Does a satisfying trip result in more future trips with that mode?

Jonas De Vos (corresponding author)
Geography Department, Ghent University, Krijgslaan 281 s8, 9000 Gent, Belgium
e-mail: jonas.devos@ugent.be; telephone: +3292644555

Tim Schwanen
School of Geography and the Environment, University of Oxford, South Parks Road, Oxford, OX1 3QY
United Kingdom
e-mail: tim.schwanen@ouce.ox.ac.uk; telephone: +441865285503

Veronique Van Acker
Geography Department, Ghent University, Krijgslaan 281 s8, 9000 Gent, Belgium
e-mail: veronique.vanacker@ugent.be; telephone: +3292649680

Frank Witlox
Geography Department, Ghent University, Krijgslaan 281 s8, 9000 Gent, Belgium
e-mail: frank.witlox@ugent.be; telephone: +3292644553

Words in abstract: 178
Words in text: 5191
Number of references: 35
Number of Figures: 2
Number of tables: 1

Submission date: 29 July 2015

Does a satisfying trip result in more future trips with that mode?

ABSTRACT

Previous studies have indicated that travel satisfaction – the experienced emotions during, and cognitive evaluation of, a trip – can be affected by travel mode choice and other trip characteristics. However, as satisfactory trips might improve a person's attitudes toward the used mode, persons may be more likely to use that same mode for future trips of the same kind. Hence, a cyclical process between travel mode choice and travel satisfaction might occur. In this paper we analyse this process – using cross-sectional data – for people who engage in walking and cycling for leisure trips in the Belgian city of Ghent. The focus on walking and cycling reflects recent studies indicating that active travel is often associated with the highest levels of travel satisfaction. Results support the idea of a cyclical process; the evaluation of walking and cycling trips positively affects the respondents' attitude towards the respective mode, which in turn has a positive effect on choosing that mode. Furthermore, results indicate a strong effect of life satisfaction on travel satisfaction, suggesting a strong impact of long-term happiness on short-term satisfaction.

1. INTRODUCTION

Frequent walking and cycling have numerous positive effects on individuals and society more generally. First of all, active travel helps to reduce the negative effects of car dependency, such as congestion, air pollution and the risk of injury and death to road users (e.g., Song et al., 2013). Furthermore, the physical activity provided by active travel increases productivity and reduces obesity, high blood pressure and the risk of several chronic health conditions, resulting in healthier people and reduced health care costs (e.g., Sallis et al., 2004). Recent studies also indicate that people who walk or cycle experience and evaluate their trip more positively compared to people using public transport or the car (Abou-Zeid, 2009; De Vos et al., 2015a, 2015b; Ettema et al., 2011; Friman et al., 2013). Furthermore, travel satisfaction might also positively affect life satisfaction through the performance of - and satisfaction with - activities at the destination of the trip.

The inclination to engage in active travel has been explained with the help of various theoretical perspectives. Public health researchers often use ecological models in which the frequency of walking and cycling is affected by multiple levels of influence, including intrapersonal, interpersonal and environmental variables (e.g., Saelens et al., 2003); transport researchers frequently resort to utility theory according to which people choose that mode which generates the highest level of utility – or the lowest disutility – which is a function of travel time and costs and a suite of other factors (e.g., Golob et al., 1981; McFadden, 2001). Neighbourhoods' physical characteristics are also commonly shown to influence the inclination to walk and cycle. From this point of view, the 'walkability', or how a neighbourhood is suited for cycling and especially walking, is an important factor explaining walking and cycling frequency (Saelens et al., 2003; Sallis et al., 2004; Song et al., 2013). Individual values and attitudes also affect active travel use. People with a positive stance towards active travel or people preferring to live in a walkable neighbourhood tend to walk and cycle more compared to people with a preference for motorised travel and a suburban way of life (e.g., De Vos et al., 2012; Schwanen and Mokhtarian, 2005).

It is also possible, however, that people's mode choice for specific trips is affected by how they have experienced previous trips of the same kind. Recent studies indicate substantial differences in how people perceive and evaluate their trip across various travel modes (Abou-Zeid, 2009; De Vos et al., 2015a, 2015b; Ettema et al., 2011; Friman et al., 2013), which suggests that travel satisfaction is an outcome of the mode choice decision. However, given that individuals often choose activities that previously gave them satisfactory experiences (Aarts et al., 1998; Kahneman and Krueger, 2006), people may also choose a travel mode based on satisfaction with previous trips. It may well be that a trip generating high levels of satisfaction improve persons' attitude towards the used mode, which may increase the odds of them choosing that mode for future trips of the same kind. If this process repeats itself multiple times, a scripted choice and habitual mode use may come into existence (Aarts

et al., 1998; Verplanken et al., 1997). In other words, travel satisfaction may play an important facilitating role in the early stages of habit formation.

In this paper we analyse to which degree mode choice can be regarded as a process rather than a decision resulting in a certain level of travel satisfaction. The way people experience and evaluate their trip can positively or adversely affect their attitude towards the used mode, possibly affecting future mode choice decisions. We use a structural equation modelling approach to analyse the cyclical process involving mode choice, travel satisfaction and travel-related attitudes of people walking and cycling to out-of-home leisure activities.

2. PREVIOUS RESEARCH

Previous studies have indicated that numerous relationships between travel-related attitudes, travel mode choice and travel satisfaction exist. However, not all these relations have been analysed to the same degree.

