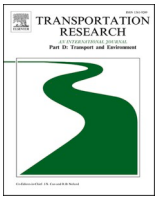
Transportation Research Part D 130 (2024) 104185

Contents lists available at ScienceDirect

Transportation Research Part D

journal homepage: www.elsevier.com/locate/trd



Satisfaction-induced travel: Do satisfying trips trigger more shared micro-mobility use?

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ARTICLE INFO

Keywords:
Travel satisfaction
Travel behavior
Shared micro-mobility
Sustainability
Europe

ABSTRACT

Most studies on travel satisfaction assumed it as an outcome of travel choices. However, travel choices may also be affected by people's satisfaction with travel. Ignoring this potential reverse effect will lead to an biased understanding on the link between travel behavior and subjective wellbeing. This research examined the influence of travel satisfaction on travel behavior, using questionnaire survey data on shared micro-mobility services in three European cities in 2022. The research findings suggest that travel satisfaction can serve as both pull factors and push factors of travel mode choice. A high satisfaction with shared micro-mobility trips encourages people's future use of these services. A relatively low satisfaction with daily travel also prompts the non-users to try shared bikes/e-bikes as alternative transport modes. Our research provides direct evidence on the feedback effect of travel satisfaction on travel behavior.

1. Introduction

To help guide the development and policy-making of transportation system, numerous studies have examined the determinants of travel behavior (Cao et al., 2009; Ewing and Cervero, 2010; Stevens, 2017; Guan et al., 2020). Meanwhile, as an indicator to measure people's judgement of travel and evaluate the quality of transportation services, travel satisfaction also received increasing research attention in the transportation filed (Ettema et al., 2011; Wang et al., 2020; Hu et al., 2023). Therefore, many studies have investigated the association between travel behavior and travel satisfaction over the last decades (Mao et al., 2016; De Vos et al., 2019a; Ye et al., 2022). Existing literature generally concludes that travel satisfaction is determined by travel behavior characteristics, such as travel time and mode choice (St-Louis et al., 2014; Ye and Titheridge, 2017).

However, studies typically assume travel satisfaction as an outcome of travel choice, ignoring that travel mode choice may also be affected by people's satisfaction with previous travel. On the one hand, studies have found that individuals generally choose the activity that gave them highest satisfactory experiences before (Kahneman and Krueger, 2006). Thus, it is also possible that a high satisfaction with trips by certain mode may encourage people to use that mode more in the future. One the other hand, the cognitive dissonance theory suggests that the dissonance between attitudes and behavior can result in feelings of discomfort, and such dissatisfaction will trigger changes in behavior (or attitudes) to reduce the cognitive dissonance (Festinger, 1957). According to this theory, a lower travel satisfaction may result in changes in future travel choices (De Vos and Singleton, 2020). In both cases, travel satisfaction could be a factor that affects travel behavior, rather than being solely a result of it. However, although the possibility of such effect has

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https://doi.org/10.1016/j.trd.2024.104185
Received 8 August 2023; Received in revised form 9 February 2024; Accepted 25 March 2024
Available online 3 April 2024

been acknowledged by some scholars (e.g., De Vos and Witlox, 2017), empirical evidence is still scarce.

Two complementary questions are worth investigating to understand the travel satisfaction's impact on travel behavior: First, could a high satisfaction with travel by certain mode encourage more trips by that mode in the future (as a pull factor, De Vos et al., 2019b)? Second, could a low satisfaction with current travel trigger people to use alternative modes (as a push factor)? While the first questions could be examined straightforward, analyses on the second one will be easily biased by people's travel habits and mobility level. For example, transit riders may not have the awareness to change their travel modes because of the habitual use of public transport, or unable to do so due to the lack of other available travel options, even if they have a high willingness to do so because of low travel satisfaction. If so, models on transit riders' past travel satisfaction and future travel mode choice would likely underestimate the role of unsatisfied trips in triggering travel changes. Fortunately, the recent introduction of shared micro-mobility services (SMM, e.g., shared bikes, e-bikes, and e-scooters) in many cities provides an arena to address this issue, since these shared mobility services prove a 'window of opportunity' to rethink and adjust travel choices by updating transport system and offering a potential alternative travel option for most people.

This research aims to shed light on the reverse influence of travel satisfaction on travel behavior taking advantage of the recently implemented shared micro-mobility services in three European cities (Malmö, Manchester, and Utrecht). In particular, we regressed intended (instead of current) use of SMM services on travel satisfaction to partially address the time precedence issue. To validate both hypotheses above, we divided the respondents into two groups (i.e., SMM users vs. non-users) and developed models respectively. For SMM users, we examined whether satisfaction with SMM trips increases the intention to use SMM services. For SMM non-users, we examined how satisfaction with current daily travel influences their intention to adopt SMM, as alternative transport options. The modelling results on these two sub-groups will provide new evidence on the impact of travel satisfaction on future travel choices. The research findings also generate insights on the prediction and modification of the general population's future travel patterns, such as the usage of SMM, based on current subjective wellbeing level.

2. Literature review

2.1. The impact of travel behavior on travel satisfaction

As a middle-term domain of subjective well-being, travel satisfaction indicates individuals' affective and cognitive evaluation on daily travel (Diener et al., 1999; De Vos and Witlox, 2017). Over the last decades, numerous studies have examined the association between travel behavior and travel satisfaction. Regardless of the spatial contexts, most studies found that bicyclist and pedestrians are generally most satisfied, followed by car users, while transit riders tend to report the lowest travel satisfaction (St-Louis et al., 2014; Mao et al., 2016; Ye and Titheridge, 2017; De Vos et al., 2021). However, different findings also exist, especially for commuting trips. For instance, a few recent studies reported that transit commuters have higher commuting satisfaction than car commuters (Schneider and Willman, 2019; Ma et al., 2021). Besides travel mode choice, travel satisfaction is also related with many other trip characteristics. For example, it was commonly found that travel duration is negatively related to travel satisfaction level (Higgins et al., 2018; De Vos et al., 2019a; Wang et al., 2020; Hu et al., 2023), and this also applies to travel distance (Schneider and Willman, 2019) and travel monetary cost (Olsson et al., 2020). Travel frequency has a similar negative effect on travel satisfaction, as the frequent users of car or public transport were found to be less satisfied with daily travel than non-frequent users (Susilo and Cats, 2014; Waygood et al., 2019; Olsson et al., 2020; Li et al., 2022). People's travel satisfaction level also varies across travels for different purpose. In general, recreational trips are more satisfactory compared with other trips, such as commuting (Ory and Mokhtarian, 2005; Ettema et al., 2013; Zhu and Fan, 2018). In addition, scholars have also revealed the significant roles of departure time (Morris and Hirsch, 2016), travel time reliability (Ettema et al., 2010; Sukhov et al., 2021), activities during travel (Ettema et al., 2011; Tang et al., 2018) and trip companionship (Zhu and Fan, 2018) in travel satisfaction.

