Modal choices within the built environment. Or why some people still use their cars in an urban neighbourhood.

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Modal choices within the built environment
Or why some people still use their cars in an urban neighbourhood

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Abstract: *This paper analyzes spatial (mis)match or, in other words, whether people's spatial perceptions of their residence correspond with the objectively measured spatial characteristics of it. This paper aims at describing the size of spatial (mis)match in the first place. Secondly, we point out the travel consequences of (mis)matched spatial perceptions. Based on an Internet survey on lifestyles and leisure mobility in Flanders (Belgium), we found that people overrate the urbanized character of their residence. Among urbanites, (mis)matched spatial perceptions do not influence modal choice. Within such an urban neighbourhood, modal choices remain mainly influenced by the built environment. However, the influence of spatial (mis)match becomes more important among ruralites and, especially, suburbanites. The travel consequences of (mis)matched spatial perceptions thus clearly depend on the residential neighbourhood type.*

Keywords*:* perceptions, spatial (mis)match, built environment, modal choice

1. Introduction

Common studies on the interaction between land use and travel behaviour might come across as deterministic: travel behaviour tends to be explained by objective spatial characteristics of the land use patterns without considering the underlying behavioural mechanisms. Higher densities, more diversity and better local accessibility are often believed to result in less car use, more public transport and more cycling and walking (for a more comprehensive review, see, e.g., Badoe and Miller, 2000; Crane, 2000; Stead et al., 2000; Ewing and Cervero, 2001; Stead and Marshall, 2002; van Wee, 2002; Handy, 2002, 2005; Van Acker and Witlox, 2005; Bartholomew and Ewing, 2009). However, not all people that reside in high-density, diverse and accessible neighbourhoods travel by definition by public transport or walk and bike instead of using their cars. This is (partly) due to differences in more subjective and behavioural influences such as perceptions (Van Acker et al., 2010). It might be possible that one person perceives the residential neighbourhood as unsafe preventing him or her to walk, whereas another person feels it is relatively safe to walk around. Only recently, attempts are made to incorporate such subjective influences into land use-travel behaviour interaction models (e.g., Kitamura et al., 1997; Bagley and Mokhtarian, 2002; van Wee et al., 2002; Scheiner and Holz-Rau, 2007). However, almost none of these studies questions whether these subjective influences correspond to the objective reality. For example, a neighbourhood is objectively evaluated as pedestrian friendly (e.g., low motorized traffic levels, availability of sidewalks), but an individual with a specific lifestyle might still consider this neighbourhood as unsafe. Therefore, it would be interesting to balance objective variables against more subjective variables. One exception is the series of studies by Schwanen and Moktharian (2003, 2005a, b) which focuses on the concept of residential neighbourhood type dissonance, or mismatch between preferred and actual type residential location. They found that travel behaviour of the mismatched individuals corresponds to the matched residents of

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the actual neighbourhoods, suggesting that the influence of land use patterns remain important despite mismatched spatial preferences. However, it might be interesting to know also how people *perceive* their current residence and how this corresponds with the objectively measured land use characteristics of that residential neighbourhood. This would offer insights in the accuracy of someone's spatial knowledge about their actual residential neighbourhood. For example, the distance between the residence and the nearest bus stop can objectively be measured but there are no guarantees that a short distance might also perceived as such. Especially non-public transport users might not be aware that a bus stop is within close distance of their residence. In this paper, we will focus on the travel consequences of such (mis)matched spatial perceptions. Therefore we use data from an Internet survey on lifestyles and leisure mobility in Flanders (Belgium) which also questioned the respondents' perceptions of their current residential neighbourhood. By adding spatial information from other land use databases, spatial perceptions can be balanced against the objective spatial characteristics of the respondents' current residential neighbourhood. The consequences of the (mis)matched spatial perceptions on modal choice for leisure trips will thus be evaluated.

