T4: ex	T5: ct	SHEDS	CH Pop
Age in years[a]	48.33***	48.36*	48.55*	47.75	48.26	49.62**	47.5	44.25	42.54
Female[b]	48%	47%	46%	48%	48%	50%	48%	53%	50%
Income (in CHF)[c]	6,000–8,999	6,000–8,999	6,000–8,999	6,000–8,999	6,000–8,999	6,000–8,999	6,000–8,999	6,000–8,999	6,609
City and agglomeration[d]	77%***	72%***	82%	76%*	79%	77%*	79%	78%	85%
Car[e]	75%	80%	74%	77%	73%	68%*	79%	72%	78%
General travel card[e,f]	29%(***)	25%***	31%***	32%***	27%***	24%***	32%***	28%	10%
Half-price travel card[e,g]	63%(***)	66%***	61%***	59%***	61%***	62%***	67%***	65%	36%
Bike[e]	70%**	66%	69%	69%	71%	68%	76%**	72%	65%
Sample size (N)	737	118	121	124	126	121	127	5,514	See ref.

We performed independent sample t-tests evaluating the probability that the group mean is different from the mean of the Swiss population.
n = 626 for known income categories.
Note: income, place of living (city and agglomeration), bike, car, general travel card and half-price travel card are collected at the household level. Therefore, we do not know if the respondent owns a car or a travel pass or if it belongs to a different household member. But since all respondents are household heads, we can assume that the respondent has at least access to these goods.
[a] Figures BFS 2018 (n = 8.5 Mio.).
[b] In the survey it is only distinguished between male and female. Figures BFS 2018 (n = 8.5 Mio.).
[c] In SHEDS only income classes are available. For CH Population: disposable household income according to HABE (n = 3,312 Households) (BFS, 2019a).
[d] Figures EDA 2017 (n = 8.5 Mio.). Respondents not living in the city or agglomeration live on the countryside.
[f] Figures Mikrozensus 2015.
[g] Travelpass for which the costumer pays a fix price and can thereafter in a certain time period (mostly one year) use all public transport (PT) in Switzerland without extra charge.
[h] Travelpass which allows the holder in a certain time period (mostly one year) to use all PT in Switzerland for half of the normal price.
$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.5$.

was therefore quite high. It raised the trip cost by the fourfold compared to the cost shown to the control group.

2.4.3. Treatment 2: CO_2 tax (ct)

A CO_2 tax on motor fossil fuels is an often-discussed measure to account for negative externalities of the transport sector. Countries including the Netherlands, Sweden, Norway, and the Canadian Province of British Columbia have already implemented such a tax (Galinato & Yoder, 2010; Hammar & Jagers, 2007). Among economists, a CO_2 tax is seen as a very cost-effective policy, since the cost of achieving a certain emission reduction are minimized if marginal abatement cost are distributed equally among all emitters (Landis et al., 2018).

In Switzerland, a CO_2 levy[7] on fossil thermal fuels for heating or the generation of electricity has existed since 2008 and amounted to CHF 96 per ton of CO_2 in 2018. This levy does not apply to transport fuels (Thalmann & Vielle, 2019). Nevertheless, the introduction of a CO_2 levy or tax on transport fuels is suggested to meet the goals of the Paris agreement (Abrell et al., 2018).

In our experiment we included a CO_2 tax on the car trips such that the cost for the short-distance car journey was increased to CHF 1.90 and for the longer-distance journey to CHF 37.50. The cost of the other travel modes remained the same.

2.4.4. Treatment 3: social norms (sn)

Travel cost and travel times were the same as for the control group (see Table 2) in the social norm (sn) group, such that the only part that varied was the information on the behavior of other users of the website. The social norm treatment was based on the idea that people are partly guided in their (mobility) behavior by their reference group (for a comprehensive overview on social norms and pro-environmental behavior, see e.g. Farrow et al., 2017). The literature distinguishes between two types of social norms: descriptive (a perception of what the reference group does) and injunctive norms (a perception of what the reference group approves of). Based on research by Bonan et al. (2020) and Schultz et al. (2007) who showed the importance of combining descriptive and injunctive norms, both types of social norms were included in our message. Specifically, our social norms treatment combines descriptive (54%) and injunctive norms ("would recommend it") in combination with a symbol, showing a group of people with a slightly larger majority being colored green (rest black), including a smiley with a thumbs-up in the middle (Figure 5), was used to indicate that the majority of other users of this website would choose

[7]The CO_2 levy on fossil thermal fuels is a special form of tax in Switzerland. It is an ecological market-based steering instrument that aims to reduce the consumption of fossil fuels by means of price incentives. It is not intended to increase government revenue, but to internalize external cost, i.e., it includes environmental and climate cost in the selling price. In order to not weaken the overall economic power, the revenues from the CO_2 levy are therefore paid back equally to companies and private individuals so that those who use fossil fuels sparingly have an advantage. The purchasing power is maintained.

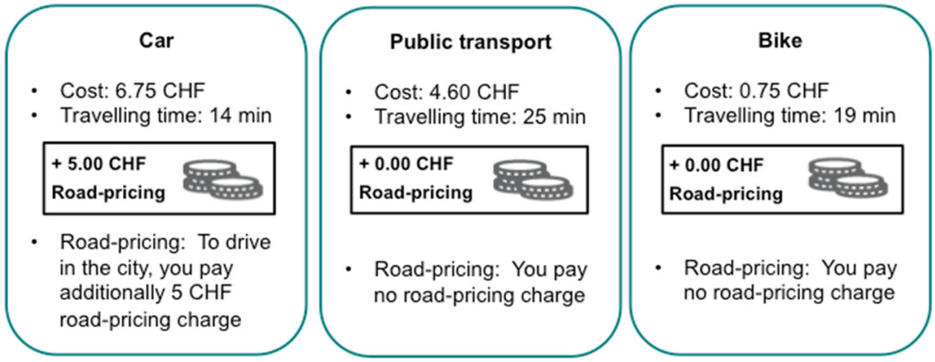


Figure 3. Experiment interface shown to respondents. Information displayed in the short-distance scenario in the road pricing treatment group. Note: For the longer-distance scenario cost and travel time have to be replaced as indicated in Table 2, except for the car travel, which cost CHF 40.00. The symbols were the same.

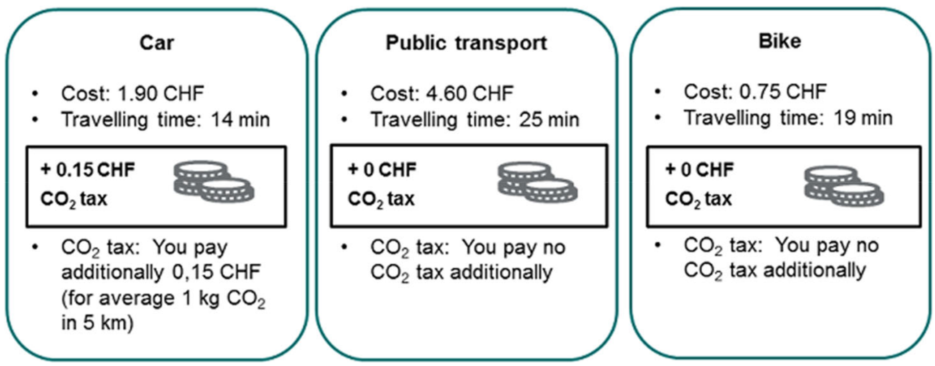


Figure 4. Experiment interface shown to respondents. Information displayed in the short-distance scenario in the CO_2 tax treatment group. Note: For the longer-distance scenario, cost and travel time have to be replaced as indicated in Table 2, except for the car-trip, which cost CHF 37.50. The symbols were the same.

the bike for the short-distance scenario or public transport for the longer-distance scenario. The 54% percent (descriptive norm) were chosen on the basis that this amount provides a good balance between being sufficiently high to activate a descriptive norm and being realistic enough to be considered relevant by the participants. Moreover, the additional text next to the symbol stated that "the users of this website living in your municipality" have chosen a certain option to show respondents that neither geographical conditions (e.g., topography) nor public transport infrastructure is relevant obstructions to taking these modes of transport.

2.4.5. Treatment 4: usable time (ut)

The idea of the usable time treatment was to make respondents aware of the advantages which come along with the usage of public transport. For example, while on the train, respondents can spend the time performing diverse activities, such as reading or sleeping, which are not possible if they have to drive a car. Literature shows that aspects like these are relevant factors for public transport users (Beirão & Sarsfield Cabral, 2007; Chen & Li, 2017; Redman et al., 2013).

2.4.6. Treatment 5: exercising (ex)

The health information treatment, abbreviated to "exercising treatment," is based on a recommendation of the World Health Organization (2011, p. 1) which states that "adults aged 18–64 should do at least 150 minutes of moderate-intensity aerobic[8] physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity." The figures were calculated according to this recommendation and represented by small green hearts within larger black hearts. The size of the green hearts displayed how much of the recommended exercising time (black heart) is fulfilled through this mode of traveling. We consider trips by car and public transport also to include some physical activity. Usually public transport stops are somewhat further away from the home or the friends' home than parking lots. This is why we assume public transport to involve more physical activity than traveling by car. In the scientific literature active travel modes are seen as a contributor to wellbeing and better health (Javaid et al., 2020).

