

## 4. PUBLIC TRANSPORT USE

### The 'soft' side of the story

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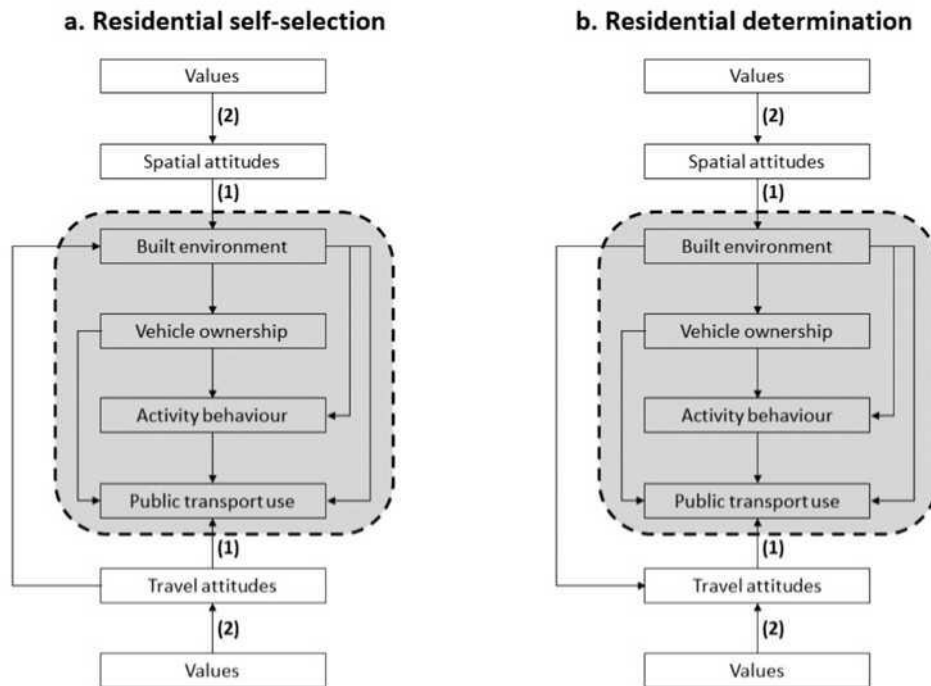
#### INTRODUCTION

Understanding the determinants of the demand for public transport is essential in designing attractive public transport systems that can offer an alternative to the dominating car use in many regions and countries (see also Chapter 21). But these determinants have been researched from many different perspectives (Polat, 2012), particularly the economic determinants such as price. In times when public transport is often deregulated, decentralised and privatised, it is not surprising that many studies seek to understand how sensitive demand for public transport is with respect to fare changes, as these processes are often associated with price increases (see, for example, Nijkamp et al., 2000, for an overview). But economic factors are not the only determinants of public transport demand. Other studies have also used structural determinants such as demographic and geographic factors. For example, in their longitudinal study of public transport use in 62 urban areas in France, Bresson et al. (2004) found a negative income elasticity, as with other economic studies. But by extending their analysis to include structural determinants such as urban sprawl and the level of car ownership, they noticed how the 'income effect' is actually a 'motorisation effect'. As income increases, it seems to be associated with urban sprawl and higher car ownership, which eventually discourages public transport use as well.

Compared to the economic determinants, less is known about how people really think and feel about public transport. Although there is literature on people's satisfaction with public transport from a consumer perspective (see, for example, van Lierop et al., 2018, for an overview), relatively less is known about people's opinion and attitudes towards public transport. The latter presupposes a broader behavioural perspective where the use of public transport is situated within people's daily life. The aim of this chapter is, therefore, to present insights into this 'soft' side of public transport use. The chapter specifically focuses on the role of attitudes in explaining public transport use while taking into account the interplay with other behavioural decisions related to residential location, vehicle ownership and activity behaviour. Moreover, it will also illustrate how these attitudes are impacted by personal values.

#### BACKGROUND

This section explains basic concepts and their interrelationships with public transport use, as depicted in the model structures in [Figure 4.1](#). This figure is based on three key elements:



**Figure 4.1 Model structures summarising complex relationships between values, attitudes and behaviours related to public transport use**

values, attitudes and behaviour, with behaviour not only related to public transport use but also to residential location, car ownership and daily activity patterns. The theoretical basis for interactions between these key elements can be found in travel behaviour studies considering a choice hierarchy (e.g., Ben-Akiva, 1973; Salomon & Ben-Akiva, 1983; Van Acker et al., 2010) on the one hand and extended by value-attitude-behaviour studies (e.g., Homer & Kahle, 1988) on the other. The public transport literature reviewed in this section is therefore limited to studies using a behavioural perspective and those empirical studies using survey data about individuals' travel behaviour.