2.1 The relationship between mode choice and travel satisfaction

Recently, studies have started analysing the effect of travel on happiness and well-being. Within this context, travel satisfaction is the most important measure analysing this link (De Vos et al., 2013). Travel satisfaction comprises two dimensions; i.e., an affective dimension (referring to emotions experienced during a trip) and a cognitive dimension (referring to an evaluation of the trip) (Ettema et al., 2011). Studies have indicated that travel satisfaction differs according to the mode people choose. Public transportation use tends to result in the lowest levels of travel satisfaction, while people walking or cycling are most satisfied (Abou-Zeid, 2009; De Vos et al., 2015a, 2015b; Ettema et al., 2011; Friman et al., 2013). How satisfaction with previous trips taken with a particular mode can influence mode choice has only been examined to a limited degree. To the best of our knowledge, only two studies have analysed this link. Abou-Zeid and Ben-Akiva (2012) state that a lower satisfaction with car use and a higher satisfaction with public transport use make a mode switch from car to public transport more likely. According to Reibstein et al. (1980), overall satisfaction with bus trips has a significant effect on the frequency of bus use. It is reasonable to assume that people who experienced a positive trip with a certain travel mode have a higher probability of choosing the same mode for a future trip (as long as the built environment or other elements do not constrain the use of that mode) compared to people who experienced their trip with this mode negatively.

Utility theories suggest that the experience of feelings and emotions during an activity is an outcome of the choice made in a certain decision process. From this point of view, satisfaction with travel can be regarded as the outcome of the mode choice decision. However, it is also possible that travel satisfaction, and the evaluation of travel in particular, can affect (future) mode choices. According to Kahneman and Krueger (2006), a retrospective evaluation of a past episode can affect the prospective choice of an alternative in order to maximise happiness (De Vos et al., 2015a; Ettema et al., 2010; Kahneman et al., 1997; Kahneman and Krueger, 2006). As part of this, it can be hypothesised that the evaluation of a trip (cognitive dimension) is a function of the emotions experienced during that trip (affective dimension).

2.2 The relationship between travel-related attitudes and mode choice

The relation between attitudes and mode choice has been examined rather frequently. Over the past two decades various studies have suggested that (travel-related) attitudes are important determinants of travel behaviour and mode choice (e.g., Bagley and Mokhtarian, 2002). A positive stance toward a certain mode of transportation will result in a higher use of that mode, as long as the use of this mode is not restricted by elements such as the built environment. Attitudes can also affect mode choice indirectly; individuals with an affinity toward a certain kind of travel will often choose a residential location that enables them to travel as much as possible with their preferred travel mode (De Vos et al., 2012; Schwanen and Mokhtarian, 2005; Handy et al., 2005).

Although most travel behaviour studies focus on the link from attitudes to mode choice, some studies also indicate that attitudes are conditioned by past behaviour. In other words, attitudes and behaviour

are mutually dependent on each other: attitudes both affect, and are conditioned by, choices (e.g., Dobson et al., 1978; Mokhtarian and Cao, 2008). It is therefore possible that mode choice affects travel-related attitudes. According to Reibstein et al. (1980) the frequency of bus use positively affects the attitude towards bus use. More recent studies found that a mode shift from car to public transport was accompanied by improved attitudes toward public transport (Abou-Zeid et al., 2012; Fujii et al., 2001; Fujii and Kitamura, 2003). It is also possible, however, that a cyclical process between travel-related attitudes and mode choice exists; a positive stance toward a certain mode can increase the use of that mode, while using that mode frequently might improve (or diminish) the attitude toward that mode.

2.3 The relationship between travel satisfaction and travel-related attitudes

The link between travel satisfaction and travel-related attitudes has not yet been analysed thoroughly. The limited studies that have explored this relationship indicate that these attitudes can affect travel satisfaction. Positive attitudes toward bus use (Reibstein et al., 1980) and public transport in general (Abou-Zeid et al., 2012; Abou-Zeid and Ben-Akiva, 2012) will positively affect the overall satisfaction of respectively bus use and public transport use. De Vos et al. (2015a) indicate that a positive attitude toward a certain mode has a positive effect on travel satisfaction when using that mode, especially on the cognitive evaluation of the trip. Travel satisfaction could also influence travel-related attitudes; it is plausible that a satisfying trip with a certain mode will result in a more positive stance toward that specific mode but no studies to date have examined this link. Since attitudes are an important determinant of travel mode choice and a feedback loop from satisfaction with a trip to attitudes towards the used mode is plausible, travel attitudes can be added to the proposed cyclical process between mode choice and travel satisfaction.

3. CONCEPTUAL MODEL

Based on the previous literature we construct a conceptual model analysing the possibility that a satisfying trip with a particular mode positively reinforces the probability of using that mode for a future trip of the same kind, through the improvement of attitudes toward the used mode. This positive reinforcement can increase people's tendency to continue a certain behaviour, possibly resulting in the formation of habits in the long run (Aarts et al., 1998; Verplanken et al., 1997). In our model, travel mode choice affects travel satisfaction, which in turn influences travel-related attitudes; these attitudes affect (future) mode choices (Figure 1).

In this model, which focuses on walking and cycling − because these modes are often characterised by high levels of travel satisfaction − residential location, socio-demographic background and household car ownership are also included as explanatory variables of travel mode choice. Numerous studies have examined the effect of the built environment, and the residential neighbourhood in particular, on travel mode choice (e.g., Cervero and Kockelman, 1997; Handy et al., 2005). Since travel-related attitudes can affect the residential location choice (self-selection) we also include this relationship in the model.

We have also included life satisfaction as an explanatory variable of travel satisfaction as life satisfaction, a subjective assessment of a person's life, can affect people's feelings during a certain activity or time-frame (Ehrhardt et al., 2000; Schwanen and Wang, 2014). Since an increasing number of studies indicate lower levels of life satisfaction in denser, more urbanised neighbourhoods (e.g., Schwanen and Wang, 2014), we included a direct link from the residential location to life satisfaction. Furthermore, as low car ownership constraints travel options and therefore reduces the chance of participating in the preferred out-of-home (leisure) activity and possibly reduces people's subjective well-being (e.g., Gärling et al., 2002), we also included a link from household car ownership to life satisfaction. Finally, we included links from socio-economic and demographic variables to life satisfaction, travel mode choice, household car ownership, the residential location and travel-related attitudes and a link from respondents' residential location to household car ownership.

