EXPLAINING PUBLIC TRANSPORT INFORMATION USE WHEN A CAR IS AVAILABLE: ATTITUDE THEORY EMPIRICALLY INVESTIGATED

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Abstract

Despite recent investments in and growing availability of various public transport information services, levels of apparent non-use (of particular information services) across the population remain high. Policymakers and information service providers could benefit from a better understanding of factors affecting information use. The goal of this paper is to provide more insight into the (non-)use of public transport information by applying attitude theory. A postal survey was sent to a random sample of 10,000 households in Bristol and Manchester, UK. The response rate was 13%. Respondents were questioned about an uncertain journey they were going to make. Structural equation modelling has been used to investigate interdependencies among the factors studied. The results show that the desire to consult public transport information for an uncertain journey is affected by attitudes, subjective norms, and past behaviour. These social-psychological factors are in turn affected by constraints such as travel behaviour and trip context. Crucially in terms of addressing issues of non-use of information it is found that consulting information is influenced by propensity to consider using public transport rather than vice-versa as has hitherto been implicitly assumed by many involved in the provision of transport and information services.

Key words: travel information, pre-trip information, public transport, attitude theory, Extended Model of Goal-directed Behaviour (EMGB), Theory of Planned Behaviour (TPB), structural equation modelling

Introduction

Until roughly a decade ago, the main options for finding out how to get somewhere were to ask other people, to rely on printed information such as timetables and road maps, or to phone an enquiries line. With the rise of Information and Communication Technologies (ICTs) such as the Internet and the mobile phone, people's travel information sources have extended dramatically. Multimodal door-to-door travel information web services[1] have been established worldwide, such as 9292OV in the Netherlands, Transport Direct in the UK, Metlink Journey Planner in Melbourne, Australia, and 511.org in San Francisco, US.

There have been considerable developments in the provision of public transport (PT) information services in the UK since an explicit policy emphasis on improving public transport and its information for passengers was formulated by the government (DETR, 1998; DETR, 2000). However, while certain information services (such as National Rail Enquiries) in the UK are reporting annual enquiries running into the millions, such levels of use can appear low in relation to the total volume of travel. Moreover, at the level of specific information services, the number of non-users continue to (heavily) out-weigh the number of users.

Lack of awareness is only one of a variety of factors affecting travel information use (Goulias et al., 2003); habit, for example, is another important factor (De Witte et al., 2008, Fuji and Kitamura, 2003; Verplanken et al., 1997). Moreover, awareness does not necessarily lead to use (GfK NOP, 2007; Peirce and Lappin, 2004). For information service providers to realise the full potential of their services, it is important that such factors are identified and, as appropriate, addressed. Allied to a need to better understand factors affecting travel information use in general, there has been little if any specific consideration of why people do not use *public transport journey planning information services* (as much as might be expected or desired by policymakers and service providers). This is especially

important in a policy environment where travel behaviour change towards greater public transport use is seen as one key aspect of more sustainable travel and mitigating congestion.

Although some studies have investigated the requirements for PT information via stated and revealed needs (AEA, 2007; Cain, 2007; Chorus et al., 2007; Grotenhuis et al., 2007; Ipsos MORI, 2006; Molin and Timmermans, 2006), most of these studies tend to be descriptive rather than explanatory, while only taking sociodemographics into account. Yet sociodemographic factors could be poor proxies for the underlying behavioural and attitudinal characteristics of individuals which may actually determine travel information use (Chorus et al., 2006a). There has also been relatively little attention given to the social context (e.g. word-of-mouth) of information (non-)use.

This paper aims to apply attitude theory to gain a better understanding of the potential underlying factors affecting PT information use and non-use - because of the nature of the data collected, PT information mainly pertains to rail travel and in an inter-urban trip context. The study not only seeks to identify various social-psychological factors that affect information use, but also to assess their *relative* importance and how they affect *each other*. A shortcoming of attitude theory is its implicit assumption that social-psychological mechanisms work similarly for every individual across different geographical and social contexts. However, constraints (such as trip context and habitual travel behaviour) could affect these mechanisms and play an important part in an individual's choice process. Therefore, external factors that represent potential constraints (or, indeed, facilitators) are added to our application of attitude theory, as has been previously done by Dijst et al. (2008).

Previous research has shown that people acquire PT information mostly for unfamiliar trips, arrival time-sensitive trips, longer distance trips, and leisure trips (AEA, 2007; Farag

[1] See: http://www.9292ov.nl/, http://www.transportdirect.info/, http://www.metlinkmelbourne.com.au/, http://www.511.org/

and Lyons, 2008; GfK NOP, 2007; Ipsos MORI, 2006). Consequently, we asked respondents questions about a specific unfamiliar or uncertain (i.e. irregularly made or arrival time-sensitive) journey they were planning to make. We excluded captive public transport users (see Krizek and El-Geneidy) from our analysis, because they would (likely) need to consult PT information by lacking an alternative transport option. This is undesirable when researching factors influencing PT information use. Thus, the target population consists of individuals who have got access to a car (or van) in their household for personal use and who are planning to make an uncertain journey.

Data were collected via a postal survey that was sent to a random sample of 10,000 households in the city of Bristol and the Greater Manchester area, UK. The response rate was 13% (n=1327) and 642 respondents who indicated they were going to undertake such an uncertain journey and who had a car available in their household were included in the analysis. Structural Equation Modelling (SEM) was employed to investigate assumed interdependencies among the factors studied. In SEM, a variable can be both an outcome variable and an explanatory variable at the same time. Latent variables are represented by observed variables which is important when studying factors such as attitudes. SEM also enables the relationships between variables to be decomposed into total, direct, and indirect effects (Jöreskog and Sörbom, 2001).