2.5. Respondents

In total, 750 participants of the SHEDS survey were allocated to our experiment out of which 737 respondents completed the experiment (this corresponds to a response rate of 98.3%). However, due to missing data in the income

[8]Aerobic exercises are endurance-type exercises that increase a person's heart rate and breathing rate over relatively long durations. Anaerobic exercises are exercises that involve short bursts of intense activity. Examples of aerobic exercise include brisk walking and riding a bicycle. Sprinting and weightlifting are forms of anaerobic exercise (Johnson, 2020).

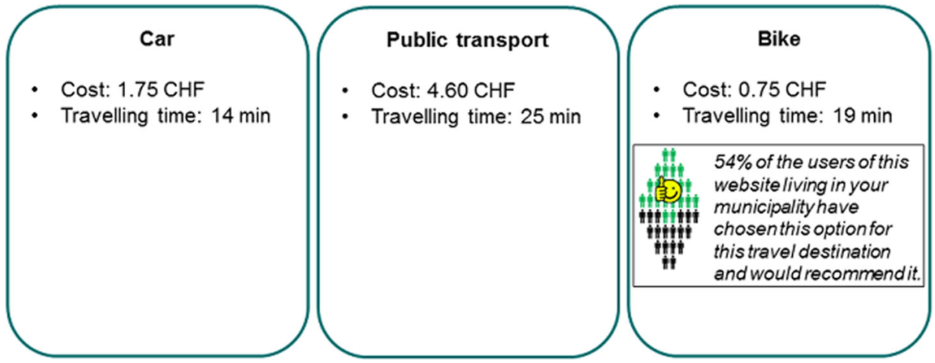


Figure 5. Experiment interface shown to respondents. Information displayed in the short-distance scenario for the social norms treatment group. Note: For the longer-distance scenario cost and travel time have to be replaced as indicated in Table 2. The symbol was the same.

variable (which is taken from the core part of SHEDS), the extended regression models were run based on a sample of 626 respondents. All other analyses included the full sample. Table 3 reports descriptive statistics of the full sample and the subsamples of the treatment groups. We compared the total experiment sample and treatment subsamples to statistics of the Swiss population utilizing independent samples t-tests. Findings reveal some differences in age in years, living in urban areas or not, availability of a general or a half-price travel card, and availability of a bike. The difference in availability of a travel card is at least partially due to sampling methods, since the Mikrozensus (BFS & ARE, 2017) evaluates the ownership of travel card at the individual level whereas SHEDS captures household data. To account for the differences in some of the respondents' characteristics, we included them as control variables.

2.6. Analysis

2.6.1. Analysis of financial and non-financial treatments

To answer our first research question, we evaluated the impact of the treatments on mode choice. We estimated these main effects with (multinomial) logit models since the dependent variable, mode choice, is a nominal variable. The short-distance scenario was analyzed with a multinomial logit model, as mode choices (the dependent variable) were almost equally split among all three options (car, PT, bike). Since less than 2 percent of respondents chose the multi-modal option (train and car-sharing) in the longer-distance scenario, we collapsed the three possibilities (car, PT and multi-model option) into a binary variable; car (1) or no car (0). Hence, for the longer-distance travel, we applied a logit model. Treatments were dummy coded with the control group being the reference group. To make sure that our multinomial logit model fulfills the assumption of IIA, we performed a suest-based Hausman test and a Small-Hsiao test, which both confirmed that the assumption is met (see the Appendix, Table A.2).

To evaluate the effect of the treatments we estimated the probability of choosing mode i given the alternative mode j (and k for the multinomial logit model) as a function F of the treatments.

2.6.2. Analysis of determinants for mode choice

To answer our second research question, we investigate the determinants of mode choice. To this end we included more explanatory variables in our models. Along the categories put forward by De Witte et al. (2013), we included a selection of factors that represented all four sub-groups: *socio-demographic indicators*, *spatial indicators*, *journey characteristic indicators*, and *socio-psychological indicators*. All determinants and variables are explained in Table 3.

To evaluate the effect of the determinants we estimated the probability of choosing mode i given the alternative modes j (and k for the multinomial logit model) as a function F of the determinants as explained in Table 1.

As a first robustness check we provide model estimates with determinants and treatments, in the Appendix, Table A.3. As an additional robustness check and to be able to use the whole sample of respondents, i.e. also including those respondents who did not provide information on their income ($n = 111$) we estimated the model with determinants with a dummy variable indicating if the income information is available (Dummy = 1) or not (Dummy = 0). We see that estimates do not differ substantially and that there is no statistically significant difference between the group of people who provided information on the income and the group of people who did not.

Finally, to get a deeper understanding of respondents' reasons for mode choice, we categorized and analyzed the open-ended questions with qualitative content analysis according to Mayring (2010), utilizing MAXQDA, a qualitative data analysis software tool.

3. Results

3.1. Mode choice preferences (rating task)

Table 4 shows the average rating of respondents expressing the likelihood of using the presented modes of transport (i.e., ratings for all presented modes, namely car for the short- and the longer-distance scenario, PT for the short- and the longer-distance scenario, bike for the short- and multi-modal for the longer-distance scenario). On average, respondents' preferences were very similar across the different modes of transport, with one exception—the multi-modal option was highly unpopular (on average rated with

Figure 6. Experiment interface shown to respondents. Information displayed in the short-distance scenario in the usable time treatment group. Note: For the longer-distance scenario, cost and travel time have to be replaced as indicated in Table 2. Usable time was 55 minutes and also displayed with a green bar.

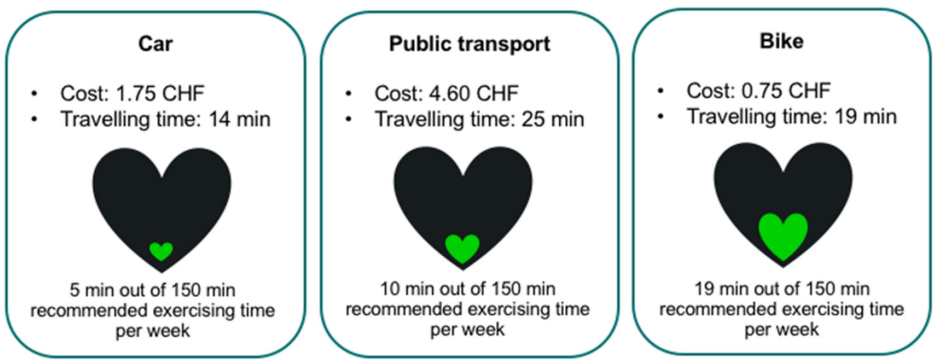


Figure 7. Experiment interface shown to respondents. Information displayed in the short-distance scenario in the exercising group. Note: For the longer-distance scenario, cost and travel time have to be replaced as indicated in Table 2. The green hearts represent 5 min of physical activity for the car trip, 15 min for PT, and 10 min for the multi-modal option. The size of the green hearts was adjusted to match.

1.68 on the five-point Likert scale), whereas the average likelihood of choosing the car and public transport for short- and longer-distances and the bike for short-distances was above 3, indicating a positive likelihood for choosing these modes of transport.

Looking at what respondents reported they would choose if they had to select one of the presented modes (choice task), we find the results of the rating task roughly confirmed. For the short-distance trip, preferences were almost equally split between car (39%) and bike (36%), followed by 25% choosing public transport (Figure 8a). For the longer-distance trip, 52% of the respondents chose public transport, 46% car, and only 2% the multi-modal option "Train + Carsharing" (Figure 8b)

3.2. Influence of financial and non-financial treatments (choice task)

Investigating the influence of the treatments on participants' choice of transportation (main effects) through logit and multinomial logit analyses, we find that the road pricing treatment had a significant effect in the short-distance scenario on reducing the probability of choosing the car. In particular, the respondents who faced the additional cost of road pricing (i.e., 5 CHF) were 12.7 percentage points less likely to choose the car for the short-distance scenario than respondents in the control group. The other treatments were not associated with a significant effect. All main effects are reported in Table 5, and for a more intuitive reading presented in average marginal effects (AME).[9]

3.3. Influence of determinants (choice task)

3.3.1. Determinants of car usage

Looking at the logit and multinomial logit analyses results for determinants of mode choice (Table 6) we find that the most important determinant for choosing the car was the availability of a car in the household.

In addition, the availability of a general travel card was negatively correlated with choosing the car. Moreover, car choice was significantly and positively related to the following reasons; the desire to travel fast, perceiving it as the only viable option, attaching a high importance to ease of use (only in the long-distance scenario) and habit (only in the long-distance scenario). Furthermore, participants that chose the car were more likely to think of a travel partner while doing the experiment. Contrary, there were significant negative correlations with the following reasons; desire to choose

[9]AMEs can be roughly interpreted as follows. A one-unit increase respectively a discrete change in an independent variable, increases (+)/decreases (–) the probability of choosing a certain mode of transport by AME * 100%- points, holding all other independent variables constant. Be aware that such interpretations are only valid for infinitesimal changes in x. Therefore, 'it is not necessarily true that dydx() = 0.5 means that "y increases by 0.5 if x increases by 1". It is true that "y increases with x at a rate such that, if the rate were constant, y would increase by 0.5 if x increased by 1" ' (StataCorp LLC, 2019, p. 1398).