## PUBLIC TRANSPORT USE AS PART OF A HIERARCHY OF DECISIONS

A behavioural perspective on public transport use positions daily travel behaviour within a wider set of decisions (see grey shaded box in the centre of [Figure 4.1](#)). It starts with activitybased studies acknowledging travel behaviour as a derived demand from the activities in which someone wants to participate, which generates the need to travel (see for example McNally & Ridt, 2007, for an overview). Complex activity patterns with multiple activities combined in one trip chain, known as trip chaining, are usually considered a barrier to public transport use. As trip chaining becomes more complex, public transport does not usually offer the same flexibility as a car. Using data from Sydney, Australia, Hensher and Reyes (2000) noticed how these barriers to using public transport are even stronger in households owning multiple vehicles. They found a strong negative influence of vehicle ownership on public transport use not only for complex trip chains structured around work activity but also for simple home-to-work trip

chains. However, the effect of vehicle ownership did not appear as strong for non-work trip chains. Paulley et al. (2006) concluded that increasing car ownership might decrease demand for public transport, especially in the bus market. Consequently, once people own a vehicle, they will seek to use it. Currie and Delbosc (2011) also pointed out that complex activity patterns do not necessarily constitute a barrier to public transport use,

especially when you distinguish between the train, tram and bus. Using data from Melbourne, Australia, they found trip chains, especially non-work trip chains, to be more complex for rail and tram than for car. Such nonwork trip chains by train or tram were particularly common in the central city, where a large range of services and activities are clustered, facilitating the use of public transport in complex activity patterns and traffic congestion and parking difficulties limiting car use. This finding illustrates how the built environment is also important in understanding public transport use. In their meta-analysis, Ewing and Cervero (2010) concluded that the built environment has a modest effect on travel behaviour, with bus and train use most strongly influenced by proximity to public transport and street network design variables and second by land-use diversity. Using data from ten communities in Tyne and Wear, northeast England, UK, Aditjandra et al. (2016) also found that accessibility is one of the most important features of the built environment explaining changes in public transport use following a residential relocation.

Findings like these suggest an interconnection between public transport use, activity behaviour, vehicle ownership and the built environment. Ben-Akiva (1973) and Salomon and Ben-Akiva (1983), for example, argued how a hierarchy of decisions exists ranging from long-term lifestyle decisions to medium-term decisions on vehicle ownership, residential and workplace location and short-term decisions on daily activities and travel (such as activity type, activity duration, destination, route and transport mode). They explain how, within each time block, decisions are made jointly, but decisions in the lower time block are made conditional on those in the upper time block.

## PUBLIC TRANSPORT USE AND THE INFLUENCE OF ATTITUDES

Decisions in the previously mentioned hierarchy are also determined by, among others, reasoned influences such as perceptions, attitudes and preferences [see arrow (1) in [Figure 4.1](#)]. While perceptions refer to general beliefs about various aspects of a subject, such as the built environment, vehicle ownership, activities and travel, attitudes refer to a positive, negative or neutral evaluation of these aspects. Preferences are subsequently developed based on these attitudes and perceptions (Van Acker et al., 2010). For example, someone might believe that using public transport is beneficial for the environment but at the same time find public transport stressful, unpleasant and uncomfortable. The combined perceptions of all these aspects might eventually result in a negative attitude towards public transport and a low preference to use it.

Attitudes might have an important influence on behaviour, as explained by the theory of planned behaviour (Ajzen, 1991). This also applies to the use of public transport. For example, based on a cluster analysis of a wide variety of attitudinal statements (related to norms, environmental awareness, perceived behavioural control and habits), Anable (2005) found six different segments among visitors of National Trust sites in the northwest of the United Kingdom. Segments characterised by a positive attitude towards car alternatives, less strong attachment to the car, stronger moral norms and greater perceived control also exhibited stronger intentions to use alternative transport modes to the car. Attitudes may even have a more important role to play for public transport use compared to car use. For example, using data from urban regions in Norway,

Şimşekoğlu et al. (2015) found how a positive attitude towards public transport remains important in explaining public transport use, even when controlling for travel habits, while this was not the case for car use. Van Acker et al. (2020) also found how a pro-travel attitude – characterised by statements such as ‘I like travelling by public transport’ and ‘Getting stuck in traffic does not bother me too much’ – is one of the most important determinants of public transport use in Sydney, Australia.