In the next section, our theoretical framework is introduced. This is followed by the study methodology. The results and their implications are discussed in the last two sections.

Theoretical framework

Looking up PT information can be classified as a goal-directed behaviour: people consult information as a means to an end, for example, making a journey successfully or performing activities at the destination (e.g., meeting friends, attending a business meeting).

Accordingly, we have applied the Extended Model of Goal-directed Behaviour (EMGB) (developed by Perugini and Conner, 2000) to our examination of information (non-)use (see Figure 1). The EMGB is based on the utilitarian notion that people act because they ultimately would like to achieve certain goals, varying from concrete goals as described above to higher level end goals such as establishing recognition and social status. It has been successfully applied in the past to explain dieting, studying, and the decision to buy products online or in-store (Perugini and Conner, 2000; Dijst et al., 2008). An earlier qualitative investigation of PT information use confirmed the appropriateness of using the EMGB (Farag and Lyons, 2008).

The EMGB has its roots in attitude theory, namely in the Theory of Planned Behaviour (Ajzen, 1991). This theory states that intention (here: the intention to look up PT information) is a direct determinant of behaviour and that intention in turn is determined by *attitudes* (the degree to which one has a favourable or unfavourable evaluation of consulting PT information), *subjective norms* (the perceived encouragement by important others, such as family and friends, to consult PT information), and *perceived behavioural control* (the perceived ease or difficulty of consulting PT information).

The EMGB incorporates additional predictors of intentions[2] and, in turn, behaviour (Perugini and Conner, 2000). *Past behaviour* is a proxy of habit and refers to the amount of past experience of performing a particular behaviour (here: consulting PT information). The more often it has been performed (implying a known degree of success in doing so), the more likely an individual is willing to execute the behaviour again. *Goal desire* refers to the level of personal value that is attached to a certain goal outcome. This could be, for example, to reach a certain destination successfully in order to perform activities there. *Goal perceived*

[2] The EMGB uses the wider concept of 'volition' (encompassing among other things the effort needed to enact a certain behaviour) instead of 'intention' (Perugini and Conner, 2000). Also, behavioural desire (motivation to act) is expected to precede volition. However, discriminant validity tests showed

feasibility is defined as the ease or difficulty of reaching the end state. *Anticipated emotions* represent positive or negative emotions in respectively achieving or not-achieving a certain goal for which the behaviour is instrumental. These are goal-related variables, since they express how people would feel if they achieve their goal or fail to do so.

Constraints could affect the behavioural mechanisms described above (Dijst et al., 2008) and could play an important part in consulting PT information. Therefore, external variables that represent potential constraints (or facilitators) are added to the EMGB, providing an integrated model of social-psychological constructs with contextual factors. Based on previous research (AEA, 2007; Cain, 2007; Farag and Lyons, 2008, 2009; Goulias et al., 2003; Ipsos MORI, 2006; Van der Horst, 2006; Verplanken et al., 1997), the following constraints/facilitators have been measured in our survey:

(i) Travel behaviour (frequency of using car, train, coach, and bus);

(ii) Travel attitudes (attitudes towards travel by car, train, and bus; prefer car when travelling with friends, willingness to travel by public transport when parking is difficult or destination is unfamiliar, dislike way finding by car in unfamiliar area);

(iii) Trip context (trip purpose, destination, distance, arrival time-sensitivity, travel party (size and type), overnight stay, trip familiarity, and preferred mode of transport);

(iv) Information factors (the ease of obtaining, understanding, and trusting PT information via telephone, website, and timetable leaflets; awareness of PT information services, and dislike to consult train and bus information);

(v) Social surrounding (not knowing many people who use public transport regularly, received a recommendation or a discouragement to use a particular PT information service by word-of-mouth, and most friends use public transport regularly); and

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no distinction between behavioural desire and volition in our data. Therefore, we do not distinguish between the two constructs and use the term ‘intention’ instead.

(vi) Sociodemographics (gender, age, education, income, household type, presence of children, full time employment, city, car access, Internet access, and Internet use).

Travel attitudes are treated here as an external (explanatory) factor to distinguish them from the attitudes towards using PT information (which are being explained) in the EMGB. Other external factors, such as social surrounding, could also incorporate social-psychological factors. However, for sake of clarity we have treated them as external factors affecting the social-psychological constructs of the EMGB.

Figure 1 represents the theoretical framework that has guided the analyses. For simplicity, all external variables are depicted together affecting the EMGB as a whole. However, we have systematically researched the effect of each individual external variable on each individual social-psychological construct (e.g. the effect of various indicators of trip context, such as distance and trip purpose, on attitudes and on subjective norms). We did this in an exploratory way, as opposed to the confirmatory analysis conducted to test the predefined relationships of the EMGB. Since no hypotheses have been formulated about possible interdependencies *between* the various social-psychological constructs by Perugini and Conner (2000), we also analysed their relationships in an exploratory way. The modelling process is described in more detail in the next section.