Table 4. Tendencies for choosing the presented mode of transport (rating task).

Variable	Mean	Std. dev.
Short-distance mode choices		
Car	3.18	1.59
Public transport	3.08	1.46
Bike	3.23	1.60
Longer-distance mode choices		
Car	3.44	1.56
Public transport	3.73	1.43
Multi-modal option (Train + Carsharing)	1.68	1.03

n = 737; Min = 1, Max = 5.

the cheapest option, making use of travel time or enjoyment (only in the long-distance scenario).

These findings were mostly in line with the qualitative analysis of the open-ended questions. Respondents, who stated that "ease of use" is important to them often named practicality and faster/shorter travel time as an explanation of what "ease of use" meant. Cost and habit were not frequently mentioned explanations for "ease of use" in relation to car use. Additionally, to the open-ended question "What must happen that you would not take the car?" car users most frequently answered that PT would be considered if better connections were provided (14%; n = 413). This is followed by weather conditions (if weather is either too bad for taking the car, e.g. in winter, or good enough for biking/motor-biking/walking) (12%), lack of access to a car or impossibility of driving (12%), security/less stress due to traffic (8%), lower cost for PT or higher cost for driving (7%), and not having to transport children/other people/animals (5%). However, among this group of car-affine respondents, some people (9%) showed a strong resistance toward any alternative mode choice other than a car by indicating that they would not change no matter the circumstances. Hence, leaving a group of "car affine" or hard to reach. Some car affine provided reasons hinting mainly at restrictions due to the living area or bad PT connections. When comparing these answers for short- and long-distance scenarios, we see a higher importance of good connections (availability, frequency, direct connections, travel time, etc.; see above) for longer distances. Not surprisingly, traveling cheaply is more important for longer distances, as are comfort and useable time. Equally important for both distances seem to be conditions like avoidance of traffic, parking problems, weather conditions (most important reason for taking the bike), and transport of people. Situational factors appear to be more relevant for short distances (planned activity, arrival/travel time).

3.3.2. Determinants of public transport usage

Respondents who had chosen public transport were influenced by other determinants than respondents who had taken the car. The PT choice was significantly and positively related to the availability of a general travelcard in the household, city or agglomeration dwelling, as well as the reasons enjoyment (only in the short-distance scenario) and habit (only for the short-distance scenario). PT choice was negatively related to the availability of a car or bike as well as the desire to travel fast (only for the short-distance scenario) and surprisingly also the reason of wanting to make use of travel time. Analyzing the meaning of "ease of use," given by the answers to the open-ended question, we encounter a broad range of associations. These were a preference for traveling by train, usability or quality time, and routine or habit. Moreover, other associations with ease of use were the availability of a general travel card/half-price travel card and same or shorter travel time, as well as reliability or more reliable than traveling by car, environmentally friendliness, feeling secure, and more appropriate for longer distances, or simply chosen because no car or driver license is available.

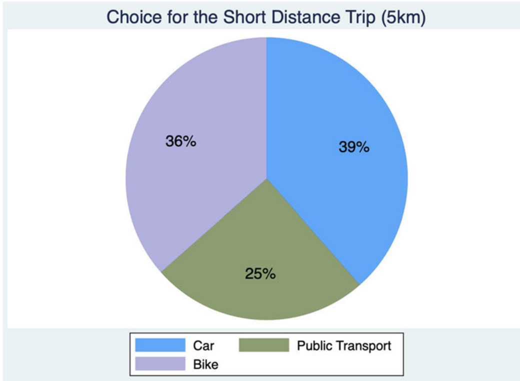
3.3.3. Determinants of bike usage

Reasons given for choosing the bike in the short-distance scenario were the availability of a bike in the household, choosing the cheapest option, being physically active and enjoyment. Whereas the availability of a car, thinking of a travel partner, traveling fast and perceiving this way of traveling as the only viable option were negatively related to this mode choice. Explaining "ease of use" in relation to taking the bike for short distances in the open-ended question, respondents named time and cost factors next to "not complicated" and flexibility: quicker travel time or shortcuts can be taken, and traveling by bike is cheaper. Furthermore, in relation to ease of bike use, health, having fun, routines, security, and lack of access to a car were named.

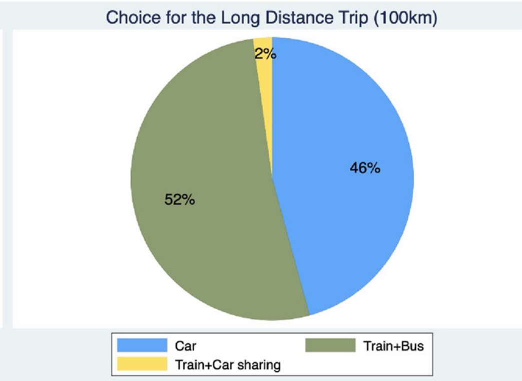
4. Discussion

From the tested treatments we find the road pricing treatment in the short-distance scenario to significantly reduce the probability of choosing the car. This finding is in line with previous studies investigating the effectiveness of road pricing treatments (e.g. Axhausen et al., 2021; Belgiawan et al., 2019; Santos & Fraser, 2006; Suter et al., 2015). Considering the substantial increase in cost associated with this treatment, this finding is not surprising. While in the road pricing treatment of the short-distance scenario the total cost was raised fourfold, it was increased to a much lower extent in the CO_2 tax treatment or in the road pricing treatment for the longer-distance scenario. This supports the idea that a sufficiently high increase in cost might reduce car-based leisure travel. From the policy perspective, however, this is probably difficult to implement, especially in a direct democracy like in Switzerland, since such an increase in cost will most likely cause strong public opposition. We suggest that future research should investigate if there is a certain pricing scheme that is political palatable and is still effective in reducing car usage.

Apart from the road pricing treatment for the short distance, the other treatments tested were not significant. These treatments, which have been found to be effective in commuting (Abou-Zeid & Fujii, 2016; Geng et al., 2016), require further investigation to determine if they are indeed not relevant for leisure trips. The result regarding the social norm treatment in particular was not in line with our



(a) Short-distance scenario



(b) Longer-distance scenario

Figure 8. Preferred mode choices (choice task).

expectations. However, it could be that the hypothetical setting of the experiment prevented the respondents from evaluating exactly how relevant the reference group (other users of the website) was for their decision. This could have led to the insignificant result (Schubert et al., 2021). In a real-word setting the respondents would be confronted with a real app and would have an impression about the community using this app and how relevant this community is for their decisions. Moreover, the finding of the treatments to be non-effective might also be seen as a consequence of people using other rationales for mode choice in leisure travel than in commuting. An explanation might be that people value leisure travel differently than commuting and are therefore also less cost sensitive. Furthermore, it is likely that people choose to have a car or travel card based on how they want to commute. Once they have bought a car or travel card it is perfectly rational with respect to marginal cost to also use the same mode for leisure trips like visiting friends.

In general, we see that the availability of a bike, car or a travel pass is a very strong predictor for the respective mode choice. This is in line with studies which found car availability to be a significant determinant (De Witte et al., 2013; Dütschke et al., 2022; Liang et al., 2021; Van Acker et al., 2011) and a study that found bike and travel pass availability to be significant predictors (Moniruzzaman & Farber, 2018; Schubert et al., 2022). Van Acker et al. (2011) additionally looked at the influence of determinants of the built environment as well as "soft" determinants like attitudes and lifestyles on mode choice in leisure activities like family visits, i.e. with a quite similar problem statement to our study. They also conclude that car availability is a strong predictor for car usage.

Apart from this common predictor we find that mode choice for bike and public transport are influenced by other determinants than mode choice for car. For example, respondents who have chosen the car were significantly influenced by the motive of traveling fast and the perception that it is the only viable option. Moreover, they were imagining traveling with someone else. Finally, to a lesser extent aspects of habits ("I am used to travel like this") and aspects of ease of use played a role. That habits (among intentions and past behavior) is one of the predominant factors for mode choice was also found by Lanzini and Khan (2017) who conducted a meta-analysis on 58 primary studies and Schubert et al. (2022) who evaluated car-usage and mode choice within a structural equation model.

Mirroring the found determinants for positively influencing mode choice of car users on the routinized-explicit decision-making poles, there are determinants like availability of a car, perception of the "only viable option" or being used to this form of travel that can be counted as factors of habitual behavior whereas traveling fast, traveling with someone else or "ease of use" are determinants related to explicit decision-making. While for respondents who had chosen the car, determinants of explicit decision-making as well as determinants of routinized behavior are equally important, respondents who had chosen public transport are mostly influenced by determinants of habitual behavior (availability of a travel card, living in a city or agglomeration, habit) and to a lesser extent by determinants of explicit decision-making (enjoyment). By contrast, bike users are mostly influenced by determinants of explicit decision-making (choosing the cheapest option, being physically active, enjoyment).