Many relevant research have controlled for environmental factors which may affect both travel behavior and travel satisfaction. One aspect is the built environment. Numerous literatures have found that compact development (e.g., dense, mixed-use, and transit-oriented development) can reduce driving and encourage travel by alternative modes (Cao et al., 2009; Ewing and Cervero, 2010; Stevens, 2017). However, findings on the built environment impact on travel satisfaction are inconsistent. Some studies reported that travel satisfaction level is higher in neighbourhoods characterized by high population density (Mouratidis et al., 2019) and better transit services and walkability (Ettema et al., 2011; Kim et al., 2014), which suggest a positive impact of compact development on travel satisfaction. Meanwhile, some others found non-significant (Ye and Titheridge, 2019; Handy and Thigpen, 2019) or opposite effects (De Vos and Witlox, 2016) of the built environment attributes. Besides, though received much fewer research attention, studies have also found the significant effect of the natural environment (e.g., Ettema et al., 2017) and social environment (e.g., Wang et al., 2020) on travel satisfaction.

Personal attributes like socio-demographics were more commonly controlled in research on travel behavior and travel satisfaction. In general, while socio-demographics are important determinators of travel behavior (Cao et al., 2009), they were found to be less predictive for travel satisfaction (e.g., Bergstad et al., 2011; Olsson et al., 2013). Nevertheless, some research still revealed the significant impacts of age, gender, personal income, and health limitations on travel satisfaction (Cao and Ettema, 2014; Mokhtarian et al., 2015; De Vos and Witlox, 2016; Ye and Titheridge, 2017). As an important factor that enables driving, car ownership level is associated with travel mode choice substantially, and can mediate the built environment impact on travel behavior (van Acker and Witlox, 2010; Ding et al., 2017). Meanwhile, recent studies suggested that the ownership of private cars shows no or a negative impact on travel satisfaction (De Vos et al., 2021; Li et al., 2022).

Some relevant studies also addressed the potential confounding role of travel attitudes. As suggested by the Theory of Planned

Behavior (Ajzen, 1991), travel attitudes could determine travel choices directly (together with social norms and perceived behavioral control). Besides, they may also affect travel behavior indirectly via long-term life choices such as the residential location (Guan et al., 2020; van Wee and Cao, 2022), work location (de Abreu e Silva, 2014), and car ownership decisions (Van Acker et al., 2014), which is referred as the "self-selection" phenomenon (van Wee, 2009; Guan and Wang, 2020). Similarly, travel attitudes can also influence travel satisfaction either directly, or indirectly through long-term choices (De Vos and Witlox, 2017; Li et al., 2022) and travel behavior (Ye and Titheridge, 2017; De Vos et al., 2022a). Not surprisingly, empirical studies generally concluded that the preference for certain mode results in more use of that mode (Bohte et al., 2009; Cao et al., 2009), and also increases the satisfaction level towards travels by that mode (St-Louis et al., 2014; Mokhtarian et al., 2015; De Vos, et al., 2016; Ye and Titheridge, 2017). Besides, it was also found that people who like travelling tend to have a longer travel time and also a higher travel satisfaction than others (Cao and Ettema, 2014; De Vos and Witlox, 2016).

A few researchers examined how travel behavior interacts with personal attributes in affecting travel satisfaction. For example, Ye and Titheridge (2019) investigated how the influential factors of commuting satisfaction vary across different income groups in Xi'an, China. They found that travel mode choice matters for commuting satisfaction in the higher income group, but not in the lower income group. Besides, the mismatch between travel attitudes and travel behavior (i.e., travel dissonance) was also found to influence travel satisfaction negatively, and this applies for both travel mode choice (De Vos, 2018; Ye and Titheridge, 2019; De Vos et al., 2021) and travel duration (Humagain and Singleton, 2020; Ye et al., 2020; Ma et al., 2021).

2.2. *The influence of travel satisfaction on travel behavior*

Although the majority of studies assumed travel satisfaction as an outcome of travel behavior, the reverse effect has also been acknowledged by a few researchers. De Vos and Witlox (2017) pointed out that travel satisfaction may affect future travel mode choice by determining the experienced utility (the experience of feelings and emotions during trips) of using certain mode. This argument is in supported by previous studies on public transport customers' behavior, which suggested that satisfaction with the quality of public transport services is positively related to the loyalty and future intention to use transit services (Lai and Chen, 2011; Van Lierop and El-Geneidy, 2016). Besides, since a satisfactory trip by certain mode may increase a person's preference for it, travel satisfaction may also influence travel behavior indirectly by shaping people's travel attitudes, and in turn the desire and intention to use certain mode (De Vos et al., 2022a).

However, so far very few studies have examined the feedback effect of travel satisfaction on travel behavior. To the best of our knowledge, one of the exceptions is De Vos et al. (2019b). Based on data from an 2012 Internet travel survey in the city of Ghent (Belgium), they revealed the cyclical relationships among travel mode choice, travel mode attitude, and satisfaction towards the most recent leisure trip using structural equation models. However, the cross-sectional nature of used data made it impossible to defend a causal impact of travel satisfaction on travel behavior confidently, since the time precedence between the two factors may not be met. As suggested by the authors, longitudinal data with repeated observations of travel satisfaction and travel behavior over time would be most appropriate. Given that such surveys are time-consuming and quite rare, studies based on quasi-longitudinal (with recalled past travel satisfaction) or stated preference (with intended future travel behavior) surveys could be an alternative and initial attempt to examine the causal impact of travel satisfaction on travel behavior (Lai and Chen, 2011; Van Lierop and El-Geneidy, 2016). Following this idea, De Vos et al. (2022b) further examined the influence of current satisfaction level of public transport on the intention to use public transport in later life stages using data from a 2013 survey conducted in Quebec, Canada. The modelling results indicated that intentions for future public transport use are stronger for those with relatively higher satisfaction levels of public transport at present.

Moreover, while previous studies have suggested that satisfaction and usage of the same mode tend to be interrelated, the complementary hypothesis was largely neglected. That is, if people are more willing to use alternative modes when they are dissatisfied with current travel? This hypothesis is in line with Festinger's cognitive dissonance theory (1957), which suggests that individuals tend to reduce discomfort by changing either behavior or attitudes to make them match better. Accordingly, people with low travel satisfaction at present will try to seek new transport options in the future if possible (De Vos, 2019; De Vos and Singleton, 2020). However, as mentioned, the achievement of such effect largely depends on individuals' access to alternative transport modes. In other words, the validation of this hypothesis requires that there is a transport option that available for all the sampled individuals. Abou-Zeid et al. (2012) made an initial attempt along this direction. They conducted a intervention-based study based on 30 habitual car commuters who had public transport available for commuting, and found that participants who continued to use public transport after the intervention (i.e., commute by public transport for 2–3 days in a week) had a higher public transport satisfaction during the intervention than those not. However, the small sample size prevented the authors from providing multivariate analyses evidence. The recent implementation of SMM services in many cities provides an avenue for investigating this complementary hypothesis. Given that SMM services provides an potential alternative travel mode for most people in the service areas, analyzing the influence of travel satisfaction on SMM use will help clarify the reciprocal influences between travel behavior and travel satisfaction.

The importance of travel satisfaction in affecting SMM use is also supported by studies on the loyalty and continuance intentions to adopt such services. For example, based on data from 224 bikeshare consumers in China, Kim and Kim (2020) found that perceived enjoyment plays an important role in the formation of continuance intention via shaping the consumers' trust to bikeshare. Similarly, in another study in Chicago, Javadinasr et al. (2022) found that the users' perceived enjoyment, usefulness, and reliability of using shared e-scooters showed significant and positive effects on their continuance intention. These studies highlight the potential of travel satisfaction in modifying travel behavior. However, they focused on the users of SMM services only, while whether a low travel satisfaction can trigger non-users to adopt these new services has not been investigated.