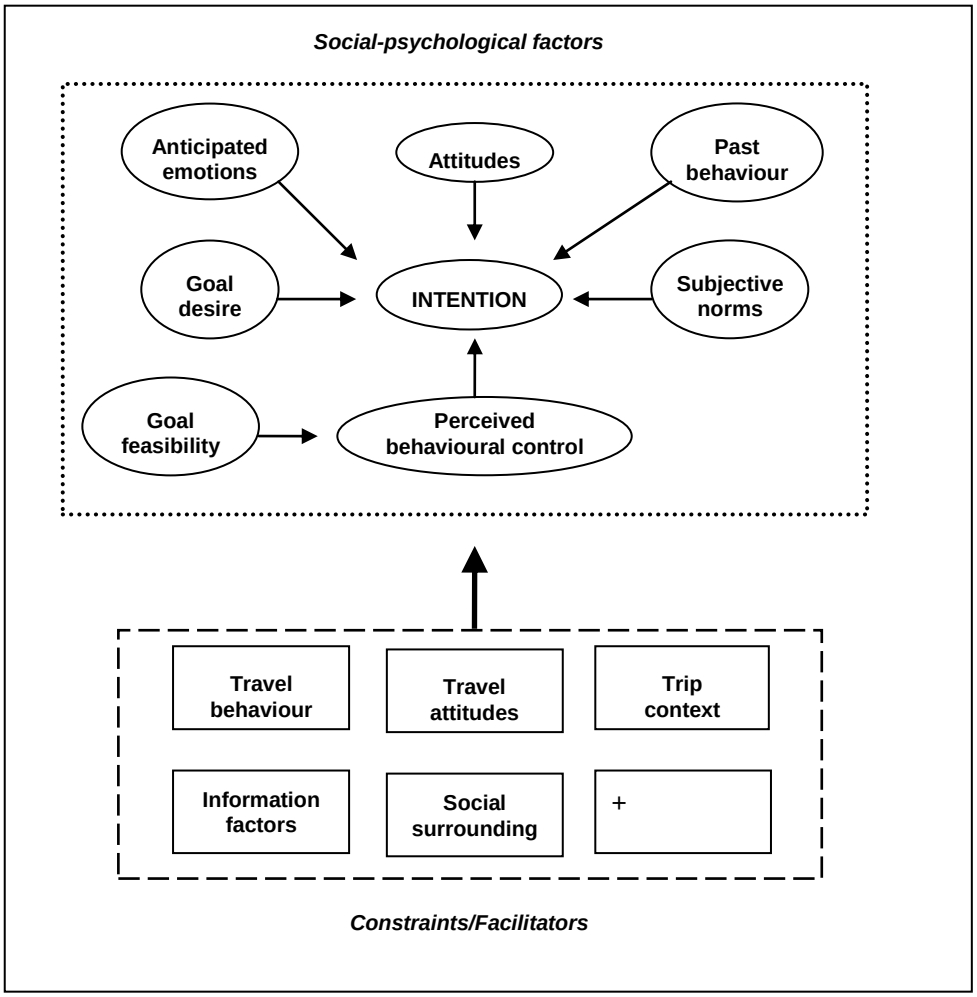

Figure 1 The Extended Model of Goal-directed Behaviour (EMGB) (Perugini and Conner, 2000) expanded with constraints/facilitators

Methodology

A travel information survey was designed and piloted in October 2007 among fifty people living in Bristol. The main topics covered were: personal travel behaviour, public transport information awareness and use, attitudes towards travel and PT information use, and sociodemographics. The questionnaire took approximately twenty minutes to fill out. Public transport was defined as: train, coach, bus, tram, and underground (excluding taxi and air travel). The following PT information sources were studied: telephone enquiry line, website, timetable leaflet, going to the station to ask staff, and asking someone you know. A random

sample of 10,000 households in Bristol (5,000) and Greater Manchester (5,000) in the UK was then selected via the municipalities' population administration and received the postal survey at the beginning of December 2007. The questionnaire could also be filled out online by those receiving an invitation to participate, but only 6% of the total response sample did so. Respondents who returned a completed survey could win a first prize of £500, 3 runner-up prizes of £150 and 10 further prizes of £50. A post card reminder was sent two weeks later. Only one person aged 18 or over could participate per household. The overall response rate was 13% (n=1327).

One section of the questionnaire was called: "Making an uncertain journey: what would you do?". Respondents were asked to think about a journey they would be making in the future within the UK from their home. The following examples of an uncertain journey were given in the questionnaire: (i) a journey you do not regularly make; (ii) a journey to an unfamiliar destination; and (iii) you have to arrive at a specific time, but are uncertain if you will make it on time. It was emphasized that the respondents should try to think of a journey for which they have *not* (yet) consulted any travel information. The majority (65%) of respondents indicated they had such a journey in mind. The analysis has been restricted to those respondents who have access to a car in their household to ensure that a choice between car and public transport is available to them and thus concerns 642 respondents of those planning to make an uncertain journey. To get more insight into the 'uncertain' journey respondents were going to make, the trip characteristics (e.g. distance, destination) described in the previous section were asked, including when the journey was expected to be made.

To give an indication of the representativeness of our sample we compared it with census data for Bristol and Manchester (Bristol City Council, 2008; Manchester City Council, 2008). Our *total* sample (n=1327) is characterised by an over-representation (ranging between 5% and 9%) of females, older persons, highly educated persons, and individuals who have

access to at least one car in their household. Two-thirds of the *analysis* sample (n=642) are from Bristol, 55% is female and the average age is 48 years. Half of the respondents have a high level of education (i.e. an academic degree), while 36% have a high income (i.e. a net household income per month of more than 2,500 GB pounds). Half of the sample is full time employed, the other half is mainly retired or works part time. See Table 1 for a description of the analysis sample's key characteristics.

Given the high education level, the sample could be biased towards people who might find it easy to plan and undertake public transport trips compared to the general population. Perceived behavioural control (the perceived ease or difficulty of consulting PT information) does indeed not have a statistically significant effect on PT information use (see the Results section); this might be why. The frequency distribution and operationalisation of variables included in the final analysis are given in Table 2. The exact question wording has been applied as used by Perugini and Conner (2000) who have tested the constructs' validity. Cronbach's alpha statistic tests showed all constructs to be reliable (Cronbach's alpha being greater than 0.80).