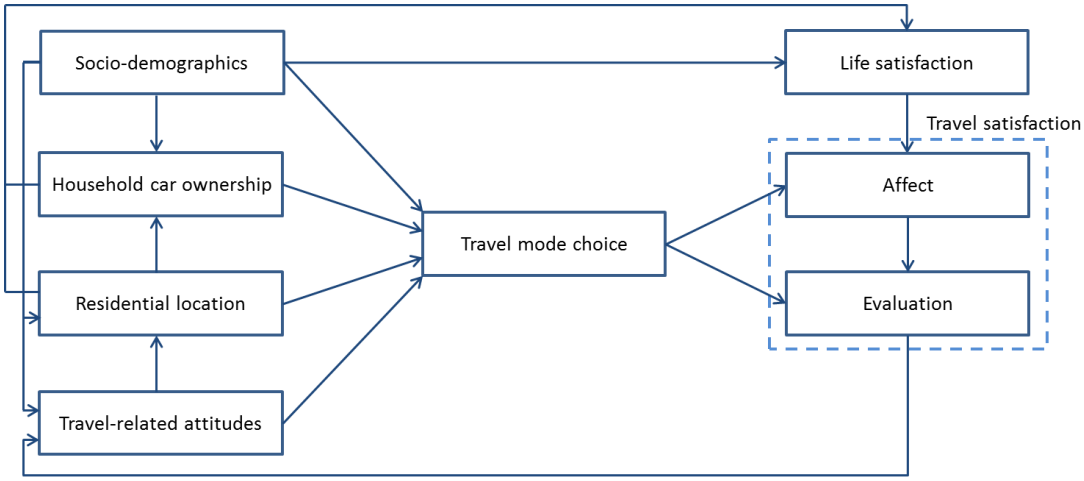

FIGURE 1 A model outlining the relationships between attitudes, mode choice and travel satisfaction

4. DATA

For this study we use data from a 2012 Internet survey on travel behaviour, residential location (choice) and travel satisfaction. Invitations with a link to the Internet survey were distributed in five typical urban neighbourhoods (characterised by high density and high diversity) and seven typical suburban neighbourhoods (characterised by low density and a design oriented toward car use) within the city of Ghent, Belgium (250 000 inhabitants). In total, 27 780 invitations were distributed, one for every household in the selected neighbourhoods, covering about one fourth of all households in Ghent. Eventually, 1807 adult persons completed the survey, of which 1720 respondents were retained after a first data cleaning. For this study we removed an additional share of respondents (see Section 4.1.1) resulting in 880 respondents. Although socio-economic and demographic variables of respondents are comparable to socio-economic and demographic variables of the total population of the selected neighbourhoods (see De Vos et al., 2015a), the low response rate (6.5%) makes it impossible to perform a descriptive analysis of the population. However, since the main goal of this study is an analytical representation of relationships among multiple variables it is more important to have a large and sufficiently diverse sample. Since our sample size is relatively large (even after removing a substantial share of respondents) coefficients to characterise specific relationships can be estimated with great confidence.

We use cross-sectional data, measuring respondents' attitudes, behaviour and experiences at one point in time. Since our model tries to measure how satisfaction with travel affects future travel choices, longitudinal data (i.e., repeated observations of the same variables over a certain period of time) would be most appropriate. Although the lack of longitudinal data in this study is a clear limitation, we do think that the cross-sectional data used in our model gives an indication of how travel satisfaction can influence future mode choices, through travel-related attitudes. This model can be seen as one piece of a repeated process (i.e., repetitive travel mode choices) where attitudes gradually change through the experience and evaluation of trips with a certain mode. These changes in attitudes can result in shifting intentions of choosing a particular mode.

4.1 Key variables

4.1.1 Travel mode choice

Respondents were asked to indicate which travel mode (car; train; bus/tram; bicycle or on foot) they used to reach their most recent out-of-home leisure activity. If they used more than one travel mode to reach their destination, they were asked to indicate the travel mode covering the longest distance. We used the most recent leisure trip (instead of the travel mode choice they usually use) because we also asked respondents to evaluate their trip. Doing so, we minimise the effect of distortions caused by the delayed recall and evaluation of experiences, and the skewing of memories of 'average' trips by extreme or unusual circumstances. For the same reason we also removed respondents performing their

most recent leisure trip at least two days before filling in the survey, resulting in 880 respondents; hence, we only include participants who undertook an out-of-home leisure activity on the day in which they filled out the survey or on the day before. Of the selected respondents, 407 (46.3%) used the car, 84 (9.5%) used public transport, 206 (23.4%) cycled, and 183 (20.8%) walked to their most recent leisure activity.

4.1.2 Travel satisfaction

In order to measure travel satisfaction of the respondents' most recent leisure trip, we use the Satisfaction with Travel Scale (STS) (De Vos et al., 2015b; Ettema et al., 2011). This scale measures the affective feelings based on two dimensions (i.e., valence: ranging from unpleasant to pleasant; and activation: ranging from deactivation to activation), and consists of six items. The endpoints of each item are combinations of the valence and activation dimensions. Three items range from negative deactivation to positive activation (i.e., *bored - enthusiastic*; *tired - alert*; *fed up - engaged*) and the other three from negative activation to positive deactivation (i.e., *stressed - calm*; *worried - confident*; *hurried - relaxed*). A cognitive evaluation of the trip being made is measured by three additional items that refer to the general quality and efficiency of the trip (i.e., *the trip was the worst - best I can think of*; *the trip was low - high standard*; *the trip did not work out - worked out well*). For all the nine scales, scores vary from -3 to 3 with a higher score implying higher satisfaction. Two factors (explaining 69.2% of total variance) – one affective and the other cognitive – can be extracted from the nine items using principal axis factoring and promax rotation. The first factor refers to positive feelings experienced during the trip, with the item *hurried–relaxed* loading most highly (i.e., factor loading: 0.82). The second factor refers to a positive evaluation of the trip, with the item *the trip was the worst–best I can think of* loading most highly (i.e., factor loading: 0.94).