Against this backdrop, the answers to our two research questions point to elements in line with existing research and, additionally, to new aspects which could benefit from further study. Coming back to our first research question it is rather difficult to state which policy measures might be most effective. Besides a high-level road pricing, none of the other measures had a significant effect on reducing car-based leisure travel. Considering the low acceptance for high-level road pricing, this could be seen as a rather disappointing result.

Looking at the second research question, our results are in line with those of Hoffmann et al. (2017) who also highlighted the importance of determinants influencing explicit decision-making and habitual aspects for car use. Regarding the latter, our results point to something like a doubled lock-in situation: owning a car frames leisure behavior and using the car for leisure is influenced by socially and individually ingrained determinants like traveling fast, (thinking of) traveling with someone else, and especially seeing it as the only viable way of traveling. These findings relate to lock-in situations which are known to be hard to change (Klöckner & Verplanken, 2018).

However, our findings point to three new angles especially for breaking lock-ins. First, the factor "enjoyment" in

Table 5. Influence of treatments.

Control group	Short-distance scenario: Multinomial logit model Reference category	Longer-distance scenario: Logit model (Car choice) Reference category
T1: Road pricing		
Car	−0.127*	0.0230
	(0.0622)	(0.0642)
Public transport	0.0869	
	(0.0551)	
Multi modal	0.0396	
	(0.0620)	
T2: CO_2 tax		
Car	−0.0397	0.0100
	(0.0633)	(0.0639)
Public transport	0.0250	
	(0.0526)	
Multi modal	0.0147	
	(0.0612)	
T3: Social norms		
Car	−0.0690	0.0448
	(0.0636)	(0.0644)
Public transport	0.0363	
	(0.0537)	
Multi modal	0.0327	
	(0.0622)	
T4: Usable time		
Car	−0.0761	−0.0254
	(0.0629)	(0.0641)
Public transport	0.0426	
	(0.0534)	
Multi modal	0.0335	
	(0.0616)	
T5: Exercising		
Car	−0.0690	0.0531
	(0.0636)	(0.0643)
Public transport	0.0859	
	(0.0555)	
Multi modal	−0.0169	
	(0.0613)	
N	**737**	**737**

Wald $Chi^2(5) = 2.10$; Prob > $Chi^2 = 0.8352$; Pseudo $R^2 = 0.0021$.
Robust standard errors in parentheses, Results in average marginal effects (AME).
$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

our findings aligns with recent research on the link between traveling and quality of life (Chatterjee et al., 2020; De Vos et al., 2013). Our study shows, for example, that the usable time and the exercising treatment were more effective if car users see the act of traveling as a possibility to gain utility out of other aspects than the pure traveling from A to B. Gaining additional utility is also a factor for respondents who have chosen public transport or bike. For these respondents reasons like enjoyment are relevant for their mode choice. Looking at the rather generic criterion "enjoyment" in our study and the manifold criteria used to study satisfaction with traveling in the referenced research, it seems to be promising to study in what respect new "meanings" in leisure traveling could contribute to overcoming the lock-in in car use. Second, the findings encourage future research to investigate if car users indeed have no other option available than traveling by car or if this is a misperception. Usually, the underlying assumption of mode choice studies is that people can choose from a range of modes. However, as the literature on captive users stresses, this is not always the case (see e.g. De Vos, 2018; Humagain et al., 2021). Many travelers would like to use another mode but cannot do so due to some restrictions. As we have shown there is, with one third of all respondents, a remarkable share of participants who evaluate the car as the only viable option. It is important to further investigate what policy measures are needed such that those people can switch to more sustainable forms of transportation. Third, and given the strong influence of car-ownership, research is invited to study in what respect individual car-ownership could be addressed. If car-based leisure traveling should be reduced to establish a more sustainable transport system and if owning a car is a major predictor for car-based leisure travel, then it is fair to conclude that addressing individual car-ownership is part of the solution toward a sustainable transport system, in particular if living without a car can also contribute to individual well-being (Hess, 2022).

5. Limitations

First of all, it should be taken into consideration that this randomized controlled online experiment has all the limitations of a stated preference approach, which means, for example, that depicted situations are somewhat artificial (for a review on the limitations of stated preference approaches, see e.g., Louviere and Timmermans (1990) or Hainmueller et al. (2014)). Therefore, findings cannot be transferred to real-world settings right away. As an example, it can be mentioned that modal split in Switzerland (e.g., more than 60% of all kilometers in leisure travel are covered by car (BFS & ARE, 2017) differs quite a lot from the modal split in our experiment (where less than half of all respondents take the car). Second, with respect to policy implications we have to keep in mind that our sample is not representative for age, place of living (urban versus rural) and most likely for the possession of a travel card. It could be that in our sample respondents owning a general travel card or a half-price travel card are overrepresented; this is hard to tell because SHEDS evaluates data at the household level and Mikrozensus (BFS & ARE, 2017) evaluates data at the personal level. Moreover, the aspect that our sample is not representative for rural places calls for special attention since literature has shown that geography is a relevant determinant of mode choice. In this context, a further shortcoming of our analysis might be that not more determinants covering geographical aspects are included. This might also increase the R^2 of our models, which is relatively low. One has also to keep in mind that the found effect of road pricing is not a robust finding. Once we add additional control variables to the model, the effect size decreases and is no longer significant at the 5% significance level. Future research on the topic might include more explanatory variables and present respondents with more choice sets, as for example in a classical discrete choice experiment.

6. Conclusions and policy implications

In this paper, we have analyzed the outcomes of a stated preference online experiment with the aim of shedding light on mode choice in leisure travel. In particular, we have tested five different treatments trying to reduce car-based

Table 6. Influence of determinants.

	MNLM short distance			LM longer distance
	Car	PT	Bike	Car taken =1
Age	−0.001	0.003*	−0.002	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Sex (1= Female)	−0.007	0.059	−0.052	−0.028
	(0.026)	(0.030)	(0.030)	(0.026)
Income categories:				
CHF 3,000 or less	0.023	0.028	−0.052	0.125*
	(0.050)	(0.066)	(0.066)	(0.050)
CHF 3,000–4,499	0.038	0.062	−0.100	−0.049
	(0.052)	(0.053)	(0.055)	(0.046)
CHF 4,500–5,999	0.102*	−0.005	−0.097*	−0.016
	(0.041)	(0.044)	(0.042)	(0.038)
CHF 6,000–8,999	Reference Category			
CHF 9,000–11,999	−0.018	0.025	0.007	0.010
	(0.034)	(0.043)	(0.042)	(0.036)
CHF 12,000 or more	0.032	−0.024	0.008	−0.006
	(0.038)	(0.046)	(0.045)	(0.035)
City and agglomeration	−0.046	0.084*	−0.038	−0.017
	(0.030)	(0.039)	(0.034)	(0.025)
General travel card	−0.070*	0.079*	−0.009	−0.150***
	(0.031)	(0.037)	(0.034)	(0.025)
Half-price travel card	−0.030	0.047	−0.017	−0.111***
	(0.026)	(0.035)	(0.034)	(0.028)
Car	0.376***	−0.263***	−0.113**	0.289***
	(0.051)	(0.036)	(0.039)	(0.044)
Bike	0.018	−0.156***	0.138***	−0.003
	(0.027)	(0.030)	(0.033)	(0.028)
Thinking of a travel partner	0.111***	0.008	−0.103***	0.109***
	(0.026)	(0.030)	(0.029)	(0.025)
Choosing the cheapest option	−0.042***	0.004	0.038**	−0.047***
	(0.011)	(0.013)	(0.013)	(0.012)
Habit	−0.014	0.060**	−0.046*	0.026*
	(0.017)	(0.021)	(0.017)	(0.014)
Traveling fast	0.129***	−0.043**	−0.087***	0.136***
	(0.014)	(0.015)	(0.014)	(0.015)
Making use of travel time	−0.107***	−0.045**	0.152***	−0.112***
	(0.011)	(0.014)	(0.015)	(0.014)
Enjoyment	0.013	0.062***	0.049**	−0.045**
	(0.018)	(0.018)	(0.017)	(0.016)
Only viable option	0.055***	0.009	−0.064***	0.025*
	(0.012)	(0.014)	(0.013)	(0.016)
Ease of use	−0.001	−0.003	0.004	0.046**
	(0.016)	(0.019)	(0.018)	(0.016)
N	626	626	626	626

Multinomial logit model short-distance scenario: Wald Chi2(40) = 305.52.
Pseudo R^2 = 0.4773.
Logit model longer-distance scenario: Wald Chi2(20) = 137.22, Pseudo R^2 = 0.5988.
Results in average marginal effects (AME).
Robust standard errors in parentheses.
$^{***}p < 0.\ 001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

leisure travel. Two were financial (road pricing and CO_2 tax) and three were non-financial (addressing social norms, highlighting usable time in public transport and information on health benefits) treatments addressing determinants of explicit mode choice as well as aspects of habitual behavior. We found the road-pricing treatment to have an effect in the short-distance scenario. Looking at the importance of determinants of explicit decision-making and habitual behavior we found both to be important, but not for all modes in the same way. The importance of determinants describing explicit decision-making like "traveling fast" varied between the tested modes while the availability of a car, bike or travel pass have been shown to be significant predictors for all mode choices, showing strong habitual aspects. Moreover, respondents who have chosen the car often think that there is no other option than car usage. The findings of our study point to some new angles or possible measures through which a reduction in car-based leisure travel could be achieved: The first is related to new or other types of utilities in traveling. The second is related to not experiencing/perceiving (rightly or falsely) viable alternatives. The third is certainly the trickiest, directed to policies that step in before people make a long-term decision, such as buying a car. These three angles go beyond the more traditional dimensions for treatments as we tested them in our study. Therefore, our study opens up a broad field for studying alternative policies to overcome car-based leisure travel.