Table 1 Description of the analysis sample's key characteristics (n=642)

Key characteristics		N	%
Gender	Female	635	55
Age (in years)		629	
	< 30		13
	30-40		22
	41-50		22
	51-60		19
	61-70		17
	>=71		7
Household type	Single	632	27
Children in household	Yes	634	29
Young children	At least one child < 12 years	181	56
Education		629	
	Low (= no qualifications, O-level, GCSE-grade)		23
	Medium (A-level, vocational training)		27
	High (Bachelor degree, post-graduate qualification)		50
Income (monthly net household income)		561	
	Low (< £1,000)		16
	Medium (£1,000 - £2,499)		48
	High (>= £2,500)		36
Full time employed	Working 35 hours or more per week	634	51
City		642	
	Bristol		66
	Greater Manchester		34
Number of cars in household		636	
	1 car		67
	2 or more cars		33
Internet access at home	Yes	637	82
Internet use		634	
	Daily		67
	Weekly		15
	Monthly		5
	Never		13

Table 2 Frequency distribution and definition of variables included in the final analysis

Variables		N	%	Mean	SD
EMGB constructs					
Intention					
I want to look up public transport information in planning this journey	0 false -10 true	642		4.60	4.01
My desire to look up public transport information in planning this journey can be described as:	1 no desire	642	38		
	2 very weak		9		
	3 weak		8		
	4 modest		13		
	5 strong		21		
	6 very strong desire		11		
Attitudes					
I think that to look up public transport information in planning this journey would be:	1 useless - 7 useful	608		4.21	2.46
I think that to look up public transport information in planning this journey would be:	1 unhelpful - 7 helpful	600		4.18	2.28
Subjective norms					
People who are important to me ..... encourage me to look up public transport information in planning this journey.	1 would not - 7 would	635		3.82	2.33
People who are important to me ..... care if I looked up public transport information in planning this journey.	1 would not - 7 would	632		3.57	2.24
Past behaviour					
How many times did you look up public transport information this year (2007) in planning a similar journey?	0 never	642	32		
	1 only once		14		
	2 a few times		34		
	3 many times		20		
External variables					
How often do you normally travel using the following types of transport?	0 less often or never	642	10		
Car or van (as driver)	1 at least once a week		90		
Train		642	33		
	1 less often or never		28		
	2 at least once a year		19		
	3 at least once every 3 months		19		
	4 at least once a month				
What is the purpose of this journey?	work	642	24		
If I am travelling with friends I prefer to go by car rather than by public transport	1 strongly disagree – 7 strongly agree	631		5.13	1.82
Have other people (for example, colleagues, family, or friends) ever *recommended* the use of a particular PT information service to you?	0 no	642	71		
	1 yes		29		

Structural Equation Modelling (SEM) was chosen as the method of analysis because of the assumed interdependencies between the various factors studied and to better understand directions of influence. In SEM, a variable can be both dependent (that is, an outcome variable) and independent (that is, an explanatory variable) at the same time. Moreover, SEM distinguishes between direct, indirect, and total effects (Jöreskog and Sörbom, 2001). A total effect consists of one direct and one or more indirect effects. An SEM analysis consists of two parts: a measurement model and a structural model. In the measurement model, latent variables are explained by their indicators (observed variables). In the structural model, relationships between the latent variables can be modelled. The structural model captures the regression effects of exogenous (independent) variables on endogenous (dependent) variables, and the regression effects of endogenous variables on each other.

Covariance analysis was used to estimate the coefficients in an SEM model. A model covariance matrix was fitted on a sample covariance matrix, while iteratively minimizing the differences between the model-implied and observed values. Maximum likelihood estimation was used as the method of estimation. We ensured the model was identified by collapsing response categories of variables where necessary, avoiding the model becoming unidentified because of too few observations within a response category.

In addition to a covariance matrix, an asymptotic covariance matrix was calculated as input for the analysis. In this way, standard errors and chi-squares were corrected for non-normality (Jöreskog, 2005). A disadvantage of constructing an asymptotic covariance matrix is that a listwise deletion procedure is applied, which resulted in many missing cases (18%). Therefore, we imputed values for missing items using the technique of Expectation Maximization (EM), which substitutes values for missing data through a maximum likelihood estimation procedure (Olinsky et al., 2003). This approach performs well with relatively small sample sizes (Olinsky et al., 2003), is preferred to case deletion, and belongs to the most

widely used methods for handling missing data (Allison, 2003). Non-recursive structural equation models with latent variables were estimated using LISREL software version 8.72 (Jöreskog and Sörbom, 2001). The measurement model and the structural model were estimated simultaneously.

The modelling process started with testing the EMGB. In a separate analysis the *direct* effect of external variables on the intention to use PT information was explored. Then, the resulting model was used to guide estimating an integrated model in which the external variables *indirectly* affect intention via various social-psychological constructs. The reason for doing so was to find out *why* external variables affect the intention to use PT information. Thus, all external variables discussed in Section 4 also have a direct effect on the intention to use PT information, but we have chosen to model their effects on intention indirectly to gain a better understanding of the behavioural mechanisms underlying their influence (see Dijst et al. 2008 for a similar modelling process). Finally, relationships between social-psychological factors were explored. We have researched all EMGB constructs and external variables, but only statistically significant variables were retained in the final analysis.

The model fit improved considerably when only cognitive attitudes (consulting PT information is seen as useful and helpful) were included in the analysis, instead of together with affective attitudes (consulting PT information is seen as interesting and pleasant). This is unsurprising, given that travel information use is typically an instrumental behaviour carried out to achieve an underlying goal.

Results

Description of trip context and preferred travel mode

Before turning to the results of the SEM analyses, we describe the types of 'uncertain journeys' that respondents indicated they were planning to make and their preferred mode of transport.