The variables positive feelings and positive evaluation play a dual role in the suggested conceptual model (Figure 1). First of all, they are affected by the mode choice. Second, trip evaluation influences mode-specific attitudes. Since in the first link (of mode choice on travel satisfaction) all respondents are required while in the second link (of trip evaluation on mode-specific attitudes) only the respondents using that specific mode are of interest, we adapted the variables positive feelings and positive evaluation as follows. When analysing this model for a specific mode, we removed values of respondents using a different mode and changed it with the average value of all respondents using different modes. Doing so enables us to analyse the relation of mode choice on travel satisfaction and of trip evaluation on mode-specific attitudes in one model.

4.1.3 Travel-related attitudes

To measure respondents' attitudes and preferences toward different travel modes we first asked respondents to indicate to which degree they like to travel with different travel modes (car; bus or tram; train; bicycle; on foot) on a five-point Likert scale. The survey also asked respondents which of the following twelve positive aspects they linked with the use of the five travel modes (yes/no): good for image; environmentally friendly; relaxing; comfortable; time saving; flexible; cheap; offering privacy; healthy; safe; reliable; possibility to perform activities during travel. For each travel mode we summed the number of positive aspects respondents indicated. Finally, five questions asked respondents to indicate (on a scale from 1 to 10) what their ideal neighbourhood looks like, from a travel-related perspective. We employed factor analysis to identify attitudes towards specific travel modes. Since attitudes toward public transport do not load separately on one factor, variables referring to public transport have been excluded. The remaining ten variables have been factor analysed (principal axis factoring; promax rotation), which has resulted in three factors (based on scree plot and eigenvalues larger than one) explaining 52.0% of total variance: Pro car (accessibility); Pro bicycling; and Pro walking.

4.1.4 Residential neighbourhood

Since we distributed survey invitations in two internally homogeneous sets of typical urban and suburban neighbourhoods in Ghent, we have information on the residential neighbourhood of respondents, i.e., suburban (0) versus urban (1). The five urban neighbourhoods, built before the Second World War, have a high density (average density: 7,900 inhabitants per km^2), a high diversity,

extensive public transport services and a street network stimulating active travel (i.e., small building blocks and a high connectivity). The seven suburban neighbourhoods, mostly built after the Second World War, are characterised by low densities (average density: 1,700 inhabitants per km^2), low diversities, limited public transportation services, and a street network stimulating car use (i.e., large building blocks, T-intersections and dead-end streets) (for more details on the selected neighbourhoods, see De Vos et al., 2015a). For this study we retained 347 respondents (39.4%) living in suburban neighbourhoods and 533 respondents (60.6%) living in urban neighbourhoods.

4.1.5 Household car ownership

In the survey we asked respondents to indicate the number of cars their household owns. After removing respondents performing their activity at least two days ago, 18.4% of the selected respondents indicated that they do not possess a car, more than half of the respondents (53.9%) lives in a household with one car while 27.7% of the respondents lives in a household with more than one car.

4.1.6 Life satisfaction and socio-demographic variables

Life satisfaction has been measured using the five statements of the Satisfaction With Life Scale (SWLS) (Diener et al., 1985). This scale asks respondents to which extent they agree with five statements: i.e., In most ways my life is close to my ideal; The conditions of my life are excellent; I am satisfied with my life; So far I have gotten the important things I want in life; If I could live my life over, I would change almost nothing. Since the internal consistency (reliability) of this scale is high (Cronbach's Alpha = 0.87), we created one life satisfaction variable by averaging the five items.

The following socio-demographic variables have been included: participants' age (in years), gender (0 = male; 1 = female), educational attainment (0 = low education (secondary school degree or less); 1 = high education (college or university degree)), the monthly net income of their household (0 = low household income (lower than 2500€ per month); 1 = high household income (at least 2500€ per month)), and whether children younger than 18 lived with them (0 = no; 1 = yes).

5. METHOD

Structural equation modelling (SEM) is now commonly used in travel behaviour studies for examining multiple relationships within a set of variables in which a given variable can be outcome (dependent variable) in one set of relationships and simultaneously predictor of outcomes (explanatory variable) in other relationships (e.g., Golob, 2003). A SEM analysis consists of two parts: a measurement model and a structural model. Since our variables are directly observed (manifest variables) or are latent variables constructed by an exploratory factor analysis, a measurement model has not been specified. A covariance analysis is used to estimate the coefficients of the structural model. A model covariance matrix is fitted on a sample covariance matrix, while iteratively minimizing the differences between the predicted and observed values. The smaller the dissimilarity between these matrices, the better the model fits the data (e.g., Kline, 2005).

Since outliers may affect the results of structural equation modelling, it is important to detect and remove them. We therefore analysed the Mahalanobis distance for each case in the data set and this for both models (i.e., on walking and cycling). The greater the Mahalanobis distance the greater the contribution to the departure from multivariate normality (Mokhtarian and Ory, 2009). Based on this information, cases were removed five at a time until the remaining data set had a multivariate normal distribution. In the end we excluded 40 outliers from the model on cycling (resulting in 840 respondents), while no outliers were detected for the model on walking (resulting in 880 respondents). We chose the maximum likelihood estimation approach, by far the most common estimation technique used in practice, to develop the SEMs in AMOS 22.0.

6. RESULTS

In this section we will analyse the model presented in Figure 1, for both cycling and walking separately. The goodness-of-fit measures for the two models are satisfactory and show that the model specifications fit the data well for both cycling and walking (i.e., χ^2/df = 2.23 and 2.79; RMSEA =

0.04 and 0.04; GFI = 0.99 and 0.99; and CFI = 0.98 and 0.97 for the model on cycling and walking respectively).