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References

Abou-Zeid, M., & Fujii, S. (2016). Travel satisfaction effects of changes in public transport usage. *Transportation*, *43*(2), 301–314. https://doi.org/10.1007/s11116-015-9576-3

Abrell, J., Betz, R., Kosch, M., Piana, V., Schleiniger, R., & Stünzi, A. (2018). *Zur schweizerischen Klimapolitik: Wie effizient ist die Bepreisung des fossilen Energieverbrauchs?* SCCER CREST White Paper No. 6; White Paper.

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckmann (Eds.), *Action control: From cognition to behavior* (pp. 11–39). Springer. https://doi.org/10.1007/978-3-642-69746-3_2

An, Z., Heinen, E., & Watling, D. (2021). The level and determinants of multimodal travel behavior: Does trip purpose make a difference? *International Journal of Sustainable Transportation*, *30*, 1–15. https://doi.org/10.1080/15568318.2021.1985195

Anable, J. (2005). 'Complacent car addicts' or 'aspiring environmentalists'? Identifying travel behaviour segments using attitude theory. *Transport Policy*, *12*(1), 65–78. https://doi.org/10.1016/j.tranpol.2004.11.004

Anable, J., & Gatersleben, B. (2005). All work and no play? The role of instrumental and affective factors in work and leisure journeys by different travel modes. *Transportation Research Part A: Policy and Practice*, *39*(2-3), 163–181. https://doi.org/10.1016/j.tra.2004.09.008

ARE, Bundesamt für Raumentwicklung (2016). Verkehrsperspektiven 2040. https://www.are.admin.ch/are/de/home/verkehr-und-infrastruktur/grundlagenund-daten/verkehrsperspektiven.html

Axhausen, K. W., Molloy, J., Tchervenkov, C., Becker, F., Hintermann, B., Schoeman, B., Götschi, T., Castro Fernández, A., & Tomic, U. (2021). *Empirical analysis of mobility behavior in the presence of Pigovian transport pricing* (Report No. 1704; Vol. 1704). ETH Zurich. https://doi.org/10.3929/ethz-b-000500100

Bamberg, S., Ajzen, I., & Schmidt, P. (2003). Choice of travel mode in the theory of planned behavior: The roles of past behavior, habit, and reasoned action. *Basic and Applied Social Psychology*, *25*(3), 175–187. https://doi.org/10.1207/S15324834BASP2503_01

Beirão, G., & Sarsfield Cabral, J. A. (2007). Understanding attitudes towards public transport and private car: A qualitative study. *Transport Policy*, *14*(6), 478–489. https://doi.org/10.1016/j.tranpol.2007.04.009

Belgiawan, P. F., Ilahi, A., & Axhausen, K. W. (2019). Influence of pricing on mode choice decision in Jakarta: A random regret minimization model. *Case Studies on Transport Policy*, *7*(1), 87–95. https://doi.org/10.1016/j.cstp.2018.12.002

BFS. (2019a). *HABE: Haushaltseinkommen und -ausgaben*. HABE: Haushaltseinkommen und -ausgaben. https://www.bfs.admin.ch/bfs/de/home/statistiken/wirtschaftliche-soziale-situation-bevoelkerung/einkommen-verbrauch-vermoegen/haushaltsbudget.html

BFS. (2019b). *Umweltauswirkungen*. https://www.bfs.admin.ch/bfs/de/home/statistiken/mobilitaet-verkehr/unfaelle-umweltauswirkungen/umweltauswirkungen.html

BFS & ARE. (2017). *Verkehrsverhalten der Bevölkerung—Ergebnisse des Mikrozensus Mobilität und Verkehr 2015*. https://www.bfs.admin.ch/bfsstatic/dam/assets/1840477/master

Bonan, J., Cattaneo, C., d'Adda, G., & Tavoni, M. (2020). The interaction of descriptive and injunctive social norms in promoting energy conservation. *Nature Energy*, *5*(11), 900–909. https://doi.org/10.1038/s41560-020-00719-z

Brög, W., Erl, E., Ker, I., Ryle, J., & Wall, R. (2009). Evaluation of voluntary travel behaviour change: Experiences from three continents. *Transport Policy*, *16*(6), 281–292. https://doi.org/10.1016/j.tranpol.2009.10.003

Büchs, M., & Schnepf, S. V. (2013). Who emits most? Associations between socio-economic factors and UK households' home energy, transport, indirect and total CO_2 emissions. *Ecological Economics*, *90*, 114–123. https://doi.org/10.1016/j.ecolecon.2013.03.007

Carroll, P., Caulfield, B., & Ahern, A. (2021). Appraising an incentive only approach to encourage a sustainable reduction in private car trips in Dublin, Ireland. *International Journal of Sustainable Transportation*, *15*(6), 474–485. https://doi.org/10.1080/15568318.2020.1765054

Chatterjee, K., Chng, S., Clark, B., Davis, A., De Vos, J., Ettema, D., Handy, S., Martin, A., & Reardon, L. (2020). Commuting and well-being: A critical overview of the literature with implications for policy and future research. *Transport Reviews*, *40*(1), 5–34. https://doi.org/10.1080/01441647.2019.1649317

Chen, J., & Li, S. (2017). Mode choice model for public transport with categorized latent variables. *Mathematical Problems in Engineering*, *2017*, e7861945. https://doi.org/10.1155/2017/7861945

Conti, B. (2018). Modal shift and interurban mobility: Environmentally positive, socially regressive. *Journal of Transport Geography*, *69*, 234–241. https://doi.org/10.1016/j.jtrangeo.2018.05.007

de Oña, J., de Oña, R., Eboli, L., & Mazzulla, G. (2015). Heterogeneity in perceptions of service quality among groups of railway passengers. *International Journal of Sustainable Transportation*, *9*(8), 612–626. https://doi.org/10.1080/15568318.2013.849318

De Vos, J. (2018). Do people travel with their preferred travel mode? Analysing the extent of travel mode dissonance and its effect on travel satisfaction. *Transportation Research Part A: Policy and Practice*, *117*, 261–274. https://doi.org/10.1016/j.tra.2018.08.034

De Vos, J., Schwanen, T., Acker, V. V., & Witlox, F. (2013). Travel and subjective well-being: A focus on findings, methods and future research needs. *Transport Reviews*, *33*(4), 421–442. https://doi.org/10.1080/01441647.2013.815665

De Witte, A., Hollevoet, J., Dobruszkes, F., Hubert, M., & Macharis, C. (2013). Linking modal choice to motility: A comprehensive review. *Transportation Research Part A: Policy and Practice*, *49*, 329–341. https://doi.org/10.1016/j.tra.2013.01.009

Donald, I. J., Cooper, S. R., & Conchie, S. M. (2014). An extended theory of planned behaviour model of the psychological factors affecting commuters' transport mode use. *Journal of Environmental Psychology*, *40*, 39–48. https://doi.org/10.1016/j.jenvp.2014.03.003

Dütschke, E., Engel, L., Theis, A., & Hanss, D. (2022). Car driving, air travel or more sustainable transport? Socio-psychological factors in everyday mobility and long-distance leisure travel. *Travel Behaviour and Society*, *28*, 115–127. https://doi.org/10.1016/j.tbs.2022.03.002

Echiburú, T., Hurtubia, R., & Muñoz, J. C. (2021). The role of perceived satisfaction and the built environment on the frequency of cycle-commuting. *Journal of Transport and Land Use*, *14*(1), 171–196. https://doi.org/10.5198/jtlu.2021.1826

Emberger, G., & Pfaffenbichler, P. (2017). Equidistance: Evidence of the influence of parking organization on mode choice. In H. Knoflacher & E. V. Ocalir-Akunal (Eds.), *Engineering tools and solutions for sustainable transportation planning*. IGI Global. https://doi.org/10.4018/978-1-5225-2116-7

Farrow, K., Grolleau, G., & Ibanez, L. (2017). Social norms and pro-environmental behavior: A review of the evidence. *Ecological Economics*, *140*, 1–13. https://doi.org/10.1016/j.ecolecon.2017.04.017