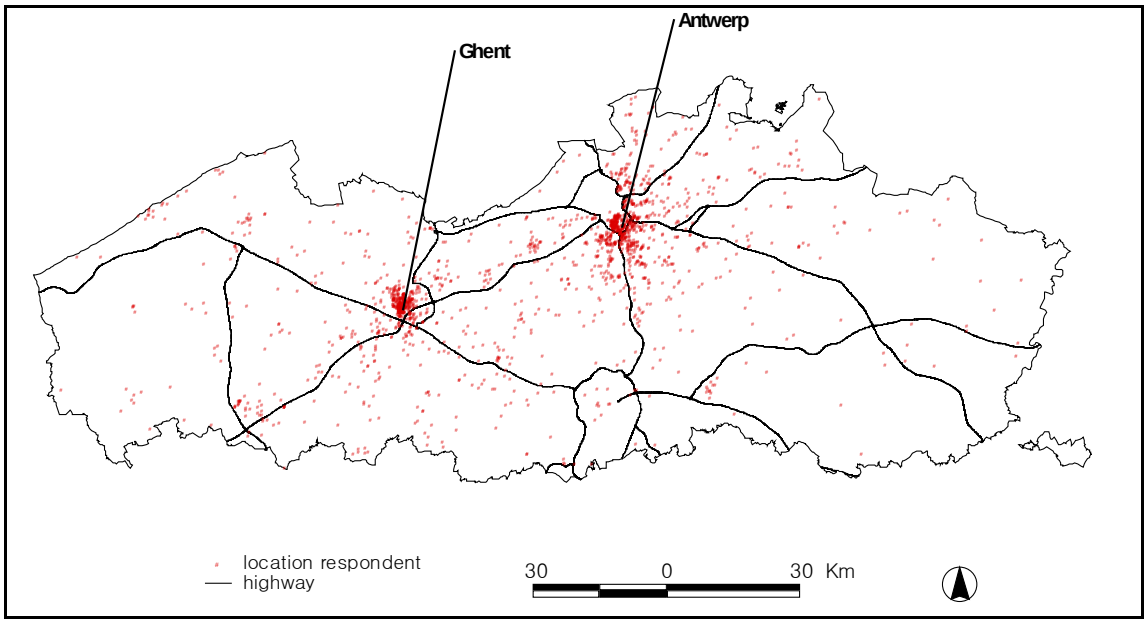
2. Data and measurement of key variables

Current travel surveys generally lack information on subjective influences such as perceptions. Therefore, we conducted an Internet survey between May 2007 and October 2007. In this section, we describe the study background characteristics, and the measurement of objective spatial characteristics and subjective spatial perceptions.

2.1. Description of the sample

The survey was made known to students and staff members of the University of Antwerp and the Faculty of Sciences at Ghent University, and an announcement was published in regional information magazines of several villages in the larger urban region of Ghent (Flanders, Belgium). In total, 2,363 persons completed the survey, of which 1,878 were retained after data cleaning for further analyses. Figure 1 illustrates the residential locations of these respondents.

Figure 1 : Locations of respondents in Flanders



Despite our efforts, we did not obtain a well-balanced sample as can be seen in Table 1. Women, married couples, people with full-time employment and younger people are overrepresented. But the most remarkable difference is in education. Highly-educated respondents are heavily overrepresented in the sample: 66% has a college or university degree, which is considerably higher than the average of 25% for Flanders. Although the sample is not representative of the entire population of Flanders, we feel that this does not devalue it for our research purposes and results. Our purpose is to model relationships among variables, not to ascertain the univariate distributions of variables in isolation. Our analysis can still properly capture the conditional influence of having a given level of education on travel behaviour, even if the proportion of people having that amount of education differs between our sample and the population. The sample also permits demonstration of our premise that, conditional on a given level of education, subjective variables such as personal perceptions can still explain a significant additional amount of variance in modal choices.

	Sample (survey)		Reference (Flanders)	
Gender, female		58.7%		51.1%
Marital status				
single		23.6%		37.7%
married/cohabiting		74.5%		62.3%
Education				
primary school		0.2%		20.7%
secondary school, 3 years		1.5%		21.6%
secondary school, 6 years		32.4%		33.4%
college, university		66.0%		24.7%
Employment, full-time		82.4%		76.3%
Monthly household income				
	0-749 €	9.6%	0-833 €	19.1%
	750-1,499 €	6.7%	834-1,666 €	32.1%
	1,500-2,249 €	14.2%	1,667-2,500 €	21.2%
	2,250-2,999 €	18.6%	2,501-3,333 €	10.4%
	3,000-3,749 €	24.8%	3,334-4,166 €	6.6%
	3,750-4,499 €	13.2%	+ 4,167 €	10.5%
	4,500-5,249 €	6.2%		
	5,250-5,999 €	3.8%		
	+ 6,000 €	2.9%		
Possession driving licence		81.5%		81.0%
Average age		30.6 years		40.8 years
Average car ownership		1.4 cars/household		1.2 cars/household

