

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

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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

106 et al., 1998; Verplanken et al., 1997). In other words, travel satisfaction may play an important
107 facilitating role in the early stages of habit formation.
108

109 In this paper we analyse to which degree mode choice can be regarded as a process rather than a
110 decision resulting in a certain level of travel satisfaction. The way people experience and evaluate
111 their trip can positively or adversely affect their attitude towards the used mode, possibly affecting
112 future mode choice decisions. We use a structural equation modelling approach to analyse the cyclical
113 process involving mode choice, travel satisfaction and travel-related attitudes of people walking and
114 cycling to out-of-home leisure activities.
115

116 **2. PREVIOUS RESEARCH**

117 Previous studies have indicated that numerous relationships between travel-related attitudes, travel
118 mode choice and travel satisfaction exist. However, not all these relations have been analysed to the
119 same degree.
120

121 **2.1 The relationship between mode choice and travel satisfaction**

122 Recently, studies have started analysing the effect of travel on happiness and well-being. Within this
123 context, travel satisfaction is the most important measure analysing this link (De Vos et al., 2013).
124 Travel satisfaction comprises two dimensions; i.e., an affective dimension (referring to emotions
125 experienced during a trip) and a cognitive dimension (referring to an evaluation of the trip) (Ettema et
126 al., 2011). Studies have indicated that travel satisfaction differs according to the mode people choose.
127 Public transportation use tends to result in the lowest levels of travel satisfaction, while people
128 walking or cycling are most satisfied (Abou-Zeid, 2009; De Vos et al., 2015a, 2015b; Ettema et al.,
129 2011; Friman et al., 2013). How satisfaction with previous trips taken with a particular mode can
130 influence mode choice has only been examined to a limited degree. To the best of our knowledge,
131 only two studies have analysed this link. Abou-Zeid and Ben-Akiva (2012) state that a lower
132 satisfaction with car use and a higher satisfaction with public transport use make a mode switch from
133 car to public transport more likely. According to Reibstein et al. (1980), overall satisfaction with bus
134 trips has a significant effect on the frequency of bus use. It is reasonable to assume that people who
135 experienced a positive trip with a certain travel mode have a higher probability of choosing the same
136 mode for a future trip (as long as the built environment or other elements do not constrain the use of
137 that mode) compared to people who experienced their trip with this mode negatively.
138

139 Utility theories suggest that the experience of feelings and emotions during an activity is an outcome
140 of the choice made in a certain decision process. From this point of view, satisfaction with travel can
141 be regarded as the outcome of the mode choice decision. However, it is also possible that travel
142 satisfaction, and the evaluation of travel in particular, can affect (future) mode choices. According to
143 Kahneman and Krueger (2006), a retrospective evaluation of a past episode can affect the prospective
144 choice of an alternative in order to maximise happiness (De Vos et al., 2015a; Ettema et al., 2010;
145 Kahneman et al., 1997; Kahneman and Krueger, 2006). As part of this, it can be hypothesised that the
146 evaluation of a trip (cognitive dimension) is a function of the emotions experienced during that trip
147 (affective dimension).
148

149 **2.2 The relationship between travel-related attitudes and mode choice**

150 The relation between attitudes and mode choice has been examined rather frequently. Over the past
151 two decades various studies have suggested that (travel-related) attitudes are important determinants
152 of travel behaviour and mode choice (e.g., Bagley and Mokhtarian, 2002). A positive stance toward a
153 certain mode of transportation will result in a higher use of that mode, as long as the use of this mode
154 is not restricted by elements such as the built environment. Attitudes can also affect mode choice
155 indirectly; individuals with an affinity toward a certain kind of travel will often choose a residential
156 location that enables them to travel as much as possible with their preferred travel mode (De Vos et
157 al., 2012; Schwanen and Mokhtarian, 2005; Handy et al., 2005).
158

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

161 are mutually dependent on each other: attitudes both affect, and are conditioned by, choices (e.g.,
162 Dobson et al., 1978; Mokhtarian and Cao, 2008). It is therefore possible that mode choice affects
163 travel-related attitudes. According to Reibstein et al. (1980) the frequency of bus use positively affects
164 the attitude towards bus use. More recent studies found that a mode shift from car to public transport
165 was accompanied by improved attitudes toward public transport (Abou-Zeid et al., 2012; Fujii et al.,
166 2001; Fujii and Kitamura, 2003). It is also possible, however, that a cyclical process between travel-
167 related attitudes and mode choice exists; a positive stance toward a certain mode can increase the use
168 of that mode, while using that mode frequently might improve (or diminish) the attitude toward that
169 mode.