Recent studies have also signalled a significant indirect effect of travel attitudes on public transport use. People who prefer using public transport might also self-select themselves into a residential neighbourhood with access to good quality public transport services. This means that travel attitudes not only have a direct

influence on public transport use (as already discussed previously) but also indirectly through the residential location choice (see [Figure 4.1a](#)). This is known as the question of ‘residential self-selection’ (Cao et al., 2009; Naess, 2009). For example, Ettema and Nieuwenhuis (2017) found that, compared to other transport modes, train users are most likely to choose a residential neighbourhood that is conducive to using their preferred mode of transport. An earlier study by van Wee et al. (2002) reached similar conclusions: transport mode preference plays a role in residential location choices, especially for public transport lovers. Moreover, adding transport mode preferences increased the explanatory power of the analyses, and this increase was found again to be the largest for public transport.

However, residential location choices can be constrained by many other factors, and not everybody can choose a residential neighbourhood that meets their travel attitudes. In that case, ‘residential dissonance’ exists (Kamruzzaman et al., 2016). However, after living somewhere and experiencing the residential neighbourhood for some time, this dissonance might become weaker. Travel attitudes might eventually change and come into line with the built environment attributes of that residential location. This illustrates how the built environment also impacts on travel attitudes (see [Figure 4.1b](#)). This process is known as ‘residential determination’ (Lin et al., 2017; De Vos et al., 2018) and is sometimes found to be more important than residential self-selection (Ewing et al., 2016). Based on a sample of recent movers in Ghent, Belgium, De Vos et al. (2018) found how moving to a more urbanised neighbourhood eventually resulted in a more positive attitude towards public transport and also active travel.

## PUBLIC TRANSPORT USE AND THE INFLUENCE OF VALUES

While public transport attitudes may thus change over time due to processes like residential determination, values are considered deeply rooted and enduring beliefs. As mentioned before, attitudes are an evaluative response and refer to how someone likes or dislikes things, people and objects. Values are much more abstract and determine what someone considers right or wrong. These abstract cognitions then serve as prototypes from which attitudes and behaviour are constructed, finally resulting in a value-attitude-behaviour hierarchy [see arrow (2) in [Figure 4.1](#)]. Homer and Kahle (1988) first introduced this hierarchy in their study on natural food shopping. Since then, this hierarchy has been studied in many areas, but applications in travel behaviour research remain limited. One exception is the study by Paulssen et al. (2014). Using data from a sample of German commuters, they found that personal values of power, hedonism and security affect personal travel attitudes towards flexibility, comfort and convenience and ownership, which in turn influence the decision to use public transport over cars (or vice versa). This eventually resulted in an indirect effect of values on mode choice. The indirect effect of values towards security was negligible, but values towards hedonism and power both had strong negative indirect effects on public transport use.

## RESEARCH DESIGN

Each of the two model structures in [Figure 4.1](#) could be considered a series of regression equations for which a structural equation model (SEM) is advanced in this chapter.

### METHODOLOGY: STRUCTURAL EQUATION MODEL

SEM is useful where one specific variable is an explanatory variable in one equation (e.g., travel attitudes influencing public transport use) and at the same time an outcome variable in another equation (e.g., travel attitudes influenced by values). Instead of estimating these equations one by one using, for example, separate regression analyses, SEM simultaneously estimates this set of related equations. Instead of using ‘independent’ and ‘dependent’ variables as in a regression analysis, SEM uses concepts of ‘exogenous’ and

'endogenous' variables. Exogenous variables influence other variables and are not influenced by any other variable in the model (and thus resemble the independent variables of a regression analysis). Endogenous variables, on the other hand, are impacted by these exogenous variables (like the dependent variable of a regression analysis) but can at the same time also impact other endogenous variables in the model (like the independent variables of a regression analysis). Furthermore, variables in a SEM can be 'manifest' or 'latent'. Manifest variables are directly observed and measured, while latent variables are not. Latent variables can only be indirectly measured by their underlying indicators (Byrne, 2010; Kline, 2015). For example, 'built environment' in [Figure 4.1](#) will be defined as a latent variable measured by the two indicators of having a bus stop within 500 m of the residence and having a train station within 2000 m.

A SEM is estimated by matching the empirically based covariance matrix of the data with the resulting model-based covariance matrix. Maximum likelihood (ML) is often used as the estimation technique, although this assumes a multivariate normal distribution of all endogenous variables in the model. However, many of the endogenous variables in [Figure 4.1](#) violate this assumption. Consequently, ML with bootstrapping was used instead, as this has proven to be a good alternative for analysis with non-normally distributed data (Byrne, 2010), as well as in travel behaviour research (Ory & Mokhtarian, 2010). Bootstrapping uses random sampling with replacement. It draws multiple subsamples of the same size as the original one and provides data for hypothesis testing.