Fu, X. (2021). How habit moderates the commute mode decision process: Integration of the theory of planned behavior and latent class choice model. *Transportation*, *48*(5), 2681–2707. https://doi.org/10.1007/s11116-020-10144-6

Fujii, S., & Taniguchi, A. (2005). Reducing family car-use by providing travel advice or requesting behavioral plans: An experimental analysis of travel feedback programs. *Transportation Research Part D: Transport and Environment*, *10*(5), 385–393. https://doi.org/10.1016/j.trd.2005.04.010

Galinato, G. I., & Yoder, J. K. (2010). An integrated tax-subsidy policy for carbon emission reduction. *Resource and Energy Economics*, *32*(3), 310–326. https://doi.org/10.1016/j.reseneeco.2009.10.001

Gawronski, B., & Creighton, L. A. (2013). Dual process theories. In D. E. Carlston (Ed.), *The Oxford handbook of social cognition* (pp. 282–312). Oxford University Press. http://bertramgawronski.com/documents/GC2013Oxford.pdf

Geng, J., Long, R., & Chen, H. (2016). Impact of information intervention on travel mode choice of urban residents with different goal frames: A controlled trial in Xuzhou, China. *Transportation Research Part A: Policy and Practice*, *91*, 134–147. https://doi.org/10.1016/j.tra.2016.06.031

Götz, K., Deffner, J., & Klinger, T. (2016). Mobilitätsstile und Mobilitätskulturen – Erklärungspotentiale, Rezeption und Kritik. In *Handbuch Verkehrspolitik* (pp. 781–804). Springer VW. https://www.springerprofessional.de/mobilitaetsstile-und-mobilitaetskulturen-erklaerungspotentiale-r/6948792

Gutiérrez, M., Hurtubia, R., & Ortúzar, J. d. D. (2020). The role of habit and the built environment in the willingness to commute by bicycle. *Travel Behaviour and Society*, *20*, 62–73. https://doi.org/10.1016/j.tbs.2020.02.007

Habib, K. N., Mahmoud, M. S., & Coleman, J. (2013). Effect of parking charges at transit stations on park-and-ride mode choice: Lessons learned from stated preference survey in Greater Vancouver. *Transportation Research Record: Journal of the Transportation Research Board*, *2351*(1), 163–170. https://doi.org/10.3141/2351-18

Hainmueller, J., Hopkins, D. J., & Yamamoto, T. (2014). Causal inference in conjoint analysis: Understanding multidimensional choices via stated preference experiments. *Political Analysis 22*, 1–30. https://doi.org/10.1093/pan/mpt024

Hammar, H., & Jagers, S. C. (2007). What is a fair CO_2 tax increase? On fair emission reductions in the transport sector. *Ecological Economics*, *61*(2–3), 377–387. https://doi.org/10.1016/j.ecolecon.2006.03.004

Hess, A.-K. (2022). The relationship between car shedding and subjective well-being. *Transportation Research Interdisciplinary Perspectives*, *15*, 100663. https://doi.org/10.1016/j.trip.2022.100663

Hess, A.-K., & Schubert, I. (2019). Functional perceptions, barriers, and demographics concerning e-cargo bike sharing in Switzerland. *Transportation Research Part D: Transport and Environment*, *71*, 153–168. https://doi.org/10.1016/j.trd.2018.12.013

Hoffmann, C., Abraham, C., White, M. P., Ball, S., & Skippon, S. M. (2017). What cognitive mechanisms predict travel mode choice? A systematic review with meta-analysis. *Transport Reviews*, *37*(5), 631–652. https://doi.org/10.1080/01441647.2017.1285819

Holden, E., & Linnerud, K. (2011). Troublesome leisure travel: The contradictions of three sustainable transport policies. *Urban Studies*, *48*(14), 3087–3106. https://doi.org/10.1177/0042098010396234

Humagain, P., De Vos, J., & Singleton, P. A. (2021). Analyzing travel captivity by measuring the gap in travel satisfaction between chosen and alternative commute modes. *Transportation Research Part D: Transport and Environment*, *97*, 102965. https://doi.org/10.1016/j.trd.2021.102965

Ingvardson, J. B., & Nielsen, O. A. (2018). Effects of new bus and rail rapid transit systems – An international review. *Transport Reviews*, *38*(1), 96–116. https://doi.org/10.1080/01441647.2017.1301594

International Transport Forum. (2019). *ITF transport outlook 2019*. OECD. https://doi.org/10.1787/transp_outlook-en-2019-en

Javaid, A., Creutzig, F., & Bamberg, S. (2020). Determinants of low-carbon transport mode adoption: Systematic review of reviews. *Environmental Research Letters*, *15*(10), 103002. https://doi.org/10.1088/1748-9326/aba032

Johnson, J. (2020). *What is the difference between aerobic and anaerobic exercise?* https://www.medicalnewstoday.com/articles/aerobic-vs-anaerobic-exercises

Kent, J. L. (2015). Still feeling the car – The role of comfort in sustaining private car use. *Mobilities*, *10*(5), 726–747. https://doi.org/10.1080/17450101.2014.944400

Kleinhückelkotten, S., Neitzke, H.-P., & Moser, S. (2016). *Repräsentative Erhebung von Pro-Kopf-Verbräuchen natürlicher Ressourcen in Deutschland (nach Bevölkerungsgruppen)*. 143.

Klöckner, C. A., & Verplanken, B. (2018). Yesterday's habits preventing change for tomorrow? About the influence of automaticity on environmental behaviour. In *Environmental psychology* (pp. 238–250). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781119241072.ch24

Landis, F., Rausch, S., & Kosch, M. (2018). Differentiated carbon prices and the economic cost of decarbonization. *Environmental and Resource Economics*, *70*(2), 483–516. https://doi.org/10.1007/s10640-017-0130-y

Lanzini, P., & Khan, S. A. (2017). Shedding light on the psychological and behavioral determinants of travel mode choice: A meta-analysis. *Transportation Research Part F: Traffic Psychology and Behaviour*, *48*(Supplement C), 13–27. https://doi.org/10.1016/j.trf.2017.04.020

Liang, L., Xu, M., Grant-Muller, S., & Mussone, L. (2021). Household travel mode choice estimation with large-scale data—An empirical analysis based on mobility data in Milan. *International Journal of Sustainable Transportation*, *15*(1), 70–85. https://doi.org/10.1080/15568318.2019.1686782

Louvière, J., & Timmermans, H. (1990). Stated preference and choice models applied to recreation research: A review. *Leisure Sciences, 12* (1), 9–32. https://doi.org/10.1080/01490409009513087.

Mayring, P. (2010). Qualitative Inhaltsanalyse. In G. Mey & K. Mruck (Eds.), *Handbuch Qualitative Forschung in der Psychologie* (pp. 601–613). VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-531-92052-8_42

mobility. (2017). *Die Mobility Preise im Überblick*. https://www.mobility.ch/de/preise/

Moniruzzaman, M., & Farber, S. (2018). What drives sustainable student travel? Mode choice determinants in the Greater Toronto Area. *International Journal of Sustainable Transportation*, *12*(5), 367–379. https://doi.org/10.1080/15568318.2017.1377326

Nayum, A., & Klöckner, C. A. (2014). A comprehensive socio-psychological approach to car type choice. *Journal of Environmental Psychology*, *40*, 401–411. https://doi.org/10.1016/j.jenvp.2014.10.001

Nordfjaern, T., Lind, H. B., Şimşekoğlu, Ö., Jørgensen, S. H., Lund, I. O., & Rundmo, T. (2015). Habitual, safety and security factors related to mode use on two types of travels among urban Norwegians. *Safety Science*, *76*, 151–159. https://doi.org/10.1016/j.ssci.2015.03.001

Ohnmacht, T., & Scherer, M. (2010). More comfort, shorter travel time, or low fares?: Comparing rail transit preferences of commuters, holiday and leisure travelers, business travelers, and shoppers in Switzerland. *Transportation Research Record: Journal of the Transportation Research Board, 2143*(1), 100–107. https://doi.org/10.3141/2143-13

Piras, F., Sottile, E., Tuveri, G., & Meloni, I. (2021). Could psychosocial variables help assess pro-cycling policies? *Transportation Research Part A: Policy and Practice*, *154*, 108–128. https://doi.org/10.1016/j.tra.2021.10.003

Prato, C. G., Halldórsdóttir, K., & Nielsen, O. A. (2017). Latent lifestyle and mode choice decisions when travelling short distances. *Transportation*, *44*(6), 1343–1363. https://doi.org/10.1007/s11116-016-9703-9

Queiroz, M. M., Celeste, P., & Moura, F. (2020). School commuting: The influence of soft and hard factors to shift to public transport. *Transportation Research Procedia*, *47*, 625–632. https://doi.org/10.1016/j.trpro.2020.03.140

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

Rodrigue, J.-P. (2020). *The geography of transport systems* (5th ed.). Routledge, Taylor & Francis Group. https://transportgeography.org/?page_id=5721

Rubin, O., Mulder, C. H., & Bertolini, L. (2014). The determinants of mode choice for family visits – Evidence from Dutch panel data. *Journal of Transport Geography*, *38*, 137–147. https://doi.org/10.1016/j.jtrangeo.2014.06.004