3. Conceptual framework

Fig. 1 presents the conceptual framework of this research. We aim to provide a more comprehensive understanding on the impact of travel satisfaction on future travel behavior (i.e., intention to use SMM) by testing both hypotheses: 1) *H1*. A high satisfaction with a certain mode will trigger more trips by that mode in the future; 2) *H2*. People are more willing to change mode choice when they were dissatisfied with current travel. The dependent variable "intention to use SMM" has different means for SMM users and non-users. For users, it represents the continue adoption of currently used mode(s), while for non-users, it means the willingness to try new alternative mode(s). Taking the advantage of this, we divided the sample into two groups based on the usage experience of SMM to investigate the two hypotheses respectively. For SMM users, we assumed that a higher satisfaction with travels by SMM contributes to a high intention on future SMM use (i.e., *H1*) (Van Lierop and El-Geneidy, 2016; De Vos et al., 2019b). Besides, it was hypothesized that future SMM use also depends on current SMM use amount, as the state dependency effect (Wang and Lin, 2019). For non-users, we used current satisfaction with whole daily travel as the predictor to examine whether people tend to use alternative modes (i.e., SMM services) when they were less satisfied with daily travel at present (i.e., *H2*). For both groups, attitudes towards SMM are also assumed to affect the intention to use SMM, as suggested by the Theory of planned behavior (Ajzen, 1991; Bohte et al., 2009). Personal socio-economics and residential built environment attributes were included in both models since they were found to be important determinators of SMM use (Dill and McNeil, 2021; Reck and Axhausen, 2021). Modelling results on two groups will help understand how travel satisfaction may affect future travel choices in different ways.

4. Methodology

4.1. Data

Data used in this research comes from an online questionnaire survey conducted from June to September 2022 in three European cities, including Utrecht (Netherlands), Malmö (Sweden), and Manchester (UK). The three cities were selected because of their comparable city size (with a population of 0.35–0.55 million) and the affluent SMM services provided. In 2022, public transport rental bicycles (*OV-fiets*), shared e-bikes & e-mopeds (*Tier*), and shared e-cargo bikes (*Cargoroo*) were available in Utrecht. The city of Malmö provided shared e-scooters (*Lime*, *Tier*, and *VOI*) and both docked (*Malmöbybike*) and dockless shared bikes (*Donkey Republic*). Shared bikes/e-bikes (*the Bee Network Cycle Hire*) and shared e-scooters (*Lime*) were provided in the city of Manchester and some other regions of Great Manchester (Salford and town of Trafford). The respondents were recruited from residents in the areas where shared micro-mobility services were available via local survey companies. Each respondent was asked to fill in an online questionnaire which included information on personal socio-demographics, access to different kinds of mobility instruments, the use frequency of different SMM services in his/her city, overall impression of different SMM services, and overall travel satisfaction at present. In addition, the users of any kind of SMM services were asked about their perceived changes in overall travel satisfaction after using that SMM. The first part of postal code (i.e., first 3 digit in Malmö/Manchester, and 4 digit in Utrecht) at the residential location was also collected from each respondent. In total, we got 2110 completed questionnaires from three cities. After data cleaning, the final sample for this study includes 1596 respondents, with 467 shared bike users (from all three cities), 261 shared e-bike users (from Manchester and Utrecht), and 409 shared e-scooter users (from Malmö and Manchester). Shared e-moped and e-cargo bike users were not included in following multivariate analyses due to small sample size.

4.2. Measurements of variables

The respondents were asked to report the frequency of using each kind of SMM services in their cities 12 months prior to the survey, which was recorded in a 7-point scale: (1) (Almost) never; (2) 1–5 days a year; (3) 6–11 days a year; (4) 1–3 days a month; (5) 1–3 days a week; (6) 4–6 days a week; (7) Daily. For certain kind of SMM, we considered the respondents who have used it at least 1–5 days a year as "users" (i.e., the sample for Model I), and others as "non-users" (i.e., the sample for Model II).

Table 1 shows the variables included in two groups of models. The respondents were asked to indicate "how much do you intend using the following forms of SMM in the future on at least one day a week?", which is recorded in 7-Likert scale (from very low to very high). We created a dummy variable based on this question to measure the intention to use SMM, and took it as the dependent variable.[1] Our questionnaire includes two kinds of travel satisfaction measures. For users of certain kind of SMM, we asked to what extent the use of that SMM impacted travel satisfaction in 5-Likert scale (from much decreased to much increased). This self-reported change in travel satisfaction reflects the users' satisfaction level with SMM trips. We named it as "travel satisfaction increase" and included it in SMM user models (Fig. 1, Model I). Meanwhile, all the respondents were asked to indicate their overall satisfaction level with daily travel in 7-Likert scale (from very low to very high). This travel satisfaction variable was used in SMM non-user models (Fig. 1, Model II).[2] Attitudes towards SMM were captured by the question "please indicate your overall impression of the following forms of shared micro-mobilities" in 5-Likert scale (from very negative to very positive).

[1] Because the proportional odds assumption is violated in our data, we recoded the dependent variable into dichotomous variable and estimated binary logistic regression models instead of ordinal regression models.

[2] Considering that the measurement "overall travel satisfaction" may be statistically coupled with "travel satisfaction increase", the former is not included in SMM user models to avoid potential collinearity problem.

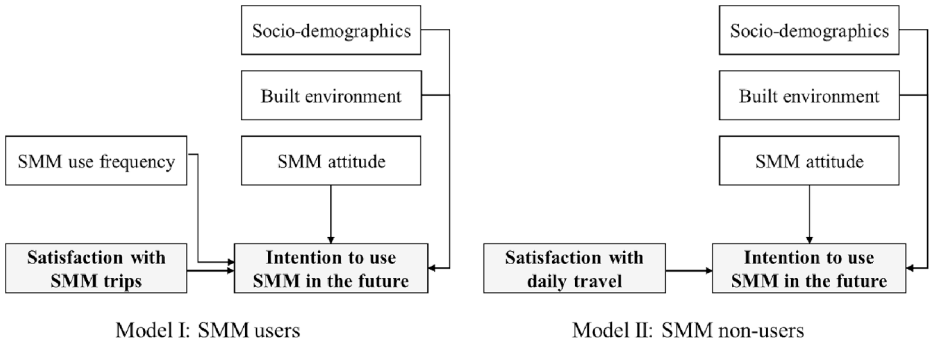

Fig. 1. Conceptual model.

Personal and household socio-demographics in the models include age, gender, employment status, education level, the ownership of driver license, the presence of children, and household income. In addition, the respondents were asked to indicate if they had "a condition that substantially limits basic physical activities such as walking, climbing stairs, or carrying". We also added this variable into the models to capture the influence of physical disability on SMM use intention. Measures on the access to transportation modes include the ownership of public transport seasonal tickets and the access to private cars. For (both the user and non-user) models on each kind of shared micro-mobility, we also controlled for the access to the corresponding private micro-vehicle (e.g., access to private bike was included in shared bike models).