170

171 **2.3 The relationship between travel satisfaction and travel-related attitudes**

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

184

185 **3. CONCEPTUAL MODEL**

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

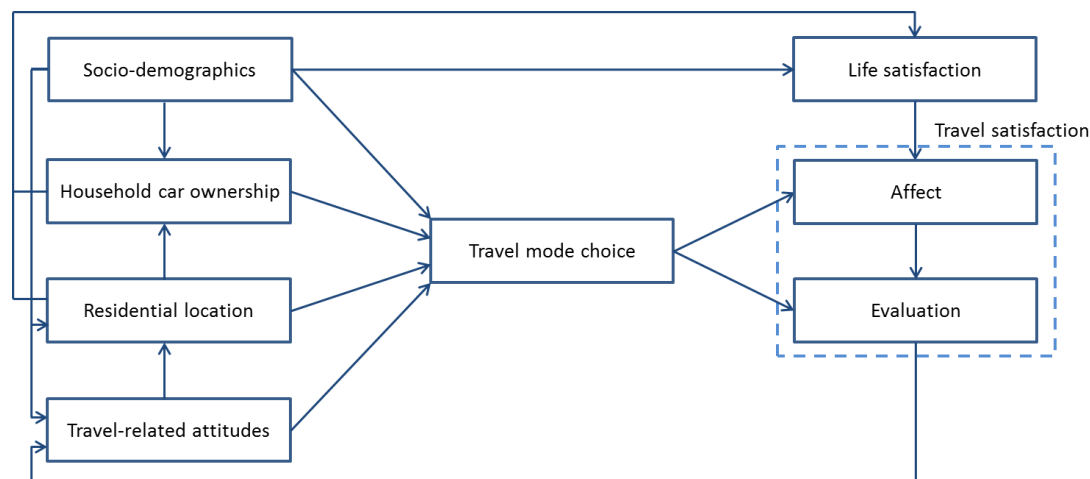
193

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

201

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

213



214

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

217

218 **4. DATA**

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

235

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

245

246 **4.1 Key variables**

247 *4.1.1 Travel mode choice*

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

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

260

261 4.1.2 Travel satisfaction

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

278

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

288

289 4.1.3 Travel-related attitudes

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

304

305 4.1.4 Residential neighbourhood

306 Since we distributed survey invitations in two internally homogeneous sets of typical urban and
307 suburban neighbourhoods in Ghent, we have information on the residential neighbourhood of
308 respondents, i.e., suburban (0) versus urban (1). The five urban neighbourhoods, built before the
309 Second World War, have a high density (average density: 7,900 inhabitants per km²), a high diversity,

310 extensive public transport services and a street network stimulating active travel (i.e., small building
311 blocks and a high connectivity). The seven suburban neighbourhoods, mostly built after the Second
312 World War, are characterised by low densities (average density: 1,700 inhabitants per km²), low
313 diversities, limited public transportation services, and a street network stimulating car use (i.e., large
314 building blocks, T-intersections and dead-end streets) (for more details on the selected
315 neighbourhoods, see De Vos et al., 2015a). For this study we retained 347 respondents (39.4%) living
316 in suburban neighbourhoods and 533 respondents (60.6%) living in urban neighbourhoods.

317

318 *4.1.5 Household car ownership*

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

324

325 *4.1.6 Life satisfaction and socio-demographic variables*

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

332

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

338

339 **5. METHOD**

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

350

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

360

361 **6. RESULTS**

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

365 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
366 respectively).