6.1. Mode choice, travel satisfaction and travel attitudes

Table1 and Figure 2 show how mode choice, travel satisfaction and travel attitudes affect each other and allow four main conclusions – based on direct effects – to be drawn. First, as expected, positive attitudes towards cycling and walking increase the tendency to cycle and walk, respectively. There nonetheless are subtle differences between the two modes: the effect of pro cycling attitude on cycling is stronger than that of pro walking attitude on walking. This might suggest that for the current sample cycling to access leisure activities is more discretionary and hence more dependent on individuals' beliefs than walking. Second, in line with previous studies (e.g., Abou-Zeid, 2009; Ettema et al., 2011; Friman et al., 2013), we find that active travel results in relatively high levels of travel satisfaction. People walking to their most recent leisure activity, however, experience and evaluate their trip more positively than people cycling. Note that this is to some extent a consequence of how the travel satisfaction values for non-chosen modes have been constructed (see 4.1.2.). Third, we find that for both walking and cycling the emotions experienced during the trip strongly affect the cognitive evaluation of that trip, confirming the idea of Kahneman et al. (1997) and Kahneman and Krueger (2006) that the evaluation of an activity is a function of the emotions during that activity. Therefore, the positive evaluation of a walking trip is to a large extent explained by the feelings experienced during that trip, which can be regarded as a mediating variable between mode choice and the evaluation of the trip. Fourth, the model estimates demonstrate that the evaluation of cycling and walking trips has a positive effect on pro cycling and pro walking attitudes, respectively. In sum, the results suggest that the conceptual model shown in Figure 2 is reasonable; travel satisfaction seems to affect travel mode choice, through travel-related attitudes.

6.2 Household car ownership, residential location and life satisfaction

The household car ownership and the residential location affect the choice of walking and cycling, although not in a same fashion (Table 1; Figure 2). Living in an urban neighbourhood significantly increases the chance of walking, while this positive effect is only indirect (through car ownership) and less strong ($0.05 < p < 0.1$) for cycling. Car ownership has a significantly negative effect on cycling, but no effect on walking, while living in an urban neighbourhood significantly reduces the possibility of owning a car. A positive stance toward walking positively affects the chance of living in an urban neighbourhood and therefore also indirectly reduces the chance of owning a car and slightly increases the change of walking, suggesting a self-selection process. Cycling attitudes, on the other hand, do not significantly affect the residential location. The direct effects of the residential location and car ownership on life satisfaction have been examined but turned out not to be significant. Therefore we excluded these links from the final models.

Life satisfaction has a significant direct effect on positive emotions experienced during the leisure trip and a significant indirect effect on a positive evaluation of this trip, through the affective dimension of travel satisfaction. The effect of life satisfaction on travel satisfaction is even stronger than the effect of mode choice on travel satisfaction (except for the total effect on the evaluation of walking trips).

6.3. Socio-demographic factors

The effects of socio-demographic variables on household car ownership, the residential location and life satisfaction are in line with expectations (Table 1; Figure 2). A high household income, for instance, positively affects household car ownership and life satisfaction, and increases the possibility of living in a suburb. Furthermore, younger people, respondents with high education and people living in a household without children have a bigger chance of living in an urban neighbourhood. There also exist indirect effects of socio-demographics on household car ownership, through the residential location. Older people, for example, have a higher car possession because they have a bigger change of living in suburban neighbourhoods. Socio-demographics also affect attitudes toward cycling and walking, although not in a same way. People living in a household with children, for instance, have a relatively positive stance toward cycling but a relatively negative stance toward walking.

Socio-demographical variables affect mode choice only indirectly. Direct effects have been explored but turned out not to render statistically significant results. Socio-demographics affect travel mode choice indirect through car ownership, the residential location and travel-related attitudes. For instance, older people do not seem to use active travel a lot mainly because they often have relatively negative stance toward active travel, live in suburbs and (consequently) have a relatively high car ownership. The indirect effects of socio-demographics on travel satisfaction, through life satisfaction (or even more indirect via mode choice), are not significant.

TABLE 1 Standardised direct (D), indirect (I) and total (T) effects on the model on respectively cycling (top)(N=840) and walking (bottom)(N=880)[a]

Endogenous variables →	Household car ownership			Residential location			Life satisfaction			Pro cycling attitude			Travel mode choice – cycling			Affect cycling trip			Evaluation cycling trip		
	D	**I**	**T**	**D**	**I**	**T**	**D**	**I**	**T**	**D**	**I**	**T**	**D**	**I**	**T**	**D**	**I**	**T**	**D**	**I**	**T**
Exogenous variables																					
Age	-0.01	**0.10**	**0.09**	**-0.37**	0.01	**-0.36**	**0.13**	-	**0.13**	**-0.28**	0.00	**-0.28**	-	**-0.10**	**-0.10**	-	0.02	0.02	-	0.01	0.01
Gender (female)	0.00	0.00	0.01	-0.02	0.00	-0.01	-0.03	-	-0.03	-0.07	0.00	-0.07	-	-0.02	-0.02	-	-0.01	-0.01	-	-0.01	-0.01
Education	0.00	-0.03	-0.02	**0.10**	-0.01	**0.10**	0.09	-	0.09	**0.13**	0.00	**0.13**	-	0.04	0.04	-	0.02	0.02	-	0.02	0.02
Income	**0.32**	0.04	**0.36**	**-0.14**	0.00	**-0.14**	**0.20**	-	**0.20**	0.05	0.00	0.05	-	**-0.06**	**-0.06**	-	0.03	0.03	-	0.03	0.03
Children	**0.05**	0.05	**0.10**	**-0.16**	0.00	**-0.17**	0.00	-	0.00	**0.06**	0.00	**0.06**	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00
Endogenous variables																					
Household car ownership	-	0.00	0.00	-	0.00	0.00	-	-	-	-	0.00	0.00	**-0.20**	0.00	-0.20	-	-0.02	-0.02	-	-0.01	-0.01
Residential location	**-0.29**	-	**-0.29**	-	0.00	0.00	-	-	-	-	0.00	0.00	0.00	**0.06**	**0.06**	-	0.01	0.01	-	0.00	0.00
Life satisfaction	-	0.00	0.00	-	0.00	0.00	-	-	-	-	0.02	0.02	-	0.01	0.01	**0.18**	-	**0.18**	-	**0.15**	**0.15**
Pro bike attitude	-	0.01	0.01	-0.04	0.00	-0.04	-	-	-	-	0.00	0.00	**0.30**	0.00	**0.30**	-	0.02	0.02	-	0.01	0.01
Travel mode choice – cycling	-	0.00	0.00	-	0.00	0.00	-	-	-	-	0.01	0.01	-	0.00	0.00	0.08	-	0.08	-0.02	**0.06**	0.05
Affect cycling trip	-	0.00	0.00	-	0.00	0.00	-	-	-	-	0.08	0.08	-	0.03	0.03	-	0.00	0.00	**0.81**	0.00	**0.82**
Evaluation cycling trip	-	0.00	0.00	-	0.00	0.00	-	-	-	**0.10**	-	**0.10**	-	0.03	0.03	-	0.00	0.00	-	0.00	0.00
Squared multiple correlations		0.23			0.20			0.07			0.13			0.13			0.04			0.66	