The residential built environment is measured at the 3-digit post code level in Malmö and Manchester, and 4-digit post code level in Utrecht. Two variables are used to capture the urbanity level of the home location: population density and the distance from home (the central point of the residential neighborhood) to the city center. We also collected the spatial locations of train, bus, and tram stations as well as cycling paths in the three cities from Open Street Map. By spatial joining the station locations with the postal code boundary in ArcGIS Pro, we created three variables on transport infrastructure: the distance from home to the nearest train station, density of local public transport (bus and tram) stations, and density of cycling paths.

5. Empirical analyses and findings

According to the conceptual model (Fig. 1), two groups of binary logistic regression models were estimated based on the variables presented in Table 1 and Table 2 respectively: 1) Model I: SMM user models; 2) Model II: SMM non-user models. Because the intention to use certain SMM is collected for different kinds of SMM separately, in both groups of models, three kinds of SMM were tested respectively: shared bikes, shared e-bikes, and shared e-scooters, resulting in six models in total. The modelling results could capture the potential difference among SMM services in terms of the travel satisfaction's impact on future use intention. The two groups of models share the same dependent variable and most of the independent variables. The main difference is regarding the travel satisfaction measure. SMM user models (Model I) uses the change of travel satisfaction after SMM usage, while SMM non-user models (Model II) include overall travel satisfaction at the survey time. Besides, for the user model on certain kind of SMM, the current use frequency of that SMM is included to address the state dependency effect. For the non-user model on certain SMM, the use of other shared micro-mobilities (yes or no) was included as a predictor. We controlled for the city dummies in all the models to address the potential influence of spatial context. The models provided acceptable fit measures in general, while the contribution to the variance explained is higher for the shared electric modalities, specifically for shared e-scooters.

5.1. *The impact of travel satisfaction on SMM use intention*

Tables 2 and 3 presents the estimation results of SMM user models and non-user models, respectively. As shown in Table 2, an increased travel satisfaction because of shared bike use shows a positive effect on the continuance intention to use it. In other words, shared bike users who were more satisfied with trips by this mode are more likely to adopt it in the future than unsatisfied users. This effect was more remarkable for shared e-bike users and even more for shared e-scooter users, where satisfied users are more than two times more likely to use shared e-scooters in the future than their counterparts. In general, these results indicate that a high satisfaction with travel by SMM will trigger more SMM use in the future, in accord with previous findings that users' perceived enjoyment in using SMM is positively related with their continuance intentions to adopt SMM (Kim and Kim, 2020; Javadinasr et al., 2022).

Table 3 shows the effect of the independent variables on the intention to use SMM in the future for respondents who had not use the evaluated modality in the past. We found a significant effect of overall travel satisfaction on the willingness to try new forms of transport modes in the future. Bikeshare non-users with a middle level of travel satisfaction are more likely to use it in the future than respondents reporting high travel satisfaction. This is also the case for non-users of shared e-bikes, but similar influence was not found in the shared e-scooter model.

In this sense, our findings support partially the *H2* and suggest that a relatively lower level of travel satisfaction could represent an opportunity to change, or at least try, other forms of mobility. However, it also worth noted that individuals with the lowest level of

Table 1
Variables in the user and non-user models.

Variables	Explanation	Mean/% (Standard Deviation)					
		Model I: Users			Model II: Non-users		
		Shared bike (N = 467)	*Shared e-bike* (N = 261)	*Shared e-scooter* (N = 409)	*Shared bike* (N = 1045)	*Shared e-bike* (N = 455)	*Shared e-scooter* (N = 828)
High intention to use	Shared bike	64 %	——	——	14 %	——	——
	Shared e-bike	——	76 %	——	——	26 %	——
	Shared e-scooter	——	——	64 %	——	——	12 %
Travel satisfaction increase	1: Increased; 0: Decreased or neutral	34 %	46 %	31 %	——	——	——
SMM use frequency							
Weekly use	>= 4 days a month	37 %	40 %	33 %	——	——	——
Monthly use	1 ~ 3 days a month	23 %	26 %	24 %	——	——	——
Annual use	< 1 day a month	41 %	33 %	43 %	——	——	——
Current travel satisfaction	High (6–7)Middle	——	——	——	50 %	44 %	51 %
	(4–5)Low	——	——	——	36 %	40 %	36 %
	(1–3)	——	——	——	14 %	16 %	13 %
User of other SMM	1: Yes; 0: No	——	——	——	19 %	21 %	15 %
Country	United Kingdom	41 %	67 %	41 %	23 %	57 %	32 %
	Sweden	35 %	——	59 %	61 %	——	68 %
	Netherlands	24 %	33 %	——	16 %	43 %	——
Attitude towards SMM [a]	1: Positive; 0: Negative or neutral	75 %	77 %	65 %	54 %	57 %	25 %
Age	18–29	38 %	43 %	40 %	18 %	25 %	16 %
	30–39	37 %	37 %	40 %	26 %	25 %	25 %
	40–50	15 %	15 %	14 %	16 %	16 %	18 %
	50+	10 %	5 %	6 %	40 %	34 %	41 %
Gender (male)	1: Male; 0: non-male	52 %	59 %	54 %	42 %	39 %	40 %
Household with children	1: Yes; 0: No	39 %	44 %	37 %	30 %	33 %	33 %
Employed	1: Employed; 0: Unemployed	82 %	86 %	80 %	66 %	69 %	65 %
High-educated	1: Bachelor or higher: 0: Otherwise	66 %	64 %	56 %	50 %	51 %	53 %
Driver license	1: Have a driver license; 0: No	84 %	87 %	88 %	83 %	75 %	81 %
Income	Low income	29 %	34 %	26 %	32 %	50 %	29 %
	Medium income	23 %	22 %	23 %	24 %	20 %	25 %
	High income	48 %	44 %	51 %	44 %	30 %	46 %
Disabled to ride	1: Yes; 0: No	5 %	8 %	5 %	10 %	13 %	9 %
Car availability	1: Yes; 0: No	83 %	89 %	85 %	78 %	75 %	76 %
Access to private micro-mobility[a]	1: Yes; 0: No	83 %	58 %	21 %	70 %	15 %	4 %
PT subscription	1: Yes; 0: No	54 %	57 %	42 %	33 %	35 %	31 %
Population density	Number of population (thousand/km^2)	5.10 (3.24)	5.24 (3.08)	4.49 (2.80)	4.68 (3.24)	5.48 (3.28)	4.17 (2.88)
Transit density	Number of bus & tram stations per km^2	13.95 (8.05)	16.15 (9.44)	13.97 (8.55)	12.17 (6.98)	14.51 (7.60)	12.43 (6.89)
Distance to the city center	Distance from the neighborhood to the city center (km)	5.24 (4.60)	6.29 (5.55)	4.89 (3.99)	4.66 (3.38)	5.58 (4.44)	4.93 (3.45)
Cycle paths density	The length (km) of cycle route (/km^2)	3.32 (2.39)	2.36 (2.29)	3.30 (2.23)	3.92 (2.20)	2.83 (2.58)	3.49 (2.17)
Distance to train station	Distance from the neighborhood to the nearest train station (km)	1.93 (1.25)	1.93 (1.49)	1.83 (0.95)	1.82 (0.99)	1.82 (1.30)	1.82 (0.87)

[a] Only attitude towards (or access to) the corresponding mode is reported in the table. For example, only attitude towards shared bike (or access to private bike) is reported in shared bike user/non-user models.

travel satisfaction did not report a significantly higher intention to trying SMM compared with their counterparts. These results may suggest that people whose daily travel is barely acceptable considered SMM as an addition in daily life, which can be utilized for short-distance recreation trips or the first/last-mile trip to public transit stations conveniently. However, individuals with the lowest level of travel satisfaction may face more critical travel constraints that SMM can hardly help, such as long-distance commuting, unaffordability for daily transport, lack of skills to use transport-related apps, or extreme aversion attitude to travel. They thus did not consider SMM as a potential solution to significantly improve their current travel conditions.