For each model in [Figure 4.1](#), all relationships were estimated simultaneously using the software package IBM SPSS AMOS 22 Graphics. Only significant relationships were retained (in this case defined as relationships with  $p < 0.10$ ). After refitting the reduced model, modification indices were considered. Modification indices specify the reduction in the overall model fit chi-square for each possible relationship that can be added to the model. AMOS always suggested many additional relationships, but only those that made sense theoretically were added.

## DATA

For this study, data were used from a 2016 Internet survey on values and travel behaviour with respondents from Brussels, Belgium. Respondents were recruited using a snowball approach based on the distribution of flyers in the city of Brussels, Belgium (e.g., on KU Leuven campus in Brussels). The survey not only included questions on values but also spatial and mobility attitudes. After data cleaning, a final sample of 334 respondents was retained for further analysis

**Table 4.1 Descriptive sample statistics**

	<i>Frequency</i>
Gender	43% male – 57% female
Education	16% low – 84% high
Professional occupation	49% professionally active – 51 not professionally active
Student	32% yes – 68% no
Income	83% low – 17% high
Partner	52% yes – 17% no
Car driving license	83% yes – 17% no
Season ticket for bus, tram, metro	57% yes – 43% no

Season ticket for train	11% yes – 89% no			
	<i>Min.</i>	<i>Max.</i>	<i>Mean</i>	<i>Std. dev.</i>
Age	13	79	37.3	16.61
Number of cars per household	0	6	1.2	1.04

(see [Table 4.1](#)). The sample is characterised by a high level of education and income. But despite sampling on campus, it is not dominated by students.

## KEY VARIABLES

### Values

Values were measured using the portrait values questionnaire (PVQ) developed by Schwartz (2003). This is a well-established 21-item measure of human values also used in, for example, the European Social Survey (ESS). The PVQ includes 21 short items describing a person's goals, aspirations or wishes. Respondents are asked to compare the item stated to themselves ('How much is this person like you?') and to indicate the extent to which it is indeed applicable on a 6-point Likert scale (with 1 = very much like me, and 6 = not like me at all). Table 4.2 summarises how these 21 items can be combined to measure 10 basic human values. Scores on the different items belonging to a specific value are averaged out. The last column of Table 4.2 shows the mean score per value of the sample used in this chapter. The strongest values in this sample, indicated by the lowest scores, are related to benevolence and universalism.

### Spatial and travel attitudes

In addition to values, the survey also included questions on spatial and travel attitudes. Respondents were asked to rate on a 7-point Likert scale (1 = not important at all, 7 = extremely important) how important various aspects are in their residential location choices and transport mode choices. These aspects were found to be highly correlated with each other, and the number of aspects could therefore be reduced by means of factor analysis (principal axis factoring with promax rotation). The number of factors was determined based on the interpretability of the factors, the interpretation of the scree-plot and the eigenvalues larger than 1. The factor analysis resulted in four spatial attitudes (i.e., pro-safe and attractive environment, pro-social interaction, pro-accessibility of mandatory activities, pro-accessibility of non-mandatory activities) and four travel attitudes (i.e., pro-privacy and comfort, pro-time saving, pro-sustainability, pro-weather protection). Results of these two-factor analyses are summarised in Table 4.3.

**Table 4.2 Human values based on Schwartz's PVQ**

<i>Human value</i>	<i>Definition</i>	<i>Specific item from 21-item instrument</i>	<i>Mean score (std. dev.)</i>
Power	Social status and prestige, control or dominance over people and resource	Wealth, tell others	3.84 (1.067)
Achievement	Personal success through demonstrating competence according to social standards	Show abilities, successful	3.15 (1.163)
Hedonism	Pleasure and sensuous gratification for oneself	Good time/spoil self, fun/pleasure	2.59 (1.026)

Stimulation	Excitement, novelty, and challenge in life	New experience, risk/ excitement	2.81 (1.117)
Self-direction	Independent thought and action – choosing, creating, exploring	Creativity/originality, free/own decisions	2.25 (0.865)
Universalism	Understanding, appreciation, tolerance, and protection for the welfare of all people and for nature	Equality for all, understand/listen, behave properly	2.16 (0.757)
Benevolence	Preservation and enhancement of the welfare of people with whom one is in frequent personal contact	Help others, loyal/ devoted	2.16 (0.806)
Tradition	Respect for, commitment to, and acceptance of the customs and ideas that traditional culture or religion impose on the self	Inconspicuous/modest, tradition	3.19 (1.003)
Conformity	Restraint of actions, inclinations, impulses likely to upset or harm others and to violate social expectations or norms	Follow rules, behave properly	3.35 (1.012)
Security	Safety, harmony and stability of society, of relationships and of self	Secure surroundings, state protect	3.20 (1.194)