Endogenous variables →	Household car ownership			Residential location			Life satisfaction			Pro walking attitude			Travel mode choice – walking			Affect walking trip			Evaluation walking trip		
	D	**I**	**T**	**D**	**I**	**T**	**D**	**I**	**T**	**D**	**I**	**T**	**D**	**I**	**T**	**D**	**I**	**T**	**D**	**I**	**T**
Exogenous variables																					
Age	-0.01	**0.10**	**0.09**	**-0.32**	-0.04	**-0.36**	**0.12**	-	**0.12**	**-0.13**	0.00	**-0.13**	-	-0.08	-0.08	-	0.01	0.01	-	0.00	0.00
Gender (female)	0.00	0.00	0.00	-0.03	0.02	-0.01	-0.03	-	-0.03	0.07	0.00	0.07	-	0.01	0.01	-	0.00	0.00	-	0.00	0.00
Education	0.00	-0.03	-0.03	**0.09**	0.02	**0.11**	**0.09**	-	**0.09**	0.07	0.00	0.07	-	0.03	0.03	-	0.02	0.02	-	0.02	0.02
Income	**0.31**	0.04	**0.35**	**-0.12**	-0.02	**-0.14**	**0.21**	-	**0.21**	-0.05	0.00	-0.05	-	-0.02	-0.02	-	0.04	0.04	-	0.02	0.02
Children	0.04	0.05	**0.09**	**-0.14**	-0.02	**-0.16**	0.00	-	0.00	-0.08	0.00	-0.08	-	-0.04	-0.04	-	-0.01	-0.01	-	-0.01	-0.01
Endogenous variables																					
Household car ownership		0.00	0.00	-	0.00	0.00	-	-	-	-	0.00	0.00	0.03	0.00	0.03	-	0.01	0.01	-	0.01	0.01
Residential location	**-0.28**	-	**-0.28**	-	0.00	0.00	-	-	-	-	0.00	0.00	**0.18**	-0.01	**0.17**	-	0.03	0.03	-	0.04	0.04
Life satisfaction		0.00	0.00	-	0.00	0.00	-	-	-	-	0.01	0.01	-	0.00	0.00	**0.20**	-	**0.20**	-	**0.14**	**0.14**
Pro walk attitude		-0.09	-0.09	**0.30**	0.00	**0.31**	-	-	-	-	0.00	0.00	**0.13**	0.05	**0.18**	-	0.03	0.03	-	0.04	0.04
Travel mode choice – walking		0.00	0.00	-	0.01	0.01	-	-	-	-	0.02	0.02	-	0.00	0.00	**0.17**	-	**0.17**	**0.10**	**0.11**	**0.21**
Affect walking trip		-0.01	-0.01	-	0.02	0.02	-	-	-	-	0.07	0.07	-	0.01	0.01	-	0.00	0.00	**0.68**	0.00	**0.68**
Evaluation walking trip		-0.01	-0.01	-	0.03	0.03	-	-	-	**0.10**	-	**0.10**	-	0.02	0.02	-	0.00	0.00	-	0.00	0.00
Squared multiple correlations		0.22			0.29			0.07			0.06			0.07			0.07			0.50	

[a] bold: significant at $0.05 < p < 0.1$; grey background: significant at $0.01 < p < 0.05$; bold and grey background: significant at $p < 0.01$