Table 2
Modelling results on the intention to use SMM (user models).

	Shared bike user (N = 467)		Shared e-bike user (N = 261)		Shared e-scooter user (N = 409)	
Variables	B	Exp (B)	B	Exp (B)	B	Exp (B)
Sweden	0.034	1.035	——	——	−1.010	0.364
Netherlands	0.266	1.305	0.207	1.231	——	——
Positive SMM attitude	1.297***	3.659	1.112**	3.041	1.859***	6.416
Travel satisfaction increase	0.539**	1.714	0.658*	1.931	0.767**	2.153
SMM use frequency						
Weekly use (ref.)						
Monthly use	−0.899**	0.407	−0.496	0.609	−0.610	0.544
Annual use	−1.714***	0.180	−1.298***	0.273	−1.832***	0.160
Age (ref: 30–39)						
18–29	0.449	1.567	−0.465	0.628	0.657**	1.930
40–50	−0.665**	0.514	−1.238**	0.290	0.937**	2.552
50+	−0.042	0.916	−1.119	0.327	−0.516	0.597
Gender (female)	0.179	1.196	−0.423	0.655	−0.087	0.917
Household with children	0.607**	1.835	0.976**	2.655	0.359	1.432
Employed	0.028	1.028	−0.065	0.938	0.632	1.881
Bachelor and higher	−0.231	0.793	−0.478	0.620	−0.578*	0.561
Driver license	0.058	1.060	−0.040	0.960	−0.643	0.526
Income (ref: low)						
High	−0.133	0.876	−0.655	0.519	−0.342	0.710
Medium	−0.237	0.789	0.211	1.235	−0.394	0.675
Disabled to ride	−0.357	0.700	−0.206	0.814	−1.261*	0.283
Car availability	0.015	1.015	−0.189	0.828	0.877*	2.404
Access to private micro-mobility	−0.011	0.989	0.261	1.242	0.912**	2.488
PT subscription	−0.084	0.919	0.528	1.696	0.333	1.396
Population density	−0.011	0.989	0.096	1.101	−0.081	0.923
Transit density	0.002	1.002	0.024	1.024	0.048*	1.049
Distance to the city center	0.021	1.022	0.125**	1.133	0.163**	1.177
Cycle paths density	−0.053	0.949	0.037	1.038	0.325*	1.384
Distance to train station	−0.032	0.969	−0.023	0.977	−0.466**	0.628
Constant	0.428		−0.132		−1.156	
Model Summary						
−2 Log likelihood	509.377[a]		222.724[a]		343.502[a]	
Cox & Snell R Square	0.198		0.216		0.373	
Nagelkerke R Square	0.271		0.324		0.511	

*p < 0.1; **p < 0.05; ***p < 0.01.

5.2. Influences of other factors on SMM use intention

SMM use intention was also influenced by some other factors. The attitude factors, measured by the overall impression of certain SMM modality, clearly affects the continuance intention to use that SMM service positively (Table 2). SMM attitudes also play an important role in encouraging non-users to try these micro-mobility services in the future (Table 3), which is in line with the Theory of planned behavior (Ajzen, 1991; Bohte et al., 2009). State dependency effects were also found for SMM usage. As shown in Table 2, occasional users of certain SMM tend to had a much lower continuance intention to use that SMM than frequent users, regardless of the type of SMM services. Besides, the usage experience of some kinds of SMM can also influence people's willingness to try other SMM services. Table 3 shows that for the non-users of shared e-scooters, those who have already used shared bike/e-bike before had a much higher intention to adopt shared e-scooters in the future than those without any SMM use experience.

In this sense, shared e-scooters appeal particularly to existing SMM users who are already familiar with and open to these services. This is also the case for shared e-bike non-users, though the effect is found to be much smaller.

Regarding the effects of socio-economics, for both users and non-users, there is a tendency that elder people had a lower intention to use shared bikes/e-bikes than their younger counterparts. However, the effect of age on shared e-scooter use intention seems mixed. Compared with their younger counterparts (30–39), while elder non-users (>50) of shared e-scooters also had a lower adoption intention, elder users (40–50) reported a higher continuance use intention, similar with the youngest users (18–29). In general, these findings suggest that the oldest group (>50) are less interested in trying the SMM services in the future. Thus, they will easily be totally non-SMM users in the long run. The presence of children is positively linked with shared bike use intention in both groups of models. Besides, education level and income level show some negative effects on the intention to use shared e-bikes or e-scooters. This result indicates that shared electric vehicles may appeal more to low-income groups.

Access to other mobility instruments also influence SMM use intention. In the user models, access to private e-scooters increases the willingness to use shared e-scooters in the future. Similarly, in the non-user models, we found that bicycle owners are more interested in trying bikeshare in the future than non-owners. This result suggests that residents in our sampled cities did not take SMM as

Table 3
Modelling results on the intention to use SMM (non-user models).

	Shared bike non-user (N = 1045)		Shared e-bike non-user (N = 455)		Shared e-scooter non-user (N = 828)	
Variables	B	Exp (B)	B	Exp (B)	B	Exp (B)
Sweden	−0.882**	0.414	——	——	−0.917	0.400
Netherlands	0.073	1.076	0.139	1.149	——	——
Current travel satisfaction						
High (ref.)						
Middle	0.456**	1.577	0.496*	1.642	−0.141	0.869
Low	0.242	1.274	0.124	1.132	0.326	1.385
Positive SMM attitude	1.525***	4.595	1.463***	4.317	1.963***	7.121
User of other SMM	0.270	1.310	0.548*	1.731	1.615***	5.027
Age (ref: 30–39)						
18–29	−0.126	0.881	−0.034	0.967	0.488	1.629
40–50	−0.149	0.862	−0.331	0.718	−0.437	0.646
50+	−0.714**	0.489	−0.921**	0.398	−0.668*	0.513
Gender (female)	0.007	1.007	−0.071	0.931	0.261	1.298
Household with children	0.556**	1.743	0.311	1.365	0.392	1.480
Employed	−0.003	0.997	0.229	1.257	−0.041	0.960
Bachelor and higher	−0.217	0.805	−0.615**	0.540	−0.399	0.671
Driver license	−0.815***	0.443	−0.049	0.953	−0.255	0.775
Income (ref: low)						
High	0.048	1.049	−0.590*	0.554	−0.364	0.695
Medium	0.396	1.485	−0.008	0.992	−0.919**	0.399
Disabled to ride	−0.268	0.765	−0.441	0.443	−0.629	0.533
Car availability	0.380	1.463	0.057	1.059	0.462	1.587
Access to private micro-mobility	0.544**	1.722	0.361	1.435	−0.233	0.800
PT subscription	0.475**	1.608	0.205	1.227	0.473*	1.605
Population density	0.013	1.014	−0.013	0.987	−0.085	0.918
Transit density	−0.012	0.988	0.001	1.001	0.007	1.007
Distance to the city center	0.032	1.032	−0.029	0.972	0.002	1.002
Cycle paths density	−0.147*	0.863	0.016	1.017	0.032	1.032
Distance to train station	0.104	1.110	0.148	1.159	0.198	1.218
Constant	−2.558		−2.058		−2.745	
Model Summary						
−2 Log likelihood	685.175[a]		440.661[a]		415.367[a]	
Cox & Snell R Square	0.127		0.162		0.202	
Nagelkerke R Square	0.232		0.237		0.391	