367

368 **6.1. Mode choice, travel satisfaction and travel attitudes**

369 Table 1 and Figure 2 show how mode choice, travel satisfaction and travel attitudes affect each other
370 and allow four main conclusions – based on direct effects – to be drawn. First, as expected, positive
371 attitudes towards cycling and walking increase the tendency to cycle and walk, respectively. There
372 nonetheless are subtle differences between the two modes: the effect of pro cycling attitude on cycling
373 is stronger than that of pro walking attitude on walking. This might suggest that for the current sample
374 cycling to access leisure activities is more discretionary and hence more dependent on individuals'
375 beliefs than walking. Second, in line with previous studies (e.g., Abou-Zeid, 2009; Ettema et al.,
376 2011; Friman et al., 2013), we find that active travel results in relatively high levels of travel
377 satisfaction. People walking to their most recent leisure activity, however, experience and evaluate
378 their trip more positively than people cycling. Note that this is to some extent a consequence of how
379 the travel satisfaction values for non-chosen modes have been constructed (see 4.1.2.). Third, we find
380 that for both walking and cycling the emotions experienced during the trip strongly affect the
381 cognitive evaluation of that trip, confirming the idea of Kahneman et al. (1997) and Kahneman and
382 Krueger (2006) that the evaluation of an activity is a function of the emotions during that activity.
383 Therefore, the positive evaluation of a walking trip is to a large extent explained by the feelings
384 experienced during that trip, which can be regarded as a mediating variable between mode choice and
385 the evaluation of the trip. Fourth, the model estimates demonstrate that the evaluation of cycling and
386 walking trips has a positive effect on pro cycling and pro walking attitudes, respectively. In sum, the
387 results suggest that the conceptual model shown in Figure 2 is reasonable; travel satisfaction seems to
388 affect travel mode choice, through travel-related attitudes.

389

390 **6.2 Household car ownership, residential location and life satisfaction**

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

402

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

407

408 **6.3. Socio-demographic factors**

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

419

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

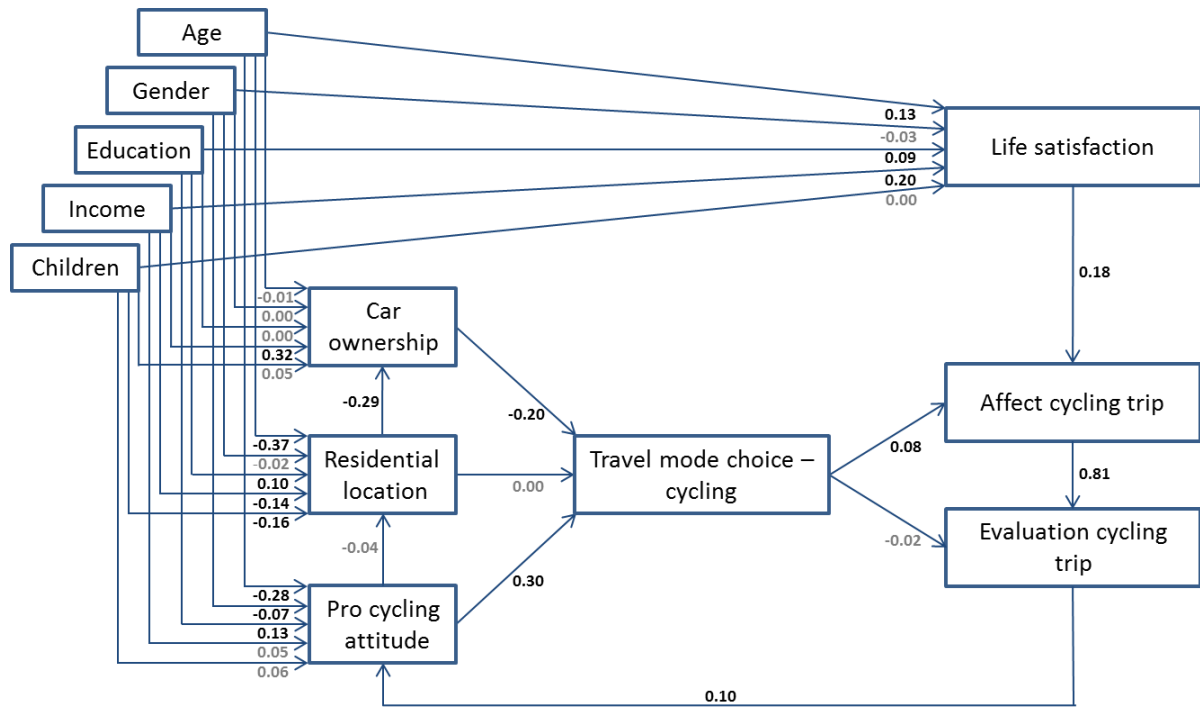
TABLE 1 Standardised direct (D), indirect (I) and total (T) effects on the model on respectively cycling (top)(N=840) and walking (bottom)(N=880)^a

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	
<i>Exogenous variables</i>																						
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	
<i>Endogenous variables</i>																						
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	
<i>Squared multiple correlations</i>		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	
<i>Exogenous variables</i>																						
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	
<i>Endogenous variables</i>																						
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	
<i>Squared multiple correlations</i>		0.22			0.29			0.07			0.06			0.07			0.07			0.50		