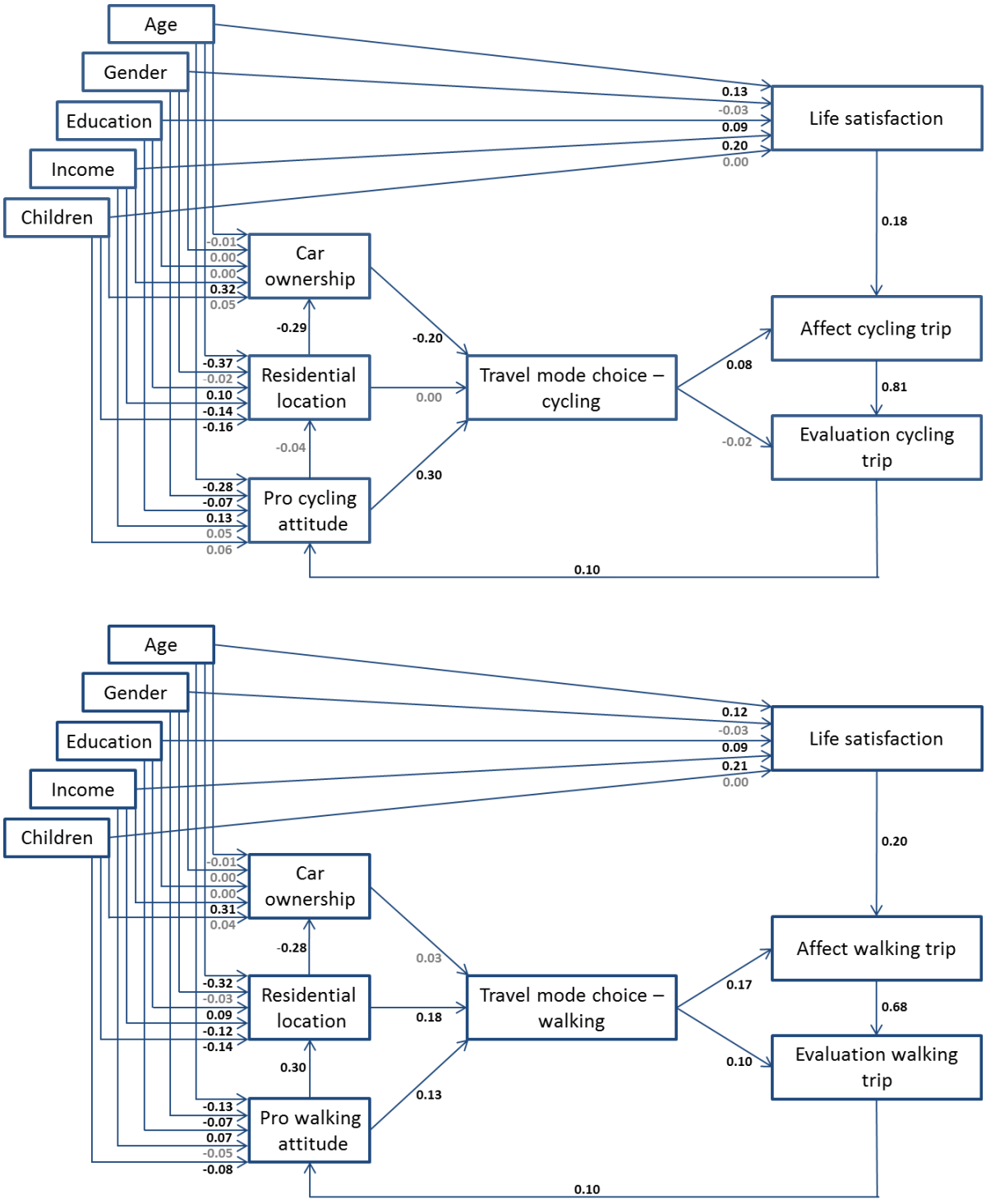

FIGURE 2 Standardised direct effects on the cycling model (top) and the walking model (bottom) (black: significant at p < 0.05; grey: not significant at p < 0.05)

7. DISCUSSION AND CONCLUSION

Using cross-sectional data on the most recent leisure trip taken on foot or by bike by a sample of 880 residents of urban and suburban neighbourhoods in the Belgian city of Ghent, this study demonstrates complex interrelations among mode choice, travel satisfaction and travel attitudes. While no robust conclusions on the causal nature of processes can be drawn from cross-sectional data, our results are at least consistent with the idea of a cyclical process in which travel mode choice affects travel satisfaction, while the evaluation of this trip affects mode-specific attitudes which in turn are an

important explanatory variable of mode choice. It is also conceivable that this cycle, if passed through repeatedly, could create habitual mode use because of the positive reinforcement it implies. In other words, results indicate that (active) travel mode choice is not only affected by elements such as the built environment and attitudes, but also by the satisfaction with previous trips. A satisfying trip with a certain mode can improve the attitude toward that mode, increasing the chance of choosing that mode for a future trip of the same kind. This suggests that travel-related attitudes are, among others, created by travel satisfaction of previous trips and that (previous) travel satisfaction should be regarded as one of the predictors of mode choice. This could indicate that travel satisfaction attenuates the effect of attitudes on mode choice and that the effect of attitudes on mode choice is overestimated, or in other words, that attitudes not only affect behaviour, but that behaviour also affects attitudes (through satisfaction).

Since active (leisure) travel is perceived and evaluated positively, resulting in improved attitudes toward walking and cycling and a bigger change of choosing active travel for future (leisure) trips, it is important to eliminate constraints for active travel as much as possible in order to increase the use of active travel modes. One of the main reasons of people using motorised travel modes is that destinations are often not within reasonable walking or cycling distance. Therefore, it seems important to adapt the built environment, for example by creating compact, mixed-use neighbourhoods where active travel (and public transport) is stimulated by high densities, high diversities and a high accessibility to public transport.

Besides rather expected effects between socio-demographics, household car ownership, the residential location and mode choice, the applied SEM also showed strong effects of life satisfaction on travel satisfaction. This suggests a strong impact of long-term happiness on satisfaction with momentary activities and is consistent with the idea that impact from long- to short-term well-being is stronger than the accumulated effect from momentary satisfaction to life satisfaction (Schwanen and Wang, 2014). Results also suggest that travel satisfaction could affect the residential location choice, through travel-related attitudes. As the residential location affects trip characteristics (such as travel mode choice, travel distance, road congestion, parking problems) for a considerable period of time, the residential location can affect travel satisfaction both directly (see De Vos et al., 2015a) and indirectly (e.g., through the travel mode choice). Since negative or positive trip evaluations might result in changing travel-related attitudes, it might also result in changing land use preferences. People might want to self-select themselves in neighbourhoods enabling them to experience satisfying trips. This expands the known self-selection concept − where people (try to) choose a neighbourhood that enables them to easily travel with their preferred travel mode − as travel satisfaction is, besides mode choice, also affected by trip characteristics, trip duration, the possibility to perform activities during travel, etc.

REFERENCES

Aarts, H., Verplanken, B., van Knippenberg, A., 1998. Predicting behavior from actions in the past: repeated decision making or a matter of habit? Journal of Applied Social Psychology 28 (15), 1355-1374.