*p < 0.1; **p < 0.05; ***p < 0.01.

complete alternatives of private micro-vehicles, and again highlights the importance of the familiarity with using micro-vehicles in SMM adoption. Another interesting finding is that people with subscriptions of public transport season ticket were more likely to use share bikes and e-scooters in the future (Table 3), probably because SMM could help them in the first/last mile of transit trips (Hirsch et al., 2019). The residential built environment attributes influence the SMM use intention only for users. In general, shared e-scooter users are more likely to continuously adopt it when they reside in suburban neighborhoods with well-equipped public transport services and cycling facilities (Table 2). The city context matters in future SMM use intention only for those non-users. Respondents from Malmö (Sweden) were less open to trying bikeshare than respondents from Great Manchester (UK).

6. Discussion

In general, the modelling results support both hypotheses about the impact of travel satisfaction on travel mode choice. A high satisfaction with SMM trips encourages individuals to continue to use these services. Besides, a relatively lower satisfaction with daily travel also triggers the non-users to try these alternative mobility instruments (i.e., shared bikes/e-bikes). What should be noted is the complex role of travel attitudes in such influences. As mentioned, travel attitudes could be confounders by affecting both travel satisfaction and travel behavior simultaneously (Ajzen, 1991; Ye and Titheridge, 2017). Meanwhile, attitudes may also be mediators since satisfied trips by certain mode may increase the intention to use it indirectly via shaping travel mode attitudes (De Vos et al., 2022a). By including travel attitudes into our models, we controlled for their potential confounding effect, while travel satisfaction's

indirect effect on SMM use intention might be absorbed by the coefficients of attitude variables. Because of this, we may underestimate the total impact of travel satisfaction on the intention to adopt SMM. To validate the findings, we re-estimated the models with attitude variables removed, finding that the effects of travel satisfaction variables increased slightly after removing attitude variables in the models.[3] These results suggest that although the attitude and satisfaction variables could be associated with each other, both of them have an independent impact on the intention to use SMM, and the independent effects of travel satisfaction is likely to be even stronger than those reported in Tables 2 and 3.

Our research findings highlight the importance of improving users' travel satisfaction for the continuation of SMM use. Improving the accessibility to SMM services, which has been found to be positively related with satisfaction with trips by SMM (Chen et al., 2022), will benefit the users' loyalty to adoption. Besides, non-users who are less satisfied with daily travel, such as transit riders (St-Louis et al., 2014; De Vos et al., 2021) and suburban residents (Mouratidis et al., 2019) could be potential adopters of shared bikes and e-bikes and worth special attention of SMM providers. However, shared e-scooters received less interest among these unsatisfied travelers, possibly because they are used mainly for shopping and recreation rather than daily commuting, therefore contribute less to overall travel satisfaction (McKenzie, 2019; Bai et al., 2021). Though further examinations are needed, the impact of travel satisfaction on modal use is likely to apply for other transportation modes (De Vos et al., 2019b). If so, policy makers should pay more attention to the travel satisfaction levels of residents in different areas of the city in the development of transportation system. New transport infrastructures (e.g., new transit lines) will be more welcomed in neighborhoods with relatively low travel satisfaction, such as suburban areas. Also, improving the service levels of non-auto transport modes and thus the users' travel satisfaction is important to form habitual non-auto travelers.

The research findings also provided insights on promoting the sustainability and equity benefits of the SMM development. We found positive effects of the access to and use of public transport on SMM use intention. This result indicates that the development of shared micro-mobility around public transport stations would achieve additional success in facilitating SMM use and multi-modality. Interestingly, the access to private micro-vehicles is positively associated with SMM use intention, suggesting that bicyclist could be the priority targeted groups of SMM service providers. Some strategies are needed to facilitate the equal use of SMM among groups. We found that elderly non-users had a lower intention to try any kind of SMM than their younger counterparts, thus will easily be excluded from SMM services. Some new kinds of SMM services which require less physical efforts in riding might be helpful to facilitate the equity in SMM use among age groups. For low-educated or low-income non-users, they had a high interest in adopting shared electric vehicles. However, as found in previous literatures (Dill and McNeil, 2021), they may have limited access to them because of low affordability or availability of these services around home. Implementing more affordable shared electric vehicles in low-income communities would benefit the equal usage of shared micro-mobility among income groups.

7. Conclusions

To our knowledge, this research is one of first empirical studies investigating the influence of travel satisfaction on travel behavior. Using data from a shared micro-mobility use survey in three European cities (Malmö, Manchester, and Utrecht), our research findings suggest that travel satisfaction can serve as both pull factors and push factors of travel mode choice. Satisfied travels by a certain mode induce more trips by that mode in the future. Meanwhile, people with a middle level of travel satisfaction are more willing to try alternative transport modes (shared bike/e-bike in our case) than those reporting high travel satisfaction. This paper contributes to a more comprehensive research framework of travel behavior and subjective wellbeing. Future studies on travel behavior and travel satisfaction should better address their bidirectional relationships to avoid endogeneity bias.

One of the limitations of this study is that travel satisfaction is measured by a single variable, which cannot distinguish the effects of different satisfaction components (e.g., affective vs. cognitive) on future travel mode choices. Future studies could investigate whether different dimensions of travel satisfaction affect the willingness to use shared micro-mobility differently. It is also valuable to further investigate why people with the lowest level of travel satisfaction did not have a high intention to use shared micro-mobility. Long commuting distance, digital divide, individuals' skills and attitudes, and spatially uneven distribution of the services might be possible reasons and should be investigated in future similar studies. Our study partially addressed the time precedence issue by examining the impact of current travel satisfaction on the intention to use shared micro-mobility. Nevertheless, longitudinal study with true panel data is highly recommended to validate to what extent the intention could really lead to travel changes, and better clarify the direction of the influences between travel behavior and travel satisfaction. Besides, while this research indicates the importance of travel satisfaction in users' loyalty to adopt shared micro-mobility, what determines people's satisfaction level with shared micro-mobility trips mostly is still largely unexplored and worth future research attention (Chen et al., 2022). Finally, due to the constraint of sample size, we pooled the samples in three cities in multivariate analyses. Future studies should better run city-specific models to capture the potential context difference regarding the travel satisfaction's impact on SMM use if the dataset permits. Also, similar studies in non-European cities are needed to verify the generalizability of the findings in this research.