Table 1: Socio-economic and demographic description of the sample

2.2. Subjective spatial perceptions

Although the survey was not designed to question perceptions, it contained 16 statements on how respondents perceive their current residential neighbourhood. Respondents were first asked to indicate which aspects except price (e.g., quietness, presence of green areas, close to work, traffic safety, …) would influence a *supposed* residential location choice. Then, they had to indicate on a five-point Likert scale how satisfied they are with these importantly-rated aspects in their *current* residential neighbourhood. From these 16 statements, we selected only those statements that are relevant and can be related to the physical characteristics of the residential neighbourhood. Statements such as “To what extent are you satisfied with traffic safety in the neighbourhood were you currently live?” were thus not selected. The scores on

these selected statements were then factor analyzed (principal axis factoring, promax rotation, 39.4% variance explained) into two underlying dimensions that influence how respondents perceive their residence (see Table 2): (i) having access to various facilities (typically for urban neighbourhoods), and (ii) the presence of open space and quietness (typically for suburban or rural neighbourhoods).

Perception factor → **To what extent are you satisfied with these aspects of the neighbourhood where you currently live? ↓**	**Accessibility**	**Open space and quietness**
close to leisure activities	0.701	
close to shops, groceries	0.681	
close to public transport	0.461	
close to work	0.367	
close to family, friends	0.365	
quietness		0.811
presence of green areas		0.801

Note:
Only factor loadings higher than 0.300 (in magnitude) are reported since these loadings characterize the factors to a large extent.

Table 2 : Pattern matrix for perception factors

In a subsequent step, respondents with similar scores on these two perception factors were grouped together by means of a cluster analysis (Ward's method, squared Euclidean distance). Doing so, we found three clusters reflecting whether respondents perceive their residential neighbourhoods as urban, suburban or rural (see Table 3)

Perception cluster → **Perception factor↓**	**Urban**	**Suburban**	**Rural**
accessibility	0.061	0.434	-1.316
open space and quietness	-1.112	0.608	0.175
N	**529**	**878**	**314**

Table 3 : Description of the perception clusters

2.3. Objective spatial characteristics

By geocoding the respondent's address, we could add spatial information from various land use and transportation databases in order to calculate several spatial characteristics of the respondent's residence. For this study, we calculated two additional spatial characteristics that can be related to the spatial perception described earlier (see also Van Acker and Witlox, 2010a, b): (i) local accessibility, and (ii) built-up index. We use the number of people that can

be reached by car within 5 minutes as a proxy for local accessibility in general. For each residence, accessibility is calculated using the regional travel demand forecasting model Multimodal Model Flanders. It is basically the sum of the number of people of every census tract in the region, weighted by the travel time from the residence to these census tracts. Travel time is calculated in ArcGIS 9.2 as the fastest path by car along the road network. We restricted this travel time to 5 minutes in order to detect differences in local accessibility. After all, our study area has a limited geographical scale so that differences in accessibility are more important on a local level (e.g., within 5 minutes) than a regional level (e.g., within 60 minutes). The built-up index equals the percentage of built-up surface at the census tract level. It can be considered as a proxy for built-up density. It is derived from the land use database of the Agency of Spatial Information Flanders which offers a categorization between built-up surfaces and open surfaces.

By performing a cluster analysis, neighbourhoods with similar scores on these two spatial characteristics are grouped together so that the clusters describe various residential neighbourhood types (see Table 4) ranging from urban, suburban to rural neighbourhoods.

Spatial cluster → **Spatial characteristic↓**	**Urban**	**Suburban**	**Rural**
local accessibility	114,026	54,396	17,400
built-up index	0.884	0.727	0.412
N	**90**	**274**	**664**

Table 4 : Description of the neighbourhood clusters

3. (Mis)matched spatial perceptions and its travel consequences

After having specified the respondents' spatial perceptions and the diverse neighbourhood types, we can balance these two against each other and determine whether respondents perceive their residence in a correct way.