Source: Schwartz & Bardi, 2001; this study's sample

**Table 4.3 Pattern matrix with factor loadings of four spatial attitudes and four travel attitudes**

	<i>Spatial attitudes</i> ( <i>explained variance: 47.8%</i> )			
	<i>Pro-safety and attractiveness</i>	<i>Pro-social interaction</i>	<i>Pro-accessibility of mandatory activities</i>	<i>Pro-accessibility of non-mandatory activities</i>
Social safety, low crime	0.757			
Traffic safety	0.713			
Neatness, tidiness	0.550			
Sufficient parking	0.527			
Appearance of buildings, architecture	0.473			
Quietness	0.411			
Good contact with neighbours		0.772		

Frequent contact with neighbours	0.771		
Presence of bike paths	0.601		
Presence of green areas	0.433		
Presence of sidewalks	0.415		
Close to public transport		0.896	
Close to shops		0.683	
Close to work/school		0.383	
Close to family and friends			0.634
Close to leisure activities			0.493
<i>Travel attitudes (explained variance: 39.6%)</i>			
	<i>Pro-privacy and comfort</i>	<i>Pro-time saving</i>	<i>Pro-sustainability Pro-weather protection</i>
Privacy-offering	0.734		
Image	0.518		
Comfortable	0.516		
Relaxing	0.430		
Time-saving		0.745	
Reliable		0.638	
Flexible		0.496	
Healthy			0.706
Environment-friendly			0.628
Cheap			0.317
Safe			0.285
Clothing			0.740
Weather			0.690

## RESIDENTIAL LOCATION, VEHICLE OWNERSHIP AND ACTIVITY BEHAVIOUR

Next to values and attitudes, other key variables in the different model structures in [Figure 4.1](#) refer to the built environment of the residential location, vehicle ownership and activity behaviour.

The built environment of the residential location was not questioned directly in the survey. However, the survey included two questions that could be used as indicators of the built

environment of the residential location. Consequently, residential location is considered in this chapter as a latent variable. Respondents indicated the distance from their residence to the nearest public transport stop. Of the respondents, 17.7% indicated living within 500 m of a bus, tram or metro stop, and 47.9% indicated

living within 2000 m of a railway station. These two spatial variables are used as indicators of an 'urban residential location'.

Regarding vehicle ownership, the survey asked respondents about the number of cars owned in their household. On average, households owned 1.2 cars (see also Table 4.1). With respect to activity behaviour, respondents were asked how many work, school, leisure, shopping, service, business, drop-off and pick-up and touring activities they did on a weekly basis. Based on this, the weekly total number of activities was calculated. Respondents had, on average, 15 activities per week.

### **Public transport use**

The final outcome variable in this SEM analysis refers to public transport use. Respondents were not only asked about their weekly activities but also about their weekly number of trips by various transport modes. Based on this, the weekly total number of trips was calculated, as well as the percentages for each transport mode. Respondents make, on average, 16 trips per week. The majority of these trips are by car as a driver (32.1%), followed by walking (25.3%) and bus, tram and metro (19.2%). The share of other transport modes is remarkably lower (10.5% car as a passenger, 7.7% bicycle, 4.1% train, 1.1% moped/motorcycle). The SEM analysis in this chapter focuses on explaining the share of public transport (bus/tram/metro and train).