Santos, G., & Fraser, G. (2006). Road pricing: Lessons from London. *Economic Policy*, *21*(46), 264–310. https://doi.org/10.1111/j.1468-0327.2006.00159.x

SBB. (2017). *Timetable*. https://www.sbb.ch/de/fahrplan.html

Scherer, M. (2010). Is light rail more attractive to users than bus transit?: Arguments based on cognition and rational choice. *Transportation Research Record: Journal of the Transportation Research Board*, *2144*(1), 11–19. https://doi.org/10.3141/2144-02

Schubert, I., de Groot, J. I. M., & Newton, A. C. (2021). Challenging the status quo through social influence: Changes in sustainable consumption through the influence of social networks. *Sustainability*, *13*(10), 5513. https://doi.org/10.3390/su13105513

Schubert, I., Weber, S., Martinez-Cruz, A. L., Burger, P., & Farsi, M. (2022). Structural equation modeling as a route to inform sustainable policies: The case of private transportation. *Frontiers in Sustainability, 3*, 837427. https://doi.org/10.3389/frsus.2022.837427

Schultz, P. W., Nolan, J. M., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2007). The constructive, destructive, and reconstructive power of social norms. *Psychological Science*, *18*(5), 429–434. https://doi.org/10.1111/j.1467-9280.2007.01917.x

Schwanen, T., Banister, D., & Anable, J. (2012). Rethinking habits and their role in behaviour change: The case of low-carbon mobility. *Journal of Transport Geography*, *24*, 522–532. https://doi.org/10.1016/j.jtrangeo.2012.06.003

Sivasubramaniyam, R. D., Charlton, S. G., & Sargisson, R. J. (2020). Mode choice and mode commitment in commuters. *Travel Behaviour and Society*, *19*, 20–32. https://doi.org/10.1016/j.tbs.2019.10.007

StataCorp, LLC (2019). *Stata base reference manual release 16*. Stata Press.

Suter, S., Lieb, C., & Rosenfellner, R. (2015). *SURPRICE: Sustainable mobility through road user charges Swiss contribution: Comprehensive road user charging (RUC)* (p. 88). https://www.ecoplan.ch/download/surprice_sb_de.pdf

TCS. (2017). *Kilometerkosten—Was kostet mein Auto?* https://www.tcs.ch/de/testberichte-ratgeber/ratgeber/kontrollen-unterhalt/kilometer-kosten.php

Thalmann, P., & Vielle, M. (2019). Lowering CO_2 emissions in the Swiss transport sector. *Swiss Journal of Economics and Statistics*, *155*(1), 10. https://doi.org/10.1186/s41937-019-0037-3

Trunk, G. (2010). *Gesamtwirtschaftlicher Vergleich von Pkw- und Radverkehr*.

UNCC. (2021). *COP26: The Glasgow Climate Pact*. https://ukcop26.org/wp-content/uploads/2021/11/COP26-Presidency-Outcomes-The-Climate-Pact.pdf

UNFCCC. (2015). *What is the Paris agreement?* UNFCCC. https://unfccc.int/process-and-meetings/the-paris-agreement/what-is-the-paris-agreement

Van Acker, V., Mokhtarian, P. L., & Witlox, F. (2011). Going soft: On how subjective variables explain modal choices for leisure travel. *European Journal of Transport and Infrastructure Research*, *11*(2), 2. https://doi.org/10.18757/ejtir.2011.11.2.2919

Van Essen, H., van Wijngaarden, L., Schroten, A., Sutter, D., Bieler, C., Maffii, S., Brambilla, M., Fiorello, D., Fermi, F., Parolin, R., & El Beyrouty, K. (2019). *Handbook on the external costs of transport: Version 2019*. European Commission. http://publications.europa.eu/publication/manifestation_identifier/PUB_MI0518051ENN

van Goeverden, K., van Arem, B., & van Nes, R. (2016). Volume and GHG emissions of long-distance travelling by Western Europeans. *Transportation Research Part D: Transport and Environment*, *45*, 28–47. https://doi.org/10.1016/j.trd.2015.08.009

Vande Walle, S., & Steenberghen, T. (2006). Space and time related determinants of public transport use in trip chains. *Transportation Research Part A: Policy and Practice*, *40*(2), 151–162. https://doi.org/10.1016/j.tra.2005.05.001

Washbrook, K., Haider, W., & Jaccard, M. (2006). Estimating commuter mode choice: A discrete choice analysis of the impact of road pricing and parking charges. *Transportation*, *33*(6), 621–639. https://doi.org/10.1007/s11116-005-5711-x

Weber, S., Burger, P., Farsi, M., Martinez-Cruz, A. L., Puntiroli, M., Schubert, I., & Volland, B. (2017). Swiss household energy demand survey (SHEDS): Objectives, design, and implementation. IRENE Working Paper No. 17–14. http://hdl.handle.net/10419/191509

Wu, L., Wang, W., Jing, P., Chen, Y., Zhan, F., Shi, Y., & Li, T. (2020). Travel mode choice and their impacts on environment—A literature review based on bibliometric and content analysis, 2000–2018. *Journal of Cleaner Production*, *249*, 119391. https://doi.org/10.1016/j.jclepro.2019.119391

Appendix

Survey text

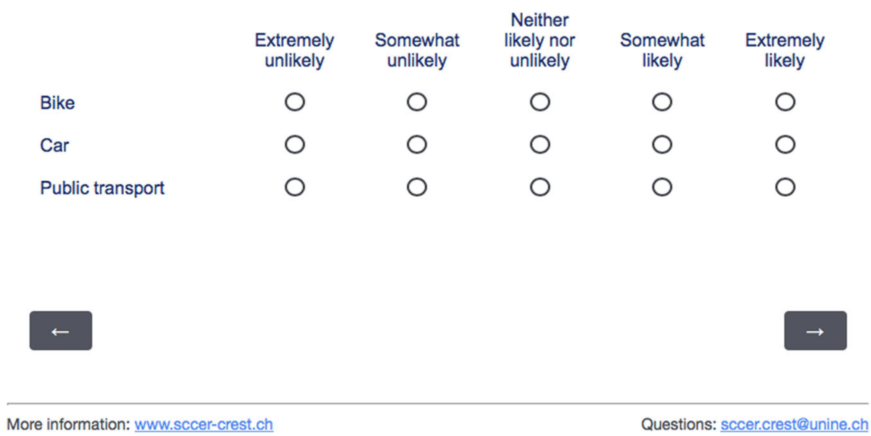
General introduction

In the following questions we will ask you about different leisure trips, you might take, and we will offer you a number of different transportation options to take these trips.

If you would like to have additional information about how the cost associated with transport options are calculated, then please move your mouse over the pictures (not available on mobile phones).

Text for short-distance scenario rating task

Please imagine that you are invited to **visit friends or families** for a day. Your friends live **5 km** away from your home. You are checking the internet and see the following traveling options. How likely is it for you to choose the presented modes?



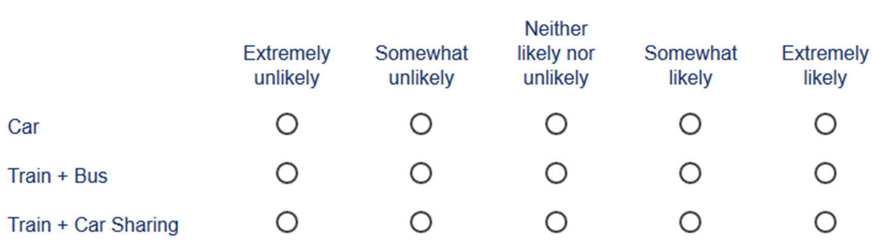
	Extremely unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Extremely likely
Bike	○	○	○	○	○
Car	○	○	○	○	○
Public transport	○	○	○	○	○

← →

More information: www.sccer-crest.ch Questions: sccer.crest@unine.ch

Text for longer-distance scenario rating task

Please imagine that you are invited to **visit friends or families** for a day. Your friends or family live in a village close to a city that is located **100 km** away from your home. You are checking the internet and see the following traveling options. How likely is it for you to choose the presented modes?



	Extremely unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Extremely likely
Car	○	○	○	○	○
Train + Bus	○	○	○	○	○
Train + Car Sharing	○	○	○	○	○

Table A.1. Small-Hsiao tests of IIA assumption.

	lnL(full)	lnL(full)	chi2	df	
Car	−103.918	−91.561	24.713	25	0.479
Public transport	−73.010	−62.356	21.308	25	0.675
Bike	−59.362	−42.893	32.937	25	0.133

Small-Hsiao Test of IIA (independence of irrelevant alternatives) with n = 626.
H_0: Odds(Outcome-J vs. Outcome-K) are independent of other alternatives.
Note: A significant test is evidence against H_0.

Table A.2. Answer options for a follow-up question on reasons for choosing a specific mode of transport, listed are mean scores (5 point Likert scale—1 = Not at all important, 5 = Very important).