3.1. Size of (Mis)matched spatial perceptions

Table 5 illustrates that almost 40% of all respondents correctly perceive their residential neighbourhood (see figures in grey, on the diagonal) and have, what we call, matched spatial perceptions. The large amount of spatial mismatch is thus striking. Moreover, respondents tend to overrate the urbanized character of their residence (see larger figures in red compared to figures in green). For example, more than half of all respondents who reside in a rural neighbourhood perceive their residence as suburban, whereas this figure is only 10% in the reverse situation (i.e., residing in a suburban neighbourhood but perceiving it as rural). This urbanized perception can be explained by the long-lasting tradition of suburbanization that exists in Belgium and goes back to the nineteenth century. After all, influenced by its housing policy and transport policy, a commuting culture has always existed in Belgium. Due to inexpensive public transport season tickets and a well-established network of railways and tramways, people were no longer compelled to reside nearby their jobs located within the city and they moved toward green, safe and quiet residential neighbourhoods outside the city centre. This was even more encouraged by the housing policy which promoted inexpensive

social house-construction in garden cities, and provided subsidies and fiscal compensations for individual home-ownership. As a consequence, some form of suburbanization already existed in Belgium from the second half of the nineteenth century (Lauwers, 1991; Kesteloot, 2003; Verhetsel et al., 2007; Boussauw et al., 2009). This process of extensive suburbanization led to a highly fragmented urbanized space evoking the impression that every square meter is densely built-up.

Perception cluster → **Spatial cluster ↓**		**Urban**	**Suburban**	**Rural**	**Total**
Urban	N	170	121	27	**318**
	% within spatial cluster	53.5%	38.1%	8.5%	**100.0%**
	% within perception cluster	33.3%	14.6%	9.4%	**19.6%**
	% of Total	10.5%	7.4%	1.7%	**19.6%**
Suburban	N	202	239	53	**494**
	% within spatial cluster	40.9%	48.4%	10.7%	**100.0%**
	% within perception cluster	39.6%	28.8%	18.5%	**30.4%**
	% of Total	12.4%	14.7%	3.3%	**30.4%**
Rural	N	138	469	207	**814**
	% within spatial cluster	17.0%	57.6%	25.4%	**100.0%**
	% within perception cluster	27.1%	56.6%	72.1%	**50.1%**
	% of Total	8.5%	28.8%	12.7%	**50.1%**
Total	**N**	**510**	**829**	**287**	**1,626**
	% within spatial cluster	**31.4%**	**51.0%**	**17.7%**	**100.0%**
	% within perception cluster	**100.0%**	**100.0%**	**100.0%**	**100.0%**
	% of Total	**31.4%**	**51.0%**	**17.7%**	**100.0%**

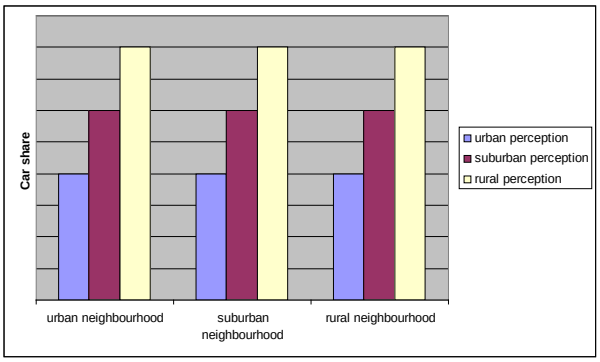
Table 5 : Size of (mis)matched spatial perceptions

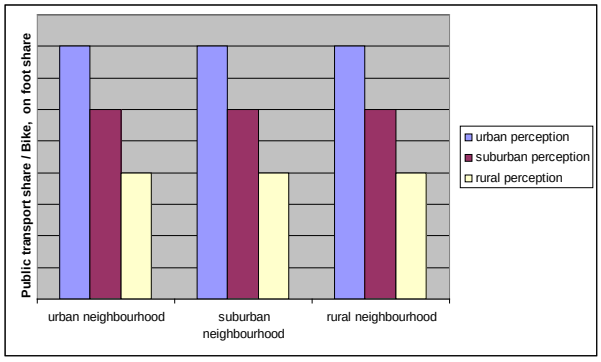
3.2. (Mis)matched spatial perceptions and modal choices