A substantial proportion of the uncertain journeys chosen (39%) were to visit family or friends, 24% were for work purposes, 22% had a holiday purpose, and 15% were a leisure trip (e.g. shopping, evening out). Nearly two-thirds (63%) of the trips had a distance of over a hundred miles, with only 15% of all trips being under fifty miles. Over a third (36%) of the respondents said they would be travelling alone on this uncertain journey, 30% with another person and 34% with two persons or more. Half of the trips involved an overnight stay of up to three nights, whereas nearly one-third (31%) of all the planned trips concerned a day trip (the rest of the trips involved an overnight stay of more than three nights). Respondents were asked how important it was in making this journey that they would arrive at a certain time (1=not important, 7=very important). Slightly more than half (53%) of the respondents indicated that their journey was arrival time-sensitive. Some examples of uncertain journeys respondents said they were going to make are: a leisure trip with a friend (distance less than 25 miles), a work trip with a colleague (distance 25 – 50 miles), and a holiday with adult family members and children (overnight stay of more than a week, distance 101 – 150 miles).

The majority (66%) of respondents indicated that (in advance of consulting any travel information) they would prefer to make this uncertain journey by car, whereas 28% indicated they would prefer to travel by train. It should be noted that in the majority of cases respondents had identified an uncertain journey such that PT information would mostly concern that for rail travel (probably because of the trip distance, combined with the fact that

coach travel is less popular in the UK compared to rail travel). The subsequent results must be seen in this light.

Preferred mode of transport is a very important determinant of looking up PT information. Of those respondents who indicated that they preferred to make an uncertain journey by public transport only 10% indicated that they would *not* look up PT information. These findings are very similar to previous results of a qualitative research study (Farag and Lyons, 2008): people do not tend to travel by public transport without looking up any PT information, unless there are no time constraints, the service runs frequently, or the journey is local. More than one-fifth (22%) of the respondents who indicated that the car would be their (initially) preferred travel option also said they would look up PT information. Furthermore, of those respondents who prefer the car, 15% indicated they would be willing to make this journey by public transport, while 7% neither agreed or disagreed with this statement. Breaking the analysis down by trip purpose shows that work[3] (29%) and leisure (33%) trips are the most likely type of uncertain journey where respondents indicate they would consult PT information, even though the car is their preferred travel option. Meanwhile only 16% of the respondents with car as their preferred travel mode who were planning a visit to family or friends said they would consult PT information.

Overall model fit

The measurement model specifies how latent variables are indicated by the observed variables, describing the reliabilities and validities of those observed variables. Standardized parameter estimates of the observed indicators for the latent variables show that the measurement model performs well. The parameter values for intention are 0.964 and 0.977;

[3] Concerning work trips; the role of employers in stimulating public transport use is discussed in the results section and the conclusion.

for attitudes 0.984 and 0.921; and for subjective norms 0.989 and 0.785. The exact question wording of these social-psychological constructs can be found in Table 2. Table 3 shows standardized coefficients of the structural model which enable a comparison of the magnitude of the effects of various factors on the intention to consult PT information for an uncertain journey. Overall, the integrated model shows a good model fit with RMSEA[4]=0.028. Figure 2 summarizes the SEM results in a diagram (depicting latent variables as ellipses and observed variables as rectangles).

Relative importance of social-psychological factors affecting intention to use PT information

Attitudes are the most important factor explaining the intention to use PT information for an uncertain journey. The more useful consulting information is perceived to be, the stronger is the intention to actually do so. The main reason why consulting PT information is perceived to be useful is when people actively consider travelling by public transport, as might be

[4] The Root Mean Square Error of Approximation (RMSEA) is based on chi-square values and measures the discrepancy between observed and predicted values per degree of freedom. A good model has an RMSEA value of less than 0.05.