## **RESULTS**

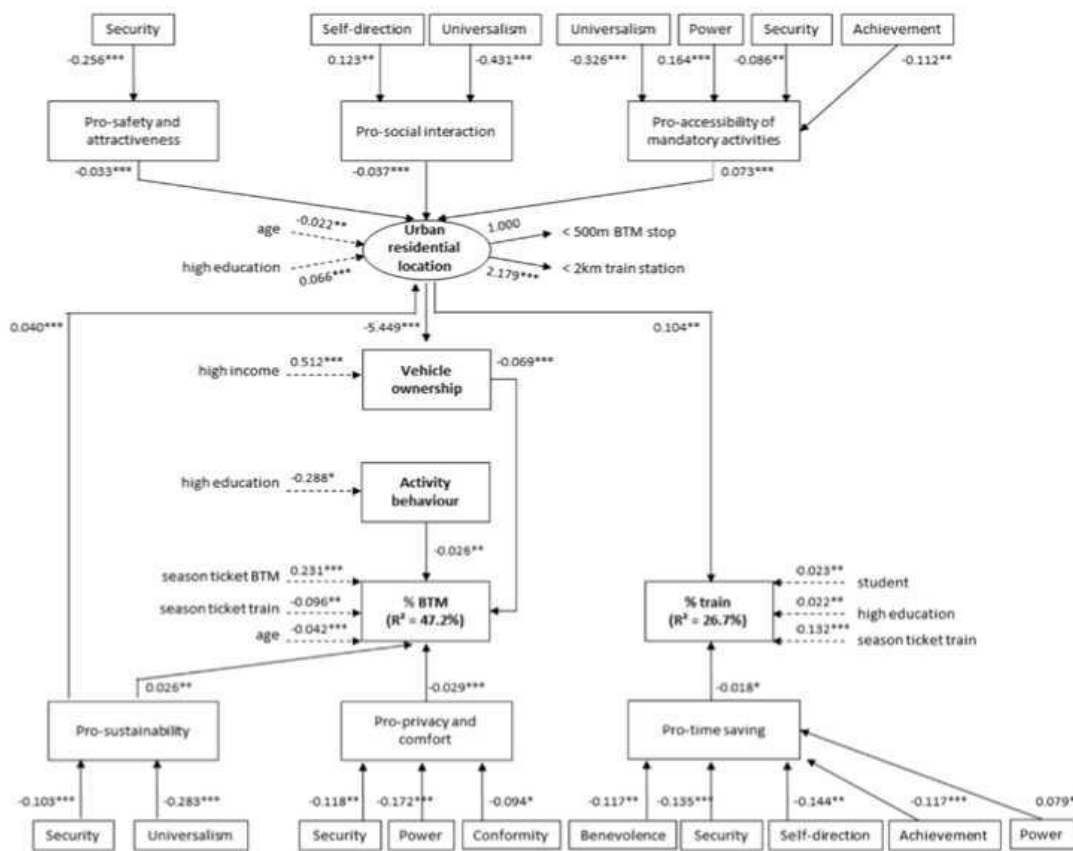
This section summarises the results of two SEMs representing the two model structures in [Figure 4.1](#), measuring the effect of attitudes and values on public transport use while also accounting for residential self-selection (see [Figure 4.2](#)) and residential determination (see [Figure 4.3](#)), respectively.

First, central in [Figures 4.2](#) and [4.3](#) is a choice hierarchy with long-term urban residential location and mid-term vehicle ownership impacting daily activity behaviour and public transport use. This choice hierarchy is very simple for train use: residing in an urban built environment directly encourages train use. Other aspects of this choice hierarchy (vehicle ownership, activity behaviour) do not have a significant influence on train use. In contrast to train use, the choice hierarchy is much more complex for the use of bus, tram and metro. Residing in an urban built environment discourages vehicle ownership, and low vehicle ownership in turn is associated with high bus, tram and metro use. Complex activity patterns, on the other hand, discourage bus, tram and metro use. This is consistent with findings of earlier studies (Hensher & Reyes, 2000; Paulley et al., 2006; Currie & Delbosc, 2011).

Second, attitudes are important predictors in this choice hierarchy. Three spatial attitudes have a direct influence on the choice of an urban residential location. Respondents with a positive attitude towards having access to mandatory activities such as work and school are also more likely to reside in an urban built environment. The reverse holds for respondents with a positive attitude towards social interaction and safety and attractiveness. Because of its interaction with the urban residential location, spatial attitudes eventually also have an indirect effect on public transport use. This indirect effect is significant but generally small compared to other variables. This confirms earlier research on modal choices in Flanders, Belgium (Van Acker et al., 2011). Only the positive attitude towards accessibility has a considerable indirect effect in the models for bus, tram and metro use (with standardised coefficients of 0.110 in [Figure 4.2](#) and 0.142 in [Figure 4.3](#)). The effect of travel attitudes on public transport use is generally more important. Standardised coefficients of most travel attitudes are larger than 0.100. Similarly to other studies like Anable (2005) and Gardner and Abraham (2008), travel attitudes are found to be important explanatory variables. Respondents who prefer privacy, comfort and/or time savings are less likely to use public transport. Only respondents with a positive attitude towards sustainable travel options are more likely to use bus, tram and metro. The latter attitude has