Abou-Zeid, M., 2009. Measuring and Modeling Activities and Travel Well-being (doctoral dissertation). Massachusetts Institute of Technology, Cambridge, MA.

Abou-Zeid, M., Ben-Akiva, M., 2012. Travel mode switching: comparison of findings from two public transportation experiments. Transport Policy 24, 48-59.

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. Transport Policy 19 (1), 93-104.

Bagley, M.N., Mokhtarian, P.L., 2002. The impact of residential neighborhood type in travel behavior: a structural equation modeling approach. Annals of Regional Science 36 (2), 279-297.

Cervero, R., Kockelman, K., 1997. Travel demand and the 3Ds. Density, diversity and design. Transportation Research part D 2 (3), 199-219.

De Vos, J., Derudder, B., Van Acker, V., Witlox, F., 2012. Reducing car use: changing attitudes or relocating? The influence of residential dissonance on travel behavior. Journal of Transport Geography 22, 1-9.

De Vos, J., Mokhtarian, P.L., Schwanen, T., Van Acker, V., Witlox, F., 2015a. Travel mode choice and travel satisfaction: bridging the gap between decision utility and experienced utility. Transportation, DOI 10.1007/s11116-015-9619-9

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

De Vos, J., Schwanen, T., Van Acker, V., Witlox, F., 2015b. How satisfying is the Scale for Travel Satisfaction. Transportation Research part F 29, 121-130.

Diener, E., Emmons, R.A., Larsen, R.J., Griffen, S., 1985. The satisfaction with life scale. Journal of Personality Assessment 49 (1), 71-75.

Dobson, R., Dunbar, F., Smith, C.J., Reibstein, D., Lovelock, C., 1978. Structural models for the analysis of traveler attitude-behavior relationships. Transportation 7 (4), 351-363.

Ehrhardt, J.J., Saris, W.E., Veenhoven, R., 2000. Stability of life-satisfaction over time. Journal of Happiness Studies 1 (2), 177-205.

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. Transportation Research Part F 14 (3), 167-175.

Ettema, D., Gärling, T., Olsson, L.E., Friman, M., 2010. Out-of-home activities, daily travel, and subjective well-being. Transportation Research Part A 44 (9), 723-732

Friman, M., Fujii, S., Ettema, D., Gärling, T., Olsson, L.E., 2013. Psychometric analysis of the satisfaction with travel scale. Transportation Research Part A 48, 132-145.

Fujii, S., Kitamura, R., 2003. What does a one-month free bus ticket do to habitual drivers? Transportation 30 (1), 81-95.

Fujii, S., Gärling, T., Kitamura, R., 2001. Changes in drivers' perceptions and use of public transport during a freeway closure: effects of temporary structural change on cooperation in a real-life social dilemma. Environment and Behavior 33 (6), 796-808.

Golob, T.F., 2003. Structural equation modeling for travel behavior research. Transportation Research Part B 37 (1), 1-25.

Golob, T.F., Beckman, M.J., Zahavi, Y., 1981. A utility-theory travel demand model incorporating travel budgets. Transportation Research Part B 15 (6), 375-389.

Gärling, T., Gärling, A., Loukopoulos, P., 2002. Forecasting psychological consequences of car use reduction: a challenge to an environmental psychology of transportation. Applied Psychology 51 (1), 90-106.

Handy, S.L., Cao, X., Mokhtarian, P.L., 2005. Correlation or causality between the built environment and travel behavior? Evidence from Northern California. Transportation Research Part D 10 (6) 427–444.

Kahneman, D., Krueger, A.B., 2006. Developments in the measurement of subjective well-being. Journal of Economic Perspectives 20 (1), 3-24

Kahneman, D., Wakker, P.P., Sarin, R., 1997. Back to Bentham? Explorations of experienced utility. Quarterly Journal of Economics 112 (2), 375-405

Kline, R.B., 2005. Principles and Practice of Structural Equation Modeling. Guilford Press, New York.

McFadden, D., 2001. Economic choices. The American Economic Review 91 (3), 351-378.

Mokhtarian, P.L., Cao, X., 2008. Examining the impacts of residential self-selection on travel behavior: a focus on methodologies. Transportation Research part B 43 (3), 204–228.

Mokhtarian, P.L., Ory, D.T., 2009. Structural Equations Models. In Kitchin R, Thrift N (eds.) International Encyclopedia of Human Geography, Volume 11, pp. 10–17. Elsevier, Oxford.

Reibstein, D.J., Lovelock, C.H., Dobson, R.P., 1980. The direction of causality between perceptions, affect, and behavior: an application to travel behavior. Journal of Consumer Research 6 (4), 370-376.

Saelens, B.E., Sallis, J.F., Lawrence D.F., 2003. Environmental correlates of walking and cycling: Findings from the transportation, urban design, and planning literatures. Annals of Behavioral Medicine 25 (2), 80-91.

536 Sallis, J.F., Frank, L.D., Saelens, B.E., Kraft, M.K., 2004. Active transportation and physical activity:
537 opportunities for collaboration on transportation and public health research. Transportation Research
538 Part A 38 (4), 249-268.
539 Schwanen, T., Mokhtarian, P.L., 2005. What affects commute mode choice, neighbourhood physical
540 structure or preferences toward neighborhoods? Journal of Transport Geography 13 (1), 83-99.
541 Schwanen, T., Wang, D., 2014. Well-being, context, and everyday activities in space and time.
542 Annals of the Association of American Geographers 104 (4), 833-851.
543 Song, Y., Preston, J.M., Brand, C., 2013. What explains active travel behavior? Evidence from case
544 studies in the UK. Environment and Planning A 45 (12), 2980-2998.
545 Verplanken, B., Aarts, H., Van Knippenberg, A., 1997. Habit, information acquisition, and the
546 process of making travel mode choices. European Journal of Social Psychology 27 (5), 539–560.
547