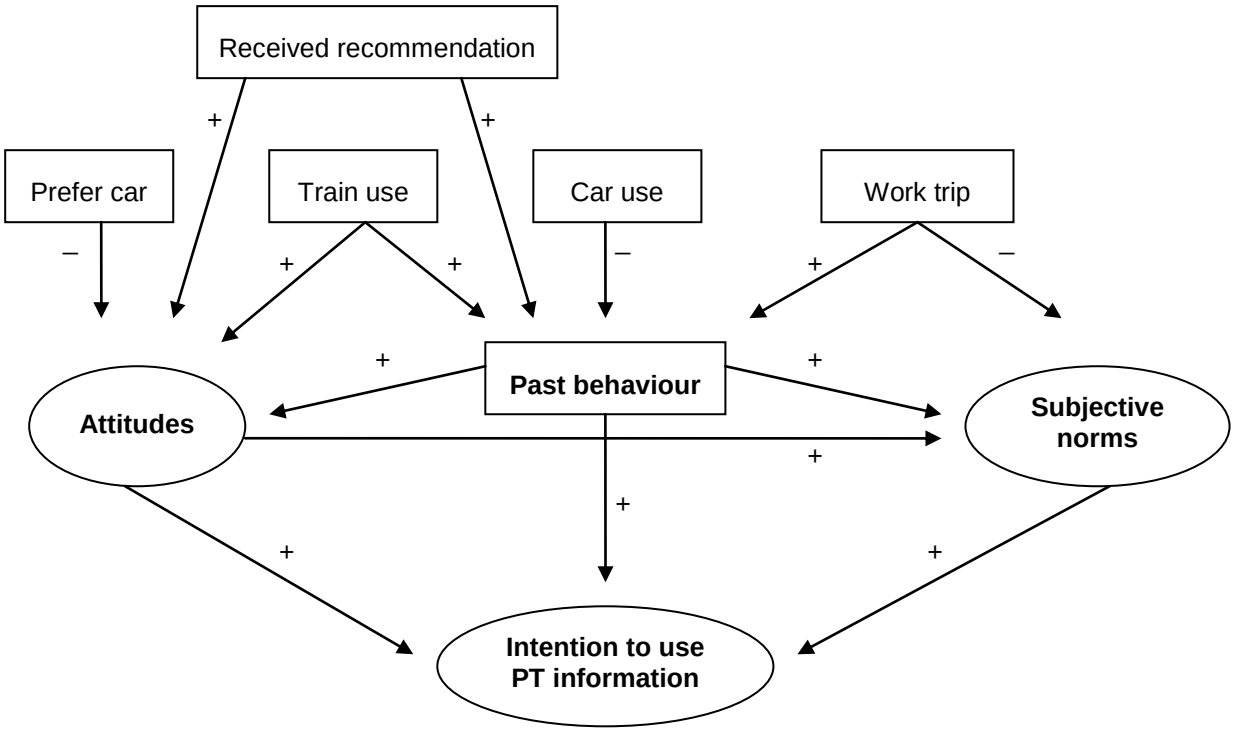

Figure 2 Graphic depiction of the SEM results

inferred from the strong correlation (Pearsons r=0.736) between the two[5]. Other social-psychological factors that affect the intention to consult PT information for an uncertain journey are subjective norms and past behaviour. The more encouragement respondents would expect from important others to consult information and the more often they have looked up PT information for a similar journey in the past, the stronger their intention is to do so (again). Perceived behavioural control was not found to be statistically significant. This means that the perceived ease or difficulty of consulting PT information in itself does not directly affect the intention to consult information.

Table 3 Standardized coefficients of direct and total[6] effects for the integrated model (significance at least p < 0.05, unless indicated otherwise[7])

Explanatory variables	**Integrated Model**			
Endogenous variables	*Intention*	*Attitudes*	*Subjective norms*	*Past behaviour*
Social-psychological factors				
Attitudes	0.605		0.746	
	0.787		*0.746*	
Subjective norms	0.244			
	0.244			
Past behaviour	0.156	0.359	0.128	
	0.469	*0.359*	*0.396*	
Exogenous variables				
Travel behaviour				
Car use				-0.144
	-0.068	*-0.052*	*-0.057*	*-0.144*
Train use		0.141		0.485
	0.339	*0.315*	*0.297*	*0.485*
Trip context				
Trip purpose is work			-0.097	0.279
	0.108	*0.100*	*0.014* [b]	*0.279*
Travel attitudes				
Prefer car when travelling with friends	*-0.122* [a]	-0.154 [a] *-0.154* [a]	*-0.115* [a]	
Social surrounding				
Received PT information service recommendation		0.069		0.073
	0.089	*0.095*	*0.081*	*0.073*
Goodness of fit indicators				
R^2 (reduced form)	0.231	0.224	0.161	0.445
Degrees of freedom	36			
Satorra-Bentler χ^2 (p-value)	54.693 (p=0.024)			
SRMR	0.028			
RMSEA	0.028			
90% confidence interval for RMSEA	(0.011; 0.043)			

[5] The direction of causality seems to be more likely as described above than the other way round: because one thinks that consulting PT information in planning this journey would be useful, one might consider travelling by public transport.

[6] Total effects are in *italic*

[7] [a]=significant at p < 0.10, [b]= not significant

Other social-psychological factors such as attitudes and past behaviour are more important. Perhaps, even if respondents would find it difficult to consult PT information, they still intend to do so because they need the information to plan their journey. They might (expect to) receive help from other people around them in planning their journey (related to the effect of subjective norms on intention to consult PT information). Furthermore, perceived behavioural control affects the choice of PT information *sources* (e.g. online or phone) (see Farag & Lyons, 2008), but its effect on the intention to use PT information seems to be less straightforward. Also, no statistically significant effects were found from the goal-related EMGB constructs, such as anticipated emotions. This is contrary to earlier results from our qualitative research (Farag & Lyons, 2008) and other research which shows that people are inclined to consult travel information if, given their level of knowledge without doing so, they anticipate an unacceptable level of regret at the outcome (Chorus et al, 2006b). Possibly, the relationship between making a journey 'successfully' (which could be an underlying goal for travel information use) and consulting travel information is more distal compared to other behaviours that have been studied using the EMGB.

Relationships between social-psychological factors

Analysis of the relationships between social-psychological factors shows that they mutually affect each other simultaneously. The direction in which these relationships are strongest are reported.

Attitudes are positively affected by past behaviour. Respondents who have consulted PT information for a similar journey in the past hold a positive attitude towards consulting information for an uncertain journey they are planning to make. There seems to be a general reinforcement of attitudes and behaviour when it comes to PT information use.

It was found that attitudes affect subjective norms more strongly than the other way round. Respondents who hold a positive attitude towards consulting PT information say more often they would be encouraged to consult PT information by people important to them. It may be that respondents try to avoid cognitive dissonance (i.e. simultaneously holding conflicting beliefs) by stating that people who are important to them would support their positive attitude towards consulting PT information. Past behaviour also affects subjective norms: respondents who have looked up PT information for a similar journey in the past are more likely than others to say that people would encourage them to consult PT information when making an uncertain journey. Perhaps, they have experienced encouragement in the past from important others.

Effect of constraints/facilitators on social-psychological factors

Information factors and sociodemographics did not have a statistically significant direct effect on the social-psychological factors described above. The lack of effect from information factors is in line with the lack of a statistically significant effect of perceived behavioural control on information use, while the lack of effect of sociodemographics seems to suggest that other external factors (i.e., travel behaviour, travel attitudes, trip context, and social surrounding) are more important than sociodemographic characteristics (see Table 3). A discussion is provided below of how constraints/facilitators affect the intention to consult PT information when planning an uncertain journey.