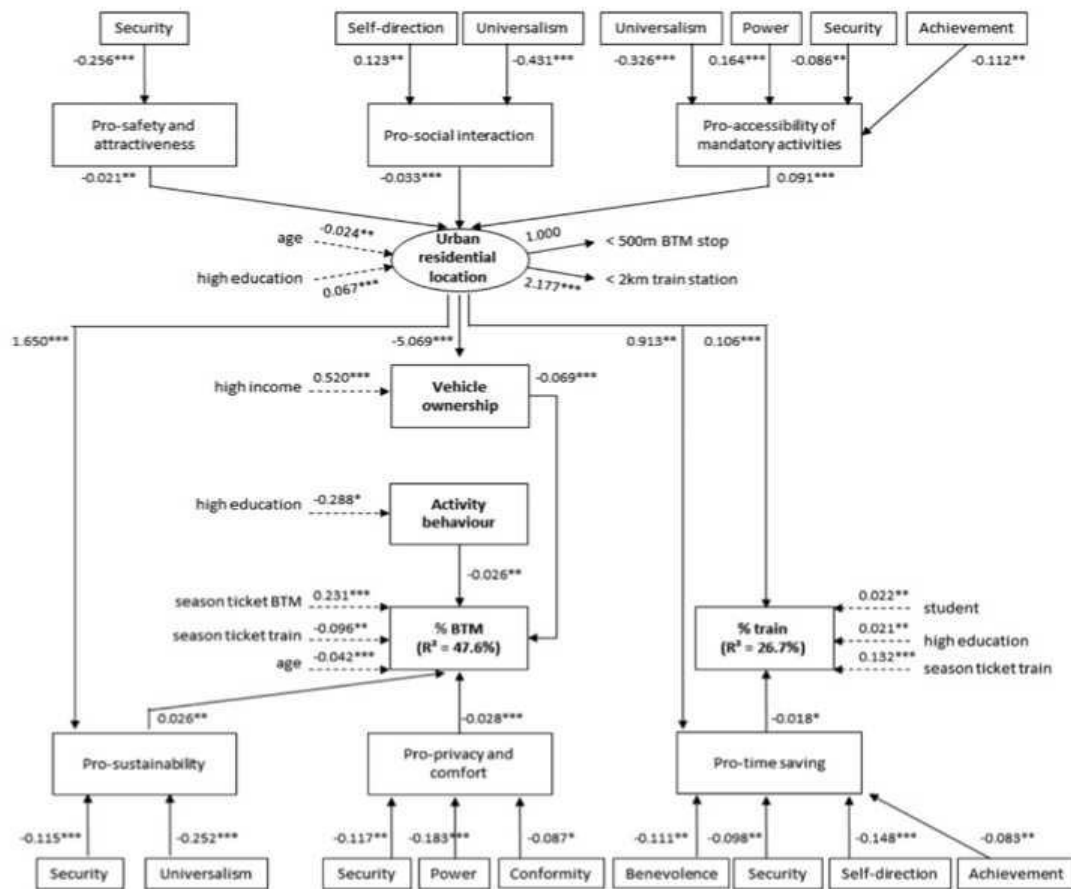
an indirect effect on bus, tram and metro use as well. Respondents who prefer sustainable travel options to some extent self-select themselves in an urban residential location, causing an indirect effect on bus, tram and metro use. This indirect effect is small but significant.

**Figure 4.2 SEM diagram with unstandardised path coefficients – model structure including residential self-selection**



Third, there is not only evidence of residential self-selection, as already mentioned, but also of residential determination. As the model fit of Figure 4.3 with residential determination is similar to the model fit of Figure 4.2 with residential self-selection, it seems that both processes are equally important. So, a sustainable travel attitude not only favours residing in an urban residential location (see Figure 4.2), but the reverse is also true. Urbanites might also develop a liking for sustainable travel options after experiencing living in an urban built environment for a while (see Figure 4.3). Moreover, urbanites are also more likely to develop a liking for saving travel time.

**Figure 4.3 SEM diagram with unstandardised path coefficients – model structure including residential determination**



Model fit:  
 Chi<sup>2</sup> = 424.79 (df = 175) p = 0.000; Chi<sup>2</sup> / df = 2.43  
 CFI = 0.88, TLI = 0.79, RMSEA = 0.07, SRMR = 0.069, PNFI = 0.48  
 Note: \*\*\* p <= 0.01; \*\* p <= 0.05; \* p <= 0.10

Fourth and finally, values have a significant influence on spatial and travel attitudes and thus offer insights into the origins of these attitudes. Because of the interaction between values and attitudes, several significant indirect effects of values on public transport use exist. As could be expected, bus, tram and metro use were found to be higher among respondents with values of conformity (referring to proper behaviour and respecting rules) and lower among respondents with values of self-direction (referring to independent thinking and action) and achievement (referring to personal success). The positive indirect effect of conformity runs via a path along travel attitudes. Respondents who value proper behaviour and respecting rules are less likely to have a positive travel attitude towards privacy and comfort (probably associated with car use instead), which eventually encourages the use of bus, tram and metro. The negative indirect effects of self-direction and achievement, on the other hand, run via a path along residential attitudes and urban residential location choices. For example, self-direction is positively associated with a positive residential attitude towards social interaction, but this residential attitude does not favour an urban residential location and also therefore not the use of bus, tram and metro. While bus, tram and metro use are discouraged by values of self-direction and achievement, the opposite holds for train use. Respondents who value self-direction and achievement are less likely to be in favour of travel time savings, which eventually encourages train use. This positive indirect effect via travel attitudes is large enough to compensate for the previously mentioned negative indirect effect of self-

direction and achievement via residential attitudes. Furthermore, train use is also positively associated with the values of benevolence (referring to preserving and enhancing the welfare of people with whom one has close contacts), something that could be expected for public transport use.