We start our analysis of modal choices with the formulation of two possible hypotheses. Several studies point out that subjective influences such as perceptions are important determinants of modal choices (e.g., Tardiff, 1977; Golob et al., 1979; Gärling et al., 1998; Parkany et al., 2004; Thogersen, 2006). Consequently, it seems plausible that respondents with mismatched perceptions will choose for those travel modes that correspond with their spatial perceptions. For example, someone residing in a suburban neighbourhood but perceiving it as urban might be more likely to use public transport or walk and bike than his matched neighbour. Or in other words, modal choices of this mismatched suburbanite correspond more to the modal choices of a machted urbanite (see 'Hypothesis 1'). However, if perceptions are not crucial to modal choices, the influence of the residential neighbourhood itself might become more important. If this is the case, then all inhabitants within a particular neighbourhood type should make similar modal choices, despite any (mis)matched spatial perceptions (see 'Hypothesis 2').

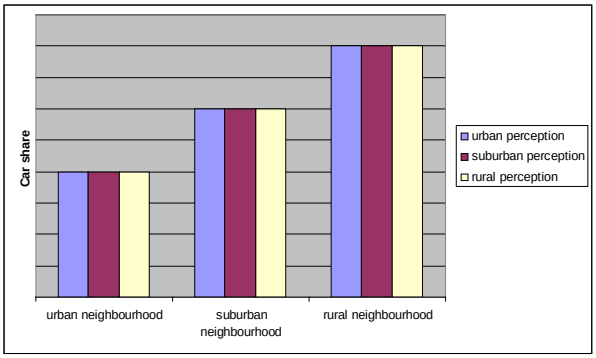
Figure 2 : Hypothesized relationships between (mis)matched spatial perceptions and modal choices

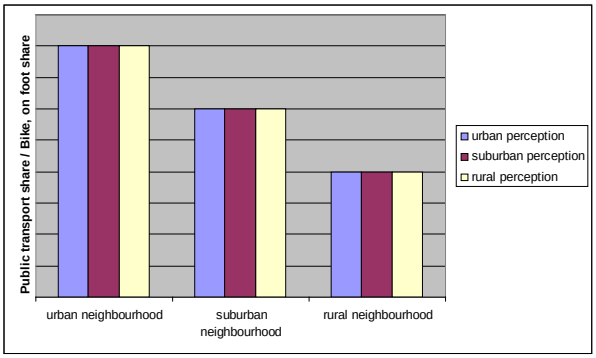
Hypothesis 1: spatial perceptions are crucial