[3] After removing the SMM attitude variable, the coefficient (*B*) of "travel satisfaction increase" changed from 0.539**/0.658*/0.767** to 0.635**/0.757**/1.064*** in shared bike/e-bike/e-scooter user models respectively. The coefficient (*B*) of "current travel satisfaction (middle level)" changed from 0.456**/0.496*/−0.141 to 0.462**/0.514**/−0.134 in shared bike/e-bike/e-scooter non user models respectively.

CRediT authorship contribution statement

Xiaodong Guan: Conceptualization, Data curation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing, Methodology. **Fabian Israel:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Eva Heinen:** Investigation, Supervision, Writing – review & editing. **Dick Ettema:** Funding acquisition, Investigation, Supervision, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This research is sponsored by the "COCOMO" project funded by JPI Urban Europe via national grants from: NWO, Netherlands, Grant 438-21-434; UK, Economic and Social Research Council (ESRC), Grant number ES/W000547/1; Sweden, Energimyndigheten, Dnr 2021-001267, Projektnr 51970-1.

References

Abou-Zeid, M., Witter, R., Bierlaire, M., Kaufmann, V., Ben-Akiva, M., 2012. Happiness and travel mode switching: findings from a Swiss public transportation experiment. Transp. Policy 19 (1), 93–104.
Ajzen, I., 1991. The theory of planned behavior. Organ. Behav. Hum. Decis. Process. 50 (2), 179–211.
Bai, S., Jiao, J., Chen, Y., Guo, J., 2021. The relationship between E-scooter travels and daily leisure activities in Austin, Texas. Transp. Res. Part D: Transp. Environ. 95, 102844.
Bergstad, C.J., Gamble, A., Gärling, T., Hagman, O., Polk, M., Ettema, D., Olsson, L.E., 2011. Subjective well-being related to satisfaction with daily travel. Transportation 38 (1), 1–15.
Bohte, W., Maat, K., van Wee, B., 2009. Measuring attitudes in research on residential self-selection and travel behaviour: a review of theories and empirical research. Transp. Rev. 29 (3), 325–357.
Cao, X.J., Ettema, D.F., 2014. Satisfaction with travel and residential self-selection: How do preferences moderate the impact of the Hiawatha Light Rail Transit line? J. Transp. Land Use 7 (3), 93–108.
Cao, X., Mokhtarian, P.L., Handy, S.L., 2009. Examining the impacts of residential self-selection on travel behaviour: a focus on empirical findings. Transp. Rev. 29 (3), 359–395.
Chen, Z., van Lierop, D., Ettema, D., 2022. Travel satisfaction with dockless bike-sharing: Trip stages, attitudes and the built environment. Transp. Res. Part D: Transp. Environ. 106, 103280.
de Abreu e Silva, J., 2014. Spatial self-selection in land-use–travel behavior interactions: accounting simultaneously for attitudes and socioeconomic characteristics. J. Transp. Land Use 7 (2), 63–84.
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. Transp. Res. A Policy Pract. 117, 261–274.
De Vos, J., 2019. Satisfaction-induced travel behaviour. Transport. Res. F: Traffic Psychol. Behav. 63, 12–21.
De Vos, J., Singleton, P.A., 2020. Travel and cognitive dissonance. Transp. Res. A Policy Pract. 138, 525–536.
De Vos, J., Singleton, P.A., Gärling, T., 2022a. From attitude to satisfaction: introducing the travel mode choice cycle. Transp. Rev. 42 (2), 204–221.
De Vos, J., Waygood, E.O.D., Letarte, L., Cao, M., 2022b. Do frequent satisfying trips by public transport impact its intended use in later life? Transportation 49 (4), 1245–1263.
De Vos, J., Witlox, F., 2016. Do people live in urban neighbourhoods because they do not like to travel? Analysing an alternative residential self-selection hypothesis. Travel Behav. Soc. 4, 29–39.
De Vos, J., Ettema, D., Witlox, F., 2019a. Effects of changing travel patterns on travel satisfaction: A focus on recently relocated residents. Travel Behav. Soc. 16, 42–49.
De Vos, J., Schwanen, T., Van Acker, V., Witlox, F., 2019b. Do satisfying walking and cycling trips result in more future trips with active travel modes? An exploratory study. Int. J. Sustain. Transp. 13 (3), 180–196.
De Vos, J., Mouratidis, K., Cheng, L., Kamruzzaman, M., 2021. Does a residential relocation enable satisfying travel? Transp. Res. A Policy Pract. 153, 188–201.
De Vos, J., Witlox, F., 2017. Travel satisfaction revisited. On the pivotal role of travel satisfaction in conceptualising a travel behaviour process. Transp. Res. A Policy Pract. 106, 364–373.
Diener, E., Suh, E.M., Lucas, R.E., Smith, H.L., 1999. Subjective well-being: Three decades of progress. Psychol. Bull. 125 (2), 276.
Dill, J., McNeil, N., 2021. Are shared vehicles shared by all? A review of equity and vehicle sharing. J. Plan. Lit. 36 (1), 5–30.
Ding, C., Wang, D., Liu, C., Zhang, Y., Yang, J., 2017. Exploring the influence of built environment on travel mode choice considering the mediating effects of car ownership and travel distance. Transp. Res. A Policy Pract. 100, 65–80.
Ettema, D., Gärling, T., Olsson, L.E., Friman, M., 2010. Out-of-home activities, daily travel, and subjective well-being. Transp. Res. A Policy Pract. 44 (9), 723–732.
Ettema, D., Gärling, T., Eriksson, L., Friman, M., Olsson, L.E., Fujii, S., 2011. Satisfaction with travel and subjective well-being: Development and test of a measurement tool. Transport. Res. F: Traffic Psychol. Behav. 14 (3), 167–175.
Ettema, D., Gärling, T., Olsson, L.E., Friman, M., Moerdijk, S., 2013. The road to happiness: Measuring Dutch car drivers' satisfaction with travel. Transp. Policy 27, 171–178.
Ettema, D., Friman, M., Olsson, L.E., Gärling, T., 2017. Season and weather effects on travel-related mood and travel satisfaction. Front. Psychol. 8, 140.
Ewing, R., Cervero, R., 2010. Travel and the built environment: A meta-analysis. J. Am. Plann. Assoc. 76 (3), 265–294.
Festinger, L., 1957. Theory of Cognitive Dissonance. Stanford University Press, Stanford.
Guan, X., Wang, D., 2020. The multiplicity of self-selection: What do travel attitudes influence first, residential location or work place? J. Transp. Geogr. 87, 102809.
Guan, X., Wang, D., Jason Cao, X., 2020. The role of residential self-selection in land use-travel research: a review of recent findings. Transp. Rev. 40 (3), 267–287.
Handy, S., Thigpen, C., 2019. Commute quality and its implications for commute satisfaction: Exploring the role of mode, location, and other factors. Travel Behav. Soc. 16, 241–248.
Higgins, C.D., Sweet, M.N., Kanaroglou, P.S., 2018. All minutes are not equal: travel time and the effects of congestion on commute satisfaction in Canadian cities. Transportation 45 (5), 1249–1268.
Hirsch, J.A., Stratton-Rayner, J., Winters, M., Stehlin, J., Hosford, K., Mooney, S.J., 2019. Roadmap for free-floating bikeshare research and practice in North America. Transp. Rev. 39 (6), 706–732.