Travel behaviour has the strongest effect (compared to other external factors) on the intention to look up PT information via past behaviour and attitudes. Frequent train users have consulted more often PT information when making a similar uncertain journey in the past than infrequent train users. They also hold more positive attitudes towards information

use. Frequent car users have consulted PT information less often in the past when making a similar uncertain trip.

Travel attitudes (here classified as an external factor) affect the intention to look up PT information via the EMGB construct attitudes. If people prefer to travel by car when travelling with friends, then they (unsurprisingly) are less positive about consulting PT information.

Trip context affects the intention to look up PT information via subjective norms and past behaviour. Respondents planning to make an uncertain work journey indicate more often that important others would not care whether they consulted PT information or not compared to respondents making other types of uncertain journeys. It seems likely that important others are less involved when it concerns a trip for work compared to private trips such as a leisure trip, a holiday, or a visit to family or friends. However, the negative effect of a work trip on subjective norms is counterbalanced by a positive effect of planning a work trip on past behaviour (leading to a total positive effect of planning a work trip on the intention to consult PT information, see Table 3). Respondents who are planning a work trip indicate more often than others that they have looked up PT information for other work trips in the past. This finding supports earlier research showing that people are likely to consult PT information for business trips (AEA, 2007; Ipsos MORI, 2006). If public transport costs are reimbursed by employers, people prefer public transport over car travel (De Witte et al., 2008). Also, the possibility to relax or use the travel time as preparation time might explain why public transport is preferred and PT information more often consulted for work trips compared to other trip types.

Finally, social surrounding affects the intention to consult information via past behaviour and attitudes. Respondents who received a recommendation by word-of-mouth to consult a particular PT information service indicate more often that they have consulted PT information

for similar uncertain journeys in the past and hold more positive attitudes towards information use. Similar results have been reported concerning word-of-mouth recommendations to use a certain bus service which affects the intention to do so (Taniguchi and Fuji, 2006).

Summary

Attitudes are by far the strongest determinant of PT information use. If people think it is useful to consult PT information, they express a strong intention to do so. The main reason for perceiving PT information to be useful is when people consider travelling by public transport. Attitudes towards consulting PT information are positively influenced by the number of times one has consulted PT information in the past for a similar journey, frequent train use, and by having received a recommendation to use a certain PT information service by word-of-mouth.

Summary observations drawn from these results are that attitudes and past experiences are important factors affecting PT information use and travel behaviour. In order to reach those people who can choose between car and public transport a continuous and combined effort of travel information service providers and public transport agencies is needed. The specific context of an uncertain journey and the predominance of rail travel in an inter-urban trip context are limitations of this study. Future studies could address these limitations by including different trip contexts and public transport modes.

Overall, the EMGB captures important factors that relate to PT information use and is, therefore, worth using again. However, those factors (such as attitudes and past behaviour) are also captured by the Theory of Planned Behaviour (TPB) (Ajzen, 1991). The goal related variables that are specific for the EMGB (i.e., goal desire, goal perceived feasibility, anticipated emotions) did not have a statistically significant effect in this study, but might be important in a different trip context. Using attitude theory helps to understand the underlying

social-psychological mechanisms that affect people's PT information use and travel behaviour.

Conclusions

Although recent developments in public transport (PT) information provision have been extensive, concerns have emerged regarding levels of non-use of information services. This paper has demonstrated how attitude theory is a useful approach to explain PT information (non-)use, giving insight into the *relative* importance of the various factors studied and how they affect *each other*. Attitude theory has been expanded with external variables (such as travel behaviour and trip context) to provide an integrated model of social-psychological constructs with potential constraints affecting individuals' decision making. The empirical evidence gathered mainly covers information for rail travel as opposed to that for other public transport modes.

Attitudes have the strongest effect on PT information use: the more positive, the stronger the intention is to consult PT information. Subjective norms and past behaviour also affect information use. Respondents who say they would be encouraged by important others to look up PT information indicate more often that they intend to do so. This finding implies that social context influences how people reach their travel decisions. Indeed, it has been found that word-of-mouth recommendations to use a certain bus service affects the intention to do so (Taniguchi and Fuji, 2006). Having looked up PT information for a similar journey in the past positively affects the desire to consult information for a comparable trip in the future. The researched social-psychological factors are interdependent. Past behaviour positively affects attitudes: if respondents consulted PT information previously, they tend to have a more favourable opinion of looking up information. These outcomes show the importance of

a positive past experience with consulting PT information and the potential of word-of-mouth marketing initiatives for the use of PT information services.

Social-psychological factors are also influenced by external factors, such as travel behaviour and trip context. This illustrates the importance of incorporating constraints/facilitators when applying attitude theory. Frequent train users and respondents planning a work trip have consulted PT information more often in the past than others. The first finding reflects the importance of building up skills and experience in using public transport and PT information (Beirão and Cabral, 2007; De Witte et al., 2008; Thøgersen, 2006). The latter finding is probably related to public transport remuneration given by employers which stimulates the use of public transport (De Witte et al., 2008). This implies that employers could play an important role in promoting public transport use (and consequently PT information use) while policy makers could provide employers with incentives to do so. Car users tend to overestimate the travel time by public transport (Van Exel and Rietveld, 2009), which might deter them from consulting PT information. Improving the image of public transport, especially among infrequent public transport users, could lead to inclusion of public transport in an individual's choice set of travel options (Van Exel and Rietveld, 2009) and a subsequent increase in consulting PT information. Marketing campaigns targeted to increase public transport usage seem to have the greatest impact when combined with fare incentives (Transportation Research Board, 2003).