Hypothesis 2: residential neighbourhood is crucial





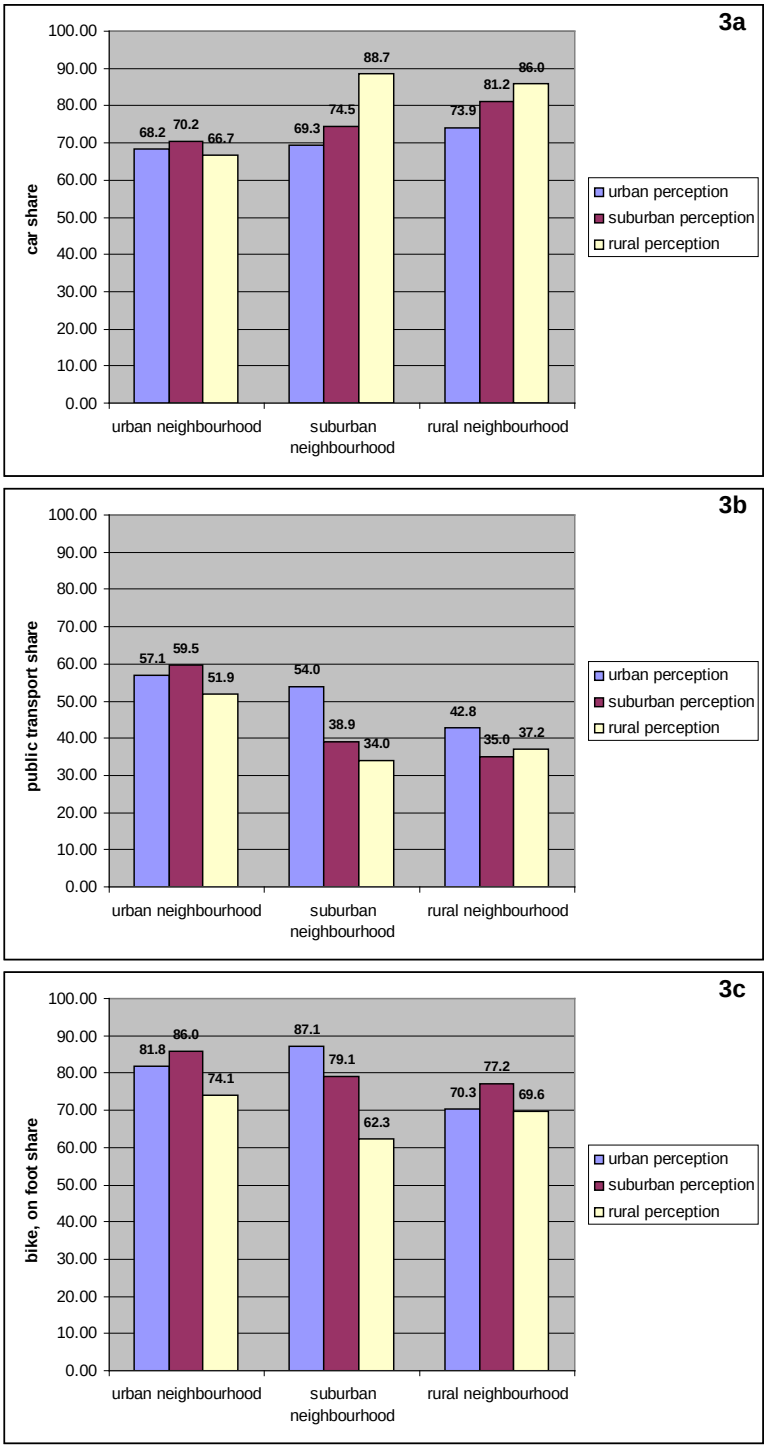
Our data suggests that both hypotheses are true, depending on the neighbourhood type and spatial perception that is considered (see Figure 3).

For example, residing in an urban neighbourhood clearly discourages car use 3a). Car use is almost equally high for all respondents residing in an urban neighbourhood. Whether someone perceives this neighbourhood as urban or not, it seems not to influence the decision to use the car. An urban residential neighbourhood is clearly an important determinant of car use. However, this does not hold for a suburban or rural neighbourhood. Perceptions become more important. A suburban resident but who perceives his/her residence as urban (rural), tends to act as a matched urbanite (matched ruralite) and uses less often (more often) the car.

The influence of (mis)matched spatial perceptions on the share of public transport (3b) and walking/cycling (3c) is less obvious. At first sight it seems that an urban neighbourhood encourages the use of public transport, and walking/cycling. Even though some mismatched urbanites perceive their urban residence as suburban, they rather behave as matched urbanites and are more likely to use public transport and walk/cycle more often than they actually would do so by virtue of their spatial perception. This association is less clear for mismatched urbanites who perceive their neighbourhood as rural (instead of urban). Their share of public transport and walking/cycling is lower than that of a matched urbanite (suggesting that it is not only about the spatial environment), yet still considerably higher than a matched ruralite (suggesting that perceptions are not the only influences as well). More or less similar patterns are found for rural dwellers, but modal choices of suburban dwellers are clearly more influenced by spatial perceptions than by the suburban neighbourhood itself. Mismatched suburbanites have similar modal choices than their matched counterparts. For example, someone who perceives his/her suburban residence as urban (rural), also behaves as a

matched urbanite (ruralite) and choose more often (less often) to use public transport, and to walk/cycle.

Figure 3 : Influence of (mis)matched spatial perceptions on modal choices



4. Discussion and conclusions

This paper aimed at contributing to the research on the interaction between land use and travel behaviour by evaluating the objective and subjective spatial influences of modal choices. Whereas most studies only use objectively measured variables such as population density, land use mix and accessibility to characterize land use patterns, some researchers recently

argued in favour of including more subjective variables as well. After all, due to differences in more subjective and behavioural influences such as individual perceptions, it remains possible that not all urban dwellers travel by definition by public transport or walk and bike more often compared to their suburban and rural counterparts. Whereas one person might perceive his/her residence as unsuitable to walk or cycle around, another person might perceive this in a totally different way. Recent land use-travel behaviour interaction studies are aware of such subjective influences, but tend to neglect the question whether these subjective influences correspond to the objective reality. Therefore, this paper aimed at describing the size of spatial (mis)match between perceptions and reality in the first place.