Hu, Y., Sobhani, A., Ettema, D., 2023. Are men or women happier commuters? A study on the determinants of travel mode dissonance and travel satisfaction for dual-earner couples with school-age children in Ganyu, China. Travel Behav. Soc. 31, 131–140.
Humagain, P., Singleton, P.A., 2020. Investigating travel time satisfaction and actual versus ideal commute times: A path analysis approach. J. Transp. Health 16, 100829.
Javadinasr, M., Asgharpour, S., Rahimi, E., Choobchian, P., Mohammadian, A.K., Auld, J., 2022. Eliciting attitudinal factors affecting the continuance use of E-scooters: An empirical study in Chicago. Transp. Res. F: Traffic Psychol. Behav. 87, 87–101.
Kahneman, D., Krueger, A.B., 2006. Developments in the measurement of subjective well-being. J. Econ. Perspect. 20 (1), 3–24.
Kim, B., Kim, D., 2020. Exploring the key antecedents influencing consumer's continuance intention toward bike-sharing services: Focus on China. Int. J. Environ. Res. Public Health 17 (12), 4556.
Kim, S., Park, S., Lee, J.S., 2014. Meso-or micro-scale? Environmental factors influencing pedestrian satisfaction. Transp. Res. Part D: Transp. Environ. 30, 10–20.
Lai, W.T., Chen, C.F., 2011. Behavioral intentions of public transit passengers—The roles of service quality, perceived value, satisfaction and involvement. Transp. Policy 18 (2), 318–325.
Li, S.A., Guan, X., Wang, D., 2022. How do constrained car ownership and car use influence travel and life satisfaction? Transp. Res. A Policy Pract. 155, 202–218.
Ma, T.Y., Van Acker, V., Lord, S., Gerber, P., 2021. Dissonance and commute satisfaction: Which reference point to use? Transp. Res. Part D: Transp. Environ. 100, 103046.
Mao, Z., Ettema, D., Dijst, M., 2016. Commuting trip satisfaction in Beijing: Exploring the influence of multimodal behavior and modal flexibility. Transp. Res. A Policy Pract. 94, 592–603.
McKenzie, G., 2019. Spatiotemporal comparative analysis of scooter-share and bike-share usage patterns in Washington, DC. J. Transp. Geogr. 78, 19–28.
Mokhtarian, P.L., Papon, F., Goulard, M., Diana, M., 2015. What makes travel pleasant and/or tiring? An investigation based on the French National Travel Survey. Transportation 42 (6), 1103–1128.
Morris, E.A., Hirsch, J.A., 2016. Does rush hour see a rush of emotions? Driver mood in conditions likely to exhibit congestion. Travel Behav. Soc. 5, 5–13.
Mouratidis, K., Ettema, D., Næss, P., 2019. Urban form, travel behavior, and travel satisfaction. Transp. Res. A Policy Pract. 129, 306–320.
Olsson, L.E., Gärling, T., Ettema, D., Friman, M., Fujii, S., 2013. Happiness and satisfaction with work commute. Soc. Indic. Res. 111 (1), 255–263.
Olsson, L.E., Friman, M., Lättman, K., Fujii, S., 2020. Travel and life satisfaction-From Gen Z to the silent generation. J. Transp. Health 18, 100894.
Ory, D.T., Mokhtarian, P.L., 2005. When is getting there half the fun? Modeling the liking for travel. Transp. Res. A Policy Pract. 39 (2–3), 97–123.
Reck, D.J., Axhausen, K.W., 2021. Who uses shared micro-mobility services? Empirical evidence from Zurich, Switzerland. Transp. Res. Part D: Transp. Environ. 94, 102803.
Schneider, R.J., Willman, J.L., 2019. Move closer and get active: How to make urban university commutes more satisfying. Transp. Res. F: Traffic Psychol. Behav. 60, 462–473.
Stevens, M.R., 2017. Does compact development make people drive less? J. Am. Plann. Assoc. 83 (1), 7–18.
St-Louis, E., Manaugh, K., van Lierop, D., El-Geneidy, A., 2014. The happy commuter: A comparison of commuter satisfaction across modes. Transp. Res. F: Traffic Psychol. Behav. 26, 160–170.
Sukhov, A., Lättman, K., Olsson, L.E., Friman, M., Fujii, S., 2021. Assessing travel satisfaction in public transport: A configurational approach. Transp. Res. Part D: Transp. Environ. 93, 102732.
Susilo, Y.O., Cats, O., 2014. Exploring key determinants of travel satisfaction for multi-modal trips by different traveler groups. Transp. Res. A Policy Pract. 67, 366–380.
Tang, J., Zhen, F., Cao, J., Mokhtarian, P.L., 2018. How do passengers use travel time? A case study of Shanghai-Nanjing high speed rail. Transportation 45 (2), 451–477.
Van Acker, V., Mokhtarian, P.L., Witlox, F., 2014. Car availability explained by the structural relationships between lifestyles, residential location, and underlying residential and travel attitudes. Transp. Policy 35, 88–99.
Van Acker, V., Witlox, F., 2010. Car ownership as a mediating variable in car travel behaviour research using a structural equation modelling approach to identify its dual relationship. J. Transp. Geogr. 18 (1), 65–74.
Van Lierop, D., El-Geneidy, A., 2016. Enjoying loyalty: The relationship between service quality, customer satisfaction, and behavioral intentions in public transit. Res. Transp. Econ. 59, 50–59.
van Wee, B., 2009. Self-selection: a key to a better understanding of location choices, travel behaviour and transport externalities? Transp. Rev. 29 (3), 279–292.
van Wee, B., Cao, X.J., 2022. Residential self-selection in the relationship between the built environment and travel behavior: A literature review and research agenda. Adv. Transp. Policy Plann. 9, 75–94.
Wang, D., Lin, T., 2019. Built environment, travel behavior, and residential self-selection: A study based on panel data from Beijing, China. Transportation 46 (1), 51–74.
Wang, F., Mao, Z., Wang, D., 2020. Residential relocation and travel satisfaction change: An empirical study in Beijing, China. Transp. Res. A Policy Pract. 135, 341–353.
Waygood, E.O.D., Friman, M., Taniguchi, A., Olsson, L.E., 2019. Children's life satisfaction and travel satisfaction: Evidence from Canada, Japan, and Sweden. Travel Behav. Soc. 16, 214–223.
Ye, R., De Vos, J., Ma, L., 2020. Analysing the association of dissonance between actual and ideal commute time and commute satisfaction. Transp. Res. A Policy Pract. 132, 47–60.
Ye, R., De Vos, J., Ma, L., 2022. New insights in travel satisfaction research. Transp. Res. Part D: Transp. Environ. 102, 103163.
Ye, R., Titheridge, H., 2017. Satisfaction with the commute: The role of travel mode choice, built environment and attitudes. Transp. Res. Part D: Transp. Environ. 52, 535–547.
Ye, R., Titheridge, H., 2019. The determinants of commuting satisfaction in low-income population: A case study of Xi'an, China. Travel Behav. Soc. 16, 272–283.
Zhu, J., Fan, Y., 2018. Daily travel behavior and emotional well-being: Effects of trip mode, duration, purpose, and companionship. Transp. Res. A Policy Pract. 118, 360–373.