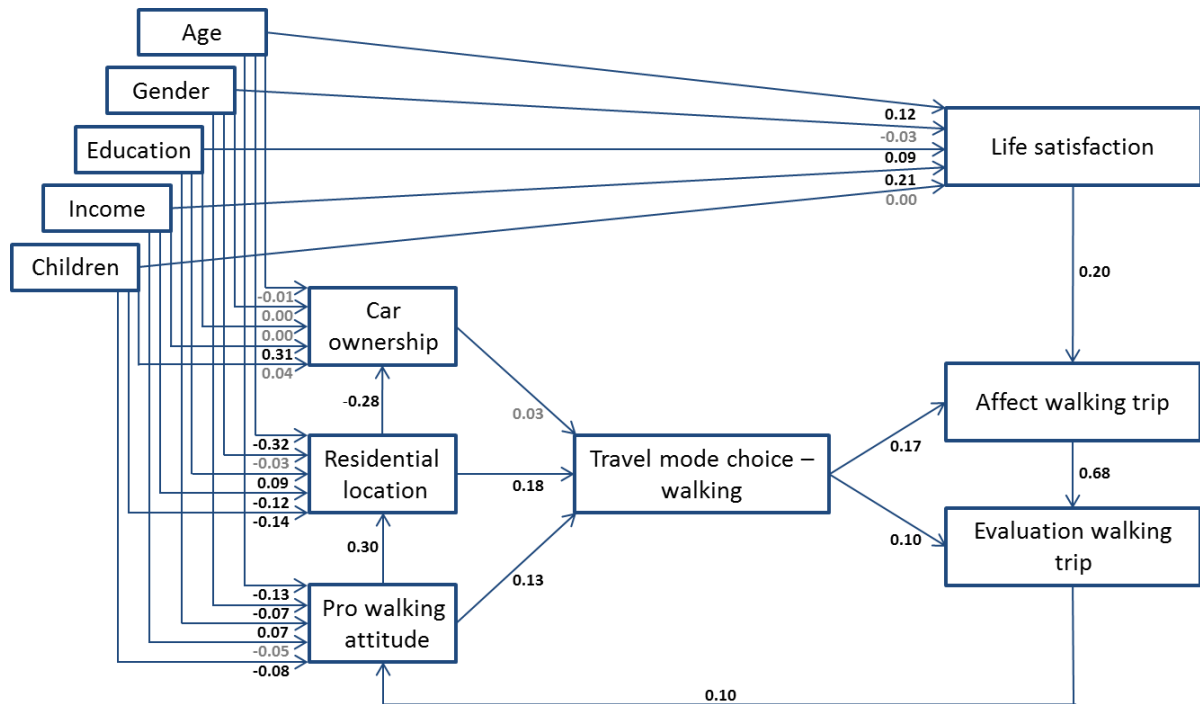
^a bold: significant at 0.05 < p < 0.1; grey background: significant at 0.01 < p < 0.05; bold and grey background: significant at p < 0.01

415



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418

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

421

422 **7. DISCUSSION AND CONCLUSION**

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

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

440

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

449

450 Besides rather expected effects between socio-demographics, household car ownership, the residential
451 location and mode choice, the applied SEM also showed strong effects of life satisfaction on travel
452 satisfaction. This suggests a strong impact of long-term happiness on satisfaction with momentary
453 activities and is consistent with the idea that impact from long- to short-term well-being is stronger
454 than the accumulated effect from momentary satisfaction to life satisfaction (Schwanen and Wang,
455 2014). Results also suggest that travel satisfaction could affect the residential location choice, through
456 travel-related attitudes. As the residential location affects trip characteristics (such as travel mode
457 choice, travel distance, road congestion, parking problems) for a considerable period of time, the
458 residential location can affect travel satisfaction both directly (see De Vos et al., 2015a) and indirectly
459 (e.g., through the travel mode choice). Since negative or positive trip evaluations might result in
460 changing travel-related attitudes, it might also result in changing land use preferences. People might
461 want to self-select themselves in neighbourhoods enabling them to experience satisfying trips. This
462 expands the known self-selection concept – where people (try to) choose a neighbourhood that
463 enables them to easily travel with their preferred travel mode – as travel satisfaction is, besides mode
464 choice, also affected by trip characteristics, trip duration, the possibility to perform activities during
465 travel, etc.

466

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