Rather surprisingly, the use of public transport (be it bus, tram and metro or train) was found to be negatively associated with values of universalism (referring to equality for all) and positively with values of power (referring to social status and prestige). One would expect the opposite, as has been found before in studies like Jaśkiewicz and Besta (2014). The negative indirect effect of universalism originates from two directions. First, values of universalism in this study do not encourage a positive residential attitude towards accessibility and therefore do not favour an urban residential location choice, eventually explaining the lower use of public transport. Second, values of universalism apparently do not translate themselves into sustainable travel attitudes, explaining the lower use of bus, tram and metro again. Similarly, the positive indirect effect of power originates from two directions via residential attitudes and travel attitudes. Respondents who value power are also more likely to have a positive residential attitude towards accessibility and as such reside in an urban residential location, explaining the higher use of public transport. Furthermore, values of power are negatively associated with travel attitudes of 'pro-privacy and comfort', which eventually discourages the use of bus, tram and metro, and positively associated with travel attitudes of travel time savings, which eventually discourages train use.

Hence, the interaction between values, attitudes, and behaviour provides additional insights into different segments of public transport users. Nevertheless, although this interaction results in significant indirect effects of values and therefore is not to be neglected, other variables often have a stronger impact on public transport use. Travel attitudes were already mentioned as having a strong influence on public transport use, but the most important variable explaining public transport use is the possession of a season ticket (with standardised coefficients above 0.400 in both SEMs).

## **CONCLUSION**

Past studies on the determinants of public transport tend to focus on economic and structural factors. Compared to this, less is known about 'soft' factors like attitudes. By using data from an online survey organised in Belgium, this book chapter has provided detailed insights into the role of spatial and travel attitudes in explaining public transport use. Moreover, it has situated these attitudes not only in a choice hierarchy of residential location, vehicle ownership and activity behaviour but also in another hierarchy of values-attitudes-behaviours.

Attitudes, and especially travel attitudes, were found to be important determinants of public transport use. Pro-sustainable travel attitudes encourage the use of bus, tram and metro, but positive attitudes towards privacy, comfort and time savings discourage public transport use. It indicates that public transport should not only be promoted as a sustainable way of travelling. Efforts are also needed to improve comfort, punctuality and reliability so that these negative attitudes towards public transport could be reversed.

Furthermore, travel attitudes might be drivers of residential self-selection, but the reverse process of residential determination is equally important. This finding illustrates how important the built environment of the residential location is for public transport use. Living in an urban residential neighbourhood with easy access to public transport not only has a direct effect (especially on train use), it also strengthens a positive attitude towards sustainability, resulting in an indirect effect (especially on the use of bus, tram and metro). However, living in an urban neighbourhood also strengthens a positive attitude towards time savings, which eventually drives people away from public transport use. Residents of urban areas might experience loss of

travel time due to congestion, public transport stuck in traffic and being delayed. This finding indicates how important it is for cities to invest in dedicated bus lanes and traffic circulation systems that do not interfere with public transport.

Adding attitudes but also considering the origins of attitudes in terms of personal values has proven to help in understanding the heterogeneity in travel choices made by individuals. It also offers avenues for sustainable mobility policies. For example, public transport seems to be positively associated with values of benevolence. Promoting the use of public transport as an act of caring for others might therefore be effective, especially in times of climate change. In addition, values of achievement were found to discourage public transport. Nevertheless, public transport could be promoted as a way to achieve personal goals. Although this might seem counterintuitive at first, it might be possible to link public transport use to personal goals related to health. For example, various studies pointed out how a shift from car to public transport increases health (Rissel et al., 2012; Rojas-Rueda et al., 2012; Stevenson et al., 2016). Consequently, by adding 'soft' factors to the models, additional opportunities for stimulating public transport use could be identified which otherwise remain unidentified.

While values are considered stable, attitudes can change over time. This chapter illustrated how travel attitudes could change due to the process of residential determination. The current COVID-19 pandemic may have an accelerating effect on this. In many regions and countries, people have been encouraged to work from home, limit their travel behaviour to essential trips only and maintain social distancing. This resulted in a large reduction in mobility (Warren & Skillman, 2020) and a reduction of activity spaces (Klein et al., 2020). People might thus have experienced their residential neighbourhood in a completely different way, and, due to residential determination, they might eventually change their travel attitudes. This calls for more research on the stability of travel attitudes.

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