The dataset we used, stemming from a 2007 Internet survey on lifestyles and leisure mobility in Flanders (Belgium) allowed us to compare the respondent's perceptions of their current residential neighbourhood (perceived as urban, suburban or rural) with objectively measured neighbourhood type (urban suburban or rural). Doing so, our analysis results point out that spatial mismatch occurs to a large degree. Only 40% of all respondents perceive his/her residence in a correct way. Moreover, due to the long-lasting tradition of suburbanization which resulted in the ubiquitous impression of Flanders as one densely built-up area, many respondents tend to overrate the urbanized character of their residential neighbourhood.

Furthermore, this paper pointed out how these (mis)matched spatial perceptions, and thus the accuracy of someone's spatial knowledge, influence modal choices. If these spatial perceptions are crucial to modal choices, then it seems plausible that respondents with mismatched perceptions choose for those travel modes that correspond with their spatial perceptions. Our analyses suggest that it is only true for suburbanites. Among all suburbanites, public transport, cycling and walking (car use) is highest among mismatched suburbanites who perceive their residence as urban (rural). Within the suburbs, residents are thus able to choose for those travel modes that fit within their perception of the residence. However, spatial perceptions are not always the only determinants of modal choices. In other cases, the residential neighbourhood itself becomes more important. Especially in urban neighbourhoods, it seems that high densities and high local accessibility almost automatically result in a lower car share, a higher public transport share and more walking and cycling. Differences in how respondents perceive their urban residence seemed less important: matched and mismatched urbanites tend to make similar modal choices. The influence of (mis)matched spatial perceptions thus clearly depends on the residential neighbourhood type and the travel mode considered.

Based on our findings, one important recommendation can be made for spatial planning policies. Spatial planning policies aimed at densifying and providing facilities at neighbourhood level can contribute to a more sustainable mobility (less car use, more public transport, more walking and cycling), especially if these policies are developed in an urban neighbourhood. After all, our findings suggest that within such an urban neighbourhood, modal choices are mainly influenced by the urban characteristics and not by personal perceptions as such. However, our results also point out similar planning policies developed outside an urban neighbourhood will not automatically have the same result and will only be successful for a specific group of residents that perceive their residence as urban.

Bibliography

Badoe, D. A. and Miller, E. J., *Transportation-land use interaction: Empirical findings in North America, and their implications for modeling*, **Transportation Research D**, 5 (4), pp. 235-263, 2000.

Bagley, M. N. and Mokhtarian, P. L., *The impact of residential neighborhood type on travel behavior: A structural equations modeling approach*, **Annals of Regional Science**, 36 (2), pp. 279-297, 2002.

Bartholomew, K. and Ewing, R., *Land use-transportation scenarios and future vehicle travel and land consumption*, **Journal of the American Planning Association**, 75 (1), pp. 13-27, 2009.

Boussauw, K., Zwerts, E. and Witlox, F., *Mobiel Vlaanderen*, in: Vanderleyden, L., Callens, M., Noppe and J. (eds.) **De sociale staat van Vlaanderen 2009**, Studiedienst van de Vlaamse Regering, Brussel, 2009.

Crane, R., *The influence of urban form on travel: An interpretive review*, **Journal of Planning Literature**, 15 (1), pp. 3-23, 2000.

Ewing, R. and Cervero, R., *Travel and the built environment: a synthesis*, **Transportation Research Record**, 1780, pp. 87-114, 2001.

Gärling, T., Gillhom, R. and Gärling, A., *Reintroducing attitude theory in travel behaviour research. The validity of an interactive interview procedure to predict car use*, **Transportation**, 25 (2), pp. 129-146, 1998.

Golob, T. F., Horowitz, A. D. and Wachs, M., *Attitude-behavior relationships in travel demand modeling*, in: Hensher, D. A. and Stopher, P. R. (eds.) **Behavioural Travel Demand Modeling**, Croom Helm, London, 1979.