Variable	Bike (5km)	Car (5 km)	PT (5 km)	Car (100 km)	PT (100 km)	Multimodal (100 km)
Cheapest option	3.17	2.70	2.98	2.86	3.25	3.31
Protecting the environment	4.02		3.87		3.98	4.13
Habit (I am used to taking this mode of transport)	3.87	3.87	4.01	3.97	4.04	3.31
Inconvenient location of PT stop	3.03	3.69		3.76		
Safety	3.00	3.42	3.68	3.60	3.76	3.50
Traveling fast	3.24	4.16	3.35	4.31	3.39	3.94
Prefer traveling alone	2.51	2.90		3.01		
Only viable option	2.36	2.99	2.92	3.01	2.71	3.19
Enjoyment	4.15	3.94	3.76	4.02	4.12	4.00
Inconvenient connections by PT	3.16	3.90		4.07		
Being independent from timetable	3.83	4.16		4.29		
Inconvenient parking possibilities at destination	2.74		2.69		2.74	
Ease of use	3.93	4.20	3.96	4.23	3.71	3.75
Peers use this option	2.71	3.07	2.67	2.98	2.76	2.44
Making use of travel pass			4.01		4.06	3.88
Convenient location of PT stop			4.08		3.92	
Convenient connections by PT			4.15		4.08	
Enjoy traveling with others			2.42		2.67	2.63
Make use of travel time	4.22[a]	2.83	3.38	3.03	3.91	3.63
Convenient parking possibilities at destination		4.06		3.92		
Taking with me other people		3.36	2.77	3.22	3.01	3.75
Not fully convenient location of PT stop						3.50
Not fully convenient connections by PT						3.31
Convenient parking possibilities at railway station						3.88
N	269	284	184	337	384	16

Note: answer options varied depending on mode choice as not all reasons are plausible.
[a]For bike users, the value is based on the importance of the reason "being physically active."

Table A.3. Influence of determinants on mode choice—model with treatments.

	MNL short distance			Model longer distance
	Car	PT	Bike	Car choice =1
T1: road pricing	−0.042	0.043	−0.001	0.025
	(0.046)	(0.055)	(0.052)	(0.041)
T2: CO_2 tax	0.000	−0.018	0.017	0.033
	(0.043)	(0.051)	(0.048)	(0.039)
T3: social norms	−0.041	−0.005	0.046	0.008
	(0.045)	(0.050)	(0.047)	(0.041)
T4: usable time	−0.041	−0.005	0.046	0.008
	(0.045)	(0.050)	(0.047)	(0.041)
T5: exercising	0.000	−0.018	0.017	0.033
	(0.043)	(0.051)	(0.048)	(0.039)
Age	−0.001	0.002*	−0.002	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Sex (1= Female)	−0.008	0.057	−0.049	−0.030
	(0.025)	(0.030)	(0.030)	(0.026)
Income categories:				
CHF 3,000 or less	0.018	0.034	−0.052	0.124*
	(0.052)	(0.067)	(0.067)	(0.051)
CHF 3,000–4,499	0.044	0.059	−0.103	−0.052
	(0.051)	(0.053)	(0.054)	(0.045)
CHF 4,500–5,999	0.094*	−0.006	−0.088*	−0.020
	(0.042)	(0.045)	(0.042)	(0.039)
CHF 6,000–8,999	Reference Category			
CHF 9,000–11,999	−0.014	0.022	0.008	0.005
	(0.034)	(0.044)	(0.042)	(0.036)
CHF 12,000 or more	0.033	−0.028	0.004	−0.007
	(0.038)	(0.046)	(0.044)	(0.035)
City and agglomeration	−0.047	0.088*	−0.041	−0.014
	(0.029)	(0.040)	(0.034)	(0.024)
General travel card	−0.070*	0.082*	−0.012	−0.151***
	(0.031)	(0.037)	(0.034)	(0.026)
Half-price travel card	−0.034	0.051	−0.018	−0.113***
	(0.025)	(0.035)	(0.034)	(0.028)
Car	0.369***	−0.257***	−0.113**	0.287***
	(0.051)	(0.036)	(0.039)	(0.046)
Bike	0.018	−0.155***	0.137***	−0.006
	(0.027)	(0.031)	(0.033)	(0.029)
Thinking of a travel partner	0.108***	0.009	−0.099***	0.108***
	(0.026)	(0.030)	(0.029)	(0.024)
Choosing the cheapest option	−0.041***	0.003	0.037**	−0.048***
	(0.011)	(0.013)	(0.013)	(0.012)
Habit	−0.014	0.058**	−0.045*	0.029*
	(0.016)	(0.021)	(0.017)	(0.014)
Traveling fast	0.129***	−0.041**	−0.089***	0.138***
	(0.014)	(0.016)	(0.014)	(0.015)
Making use of travel time	−0.106***	−0.043**	0.149***	−0.114***
	(0.011)	(0.016)	(0.014)	(0.014)
Enjoyment	0.013	0.065***	0.051**	−0.047**
	(0.018)	(0.018)	(0.017)	(0.016)
Only option	0.055***	0.009	−0.064***	0.024*
	(0.012)	(0.014)	(0.013)	(0.012)
Ease of use	−0.003	−0.003	0.006	0.046**
	(0.016)	(0.019)	(0.018)	(0.016)
N	626	626	626	626

Model short-distance scenario: Wald $chi^2(50) = 312.64$, Pseudo $R^2 = 0.4811$.
Model longer-distance scenario: Wald $chi^2(25) = 148.78$, Pseudo $R^2 = 0.6022$.
Results in average marginal effects (AME).
Robust standard errors in parentheses.
$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

Table A.4. Influence of determinants on mode choice—model without income variable and without treatments.

	MNL short distance			Model longer distance
	Car	PT	Bike	Car choice =1
Age	0.000	0.002*	−0.002*	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Sex	0.004	0.056*	−0.061*	−0.073*
(1= Female, 0 = male)	(0.024)	(0.028)	(0.028)	(0.029)
Dummy Income missing	−0.024	−0.009	0.034	0.050
(1 = missing, 0 = nonmissing)	(0.034)	(0.038)	(0.035)	(0.041)
City and agglomeration	−0.028	0.084*	−0.056	−0.019
	(0.029)	(0.036)	(0.033)	(0.034)
General travel card	−0.078**	0.071*	0.007	−0.291***
	(0.028)	(0.032)	(0.030)	(0.032)
Half-price travel card	−0.044	0.045	−0.001	−0.197***
	(0.024)	(0.030)	(0.030)	(0.030)
Car	0.362***	−0.258***	−0.104**	0.462***
	(0.049)	(0.032)	(0.036)	(0.046)
Bike	0.007	−0.168***	0.161***	0.025
	(0.027)	(0.027)	(0.031)	(0.035)
Thinking of a travel partner	0.125***	−0.014	−0.111***	0.115***
	(0.025)	(0.027)	(0.027)	(0.029)
Choosing the cheapest option	−0.031**	−0.001	0.032**	−0.005
	(0.010)	(0.012)	(0.012)	(0.013)
Habit	−0.005	0.067***	−0.062***	−0.039*
	(0.017)	(0.018)	(0.017)	(0.018)
Traveling fast	0.123***	−0.043**	−0.081***	0.017
	(0.014)	(0.014)	(0.013)	(0.016)
Making use of travel time	−0.114***	−0.046***	0.160***	−0.011
	(0.010)	(0.013)	(0.014)	(0.014)
Enjoyment	0.003	−0.062***	0.059***	0.016
	(0.018)	(0.017)	(0.017)	(0.019)
Only option	0.051***	0.008	−0.059***	0.032*
	(0.011)	(0.013)	(0.012)	(0.013)
Ease of use	0.000	−0.002	0.002	0.028
	(0.015)	(0.017)	(0.016)	(0.017)
N	737	737	737	737

Model short-distance scenario: Wald $chi^2(32) = 345.68$, Pseudo R^2 0.4581.
Model longer-distance scenario: Wald $chi^2(16) = 160.80$, Pseudo $R^2 = 0.3223$.
Results in average marginal effects (AME).
Robust standard errors in parentheses.
$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

Table A.5. Numbers of associations/codings “ease of use.”

	Short-distance scenario	Longer-distance scenario
Car users	**n = 229**	**n = 285**
Not complicated/requires little effort	94	140
Flexibility	93	132
Practicality	23	35
Faster/Shorter travel time	33	23
Cost	6	9
Routine	1	4
Public transport users	**n = 136**	**n = 231**
Not complicated/requires little effort	80	104
Flexibility	80	104
Preference for traveling by train	32	52
Quality time	10	29
Routine	7	14
Availability of general travel card or half-price travel card	16	31
Same or shorter travel time	7	13
Reliability (more reliable than car)	5	13
Environmentally friendly		4
Security		1
More appropriate for longer distances		4
No availability of car or having no driver license		1
Bike users	**N = 196**	
Not complicated/requires little effort	109	
Flexibility	86	
Faster/Making use of shortcuts	37	
Cheaper	18	
Health	24	
Having fun	12	
Routine	2	
Security	2	
No availability of car or having no driver license	3	