Handy, S., Travel behaviour - land use interactions: An overview and assessment of the research, in: Mahmassani, H.S. (ed.) **In Perpetual Motion: Travel Behavior Research Opportunities and Application Challenges,** Pergamon, Amsterdam, 2002.

Handy, S. **Critical Assessment of the Literature on the Relationships among Transportation, Land Use and Physical Activity**, Transportation Research Board, Washington, 2005.

Kesteloot, C., *Verstedelijking in Vlaanderen: Problemen, kansen en uitdagingen voor het beleid in de 21ste eeuw*, in: Boudry, L., Cabus, P., Corijn, E., De Rynck, E., Kesteloot, C., Loeckx, A. (eds.) **De eeuw van de stad**, Ministerie van de Vlaamse Gemeenschap, Brussel, 2003.

Kitamura, R., Mokhtarian, P.L. and Laidet, L., *A micro-analysis of land use and travel in five neighborhoods in the San Francisco Bay Area*, **Transportation**, 24 (2), pp. 125-158, 1997.

Lauwers, D., *Ruimtelijke aspecten van de fileproblematiek*, in: Poté, R., (ed.) **Files in Vlaanderen**, Leuven, Garant, 1991.

Parkany, E., Gallagher, R. and Viveiros, P., *Are attitudes important in travel choice?*, **Transportation Research Record**, 1984, pp. 127-139, 2004.

Scheiner, J. and Holz-Rau, C., *Travel mode choice: Affected by objective or subjective determinants?*, **Transportation**, 34 (4), pp. 487-511, 2007.

Schwanen, T. and Mokhtarian, P. L., *What if you live in the wrong neighborhood? The impact of residential neighborhood type dissonance on distance traveled*, **Transportation Research D**, 10 (2), pp. 127-151, 2005a.

Schwanen, T. and Mokhtarian, P.L., *What affects commute mode choice: Neighborhood physical structure or preferences toward neighborhoods?*, **Journal of Transport Geography,** 13 (1), pp. 83-99, 2005b.

Stead, D. and Marshall, S., *The relationships between urban form and travel patterns. An international review and evaluation*, **European Journal on Transport Infrastructure and Research**, 1 (2), pp. 113-141, 2001.

Stead, D., Williams, J. and Titheridge, H., *Land use, transport and people: Identifying the connections*, in: Williams, K., Burton, E. and Jenks, M. (eds.) **Achieving Sustainable Urban Form,** E. and F.N. Spon, London, 2000.

Tardiff, T.J., *Causal inferences involving transportation attitudes and behaviour*, **Transportation Research**, 11 (6), pp. 397-404, 1977.

Thogersen, J., *Understanding repetitive travel mode choices in a stable context: A panel study approach*, **Transportation Research A**, 40 (8), pp. 621-638, 2006.

Van Acker, V., van Wee, B. and Witlox, F., *When transport geography meets social psychology: Toward a conceptual model of travel behaviour*, **Transport Reviews**, 30 (2), pp. 219-240, 2010.

Van Acker, V. and Witlox, F., *Exploring the relationships between land use system and travel behaviour concepts: some first findings*, **Solstice**, 16 (1), pp. 1-18, 2005.

Van Acker, V. and Witlox, F., *Car ownership as a mediating variable in car travel behaviour research using a structural equation modelling approach to identify its dual relationship*, **Journal of Transport Geography**, 18 (1), pp. 65-74, 2010a.

Van Acker, V. and Witlox, F., *Commuting trips within tours: How is commuting related to land use ?*, **Transportation**, 38 (3), pp. 465-486, 2011.

van Wee, B., *Land use and transport: Research and policy challenges*, **Journal of Transport Geography**, 10 (4), pp. 259-271, 2002.

van Wee, B., Holwerda, H. and van Baren, R., *Preferences for modes, residential location and travel behaviour: The relevance for land-use impacts on mobility*, **European Journal on Transport and Infrastructure Research**, 2 (3/4), pp. 305-316, 2002.

Verhetsel, A., Thomas, I. and Beelen, M., *De kracht van het Alonso-Mutch model. Het woon-werkverkeer in en rond de Belgische grootsteden*, **Ruimte en Planning**, 27 (3), pp. 9-28, 2007.