If people think it is useful to look up information, they will do so. A key question that emerges then is: when do people find it useful to consult PT information – specifically in the context of making decisions about an uncertain journey? Our findings and our previous research (Farag & Lyons, 2009) strongly suggest that this is likely to happen when people are willing to *consider* travelling by public transport. Preferred mode of transport (prior to consulting information) is a very important determinant of looking up PT information when planning an uncertain journey. The overwhelming majority (90%) of respondents who

indicated that public transport was their preferred travel mode said they would consult PT information. Mode choice is an important first step in journey planning and, thus, an important determinant of the intention to use PT information. Nevertheless, more than one-fifth (22%) of the respondents who preferred to make their uncertain journey by car also said they would look up PT information – presumably with some expectation that such information could influence their prior preferences.

What could public and private agencies do to increase use of PT information to benefit public transport use? In our opinion, such agencies should try to increase the propensity to consider using and in turn the use of public transport itself, rather than see the increased use of information as a means to stimulate greater public transport use. Of course, PT information use is often prerequisite for actual public transport use. However, people usually consult information when they feel they might need it. Hence, the stimulation of public transport use and information use should go together.

Overall, we conclude that past experiences of information use, current travel behaviours and attitudes towards both information and transport options are interacting with one another and can become self-reinforcing for better or worse. This matches previous research findings (Thøgersen, 2006). Temporarily providing people with free bus tickets has been shown to positively affect both attitudes and behaviour towards bus use, provided the bus experience was good (Fuji and Kitamura, 2003). Moreover, it helps correct negative beliefs about using public transport (Fuji and Kitamura, 2003) which might increase PT *information* use. Other research has also found that a positive public transport attitude underpins actual use of public transport (Beirao and Cabral, 2007; De Witte et al., 2008). Thus, a segmentation for marketing purposes is desirable that is based on attitudes and not only on sociodemographics (Beirão and Cabral, 2007).

Greater use of PT information will come over time from greater willingness to consider using public transport. Thus it is inappropriate in the ongoing provision of PT information

services to simply presume that improvements to information services themselves and increased awareness of them will lead to increased PT information use. In practice the information services and transport services must be considered together; investment is required in both.

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References

AEA Technology (2007) Transport Direct evaluation: final report. UK Department for Transport. Available via http://www.dft.gov.uk/162259/245385/249577/TD_Final_Report_Version_1.21.pdf Accessed 23 Apr 2009

Ajzen I (1991) The theory of planned behavior. Organizational Behavior and Human Decision Processes **50**, 179-211

Allison PD (2003) Missing data techniques for Structural Equation Modeling. Journal of Abnormal Psychology **112**, 545-557

Beirão G, Cabral JAS (2007) Understanding attitudes towards public transport and private car: A qualitative study. Transport Policy **14**, 478-489

Bristol City Council, 2008. Statistics and census information. Available via http://www.bristol.gov.uk/ccm/navigation/council-and-democracy/statistics-and-census information/;jsessionid=9FF6B1FCA642815482F9CF76EAAB7A15> Accessed 23 Apr 2009

Cain A (2007) Are printed transit information materials a significant barrier to transit use? Journal of Public Transportation **10**, 33-52

Chorus CG, Molin EJE, Van Wee B (2006a) Use and effects of Advanced Traveller Information Services (ATIS): a review of the literature. Transport Reviews **26**, 127-149

Chorus CG, Molin EJE, Van Wee B, Arentze TA, Timmermans HJP (2006b) Responses to transit information among car-drivers: regret-based models and simulations. Transportation Planning and Technology **29**, 249-271

Chorus CG, Arentze TA, Timmermans HJP, Molin EJE, Van Wee B (2007) Travelers' need for information in traffic and transit: results from a web survey. Journal of Intelligent Transportation Systems **11**, 57-67

De Witte A, Macharis C, Mairesse O (2008) How persuasive is 'free' public transport? A survey among commuters in the Brussels Capital region. Transport Policy **15**, 216-224

DETR (1998) A New Deal for Transport- Better for Everyone. Transport White Paper, Department for the Environment, Transport and the Regions, July, London

DETR (2000) Transport 2010 - the ten year plan. Department of the Environment, Transport and the Regions, July, London

Dijst M, Farag S, Schwanen T (2008) A comparative study of attitude theory and other theoretical models for understanding travel behaviour. Environment & Planning A **40**, 831–847

Farag S, Lyons G (2008) What affects pre-trip public transport information use? Empirical results of a qualitative study. Transportation Research Record **2096**, 85-92

Farag S, Lyons G (2009) Public transport information (non-)use empirically investigated for various trip types. Paper presented at the Annual Meeting of the Transportation Research Board, Washington D.C US, January 2009. Submitted for publication, available from the authors upon request.

Fuji S, Kitamura K (2003) What does a one-month free bus ticket do to habitual drivers? Transportation **30**, 81-95

GfK NOP (2007) Travel Information Services Wave 10 − 8th to 13th March 2007. UK Department for Transport. Available via http://www.dft.gov.uk/173086/249736/249739/wave10 Accessed 23 Apr 2009

Goulias KG, Kim T, Pribyl O (2003) A longitudinal analysis of awareness and use for advanced traveler information systems. Journal of Intelligent Transportation Systems: Technology, Planning, and Operations **8**, 3-17

Grotenhuis J, Wiegmans BW, Rietveld P (2007) The desired quality of integrated multimodal travel information in public transport: customer needs for time and effort savings. Transport Policy **14**, 27-38

Ipsos MORI, 2006. Contribution made by Traveline Scotland to modal shift. Scottish Executive Social Research. Available via http://www.scotland.gov.uk/Resource/Doc/139659/0034503.pdf Accessed 23 Apr 2009

Jöreskog KG, Sörbom D (2001) LISREL 8: user's reference guide. Scientific Software International, Lincolnwood

Jöreskog KG. (2005) Structural equation modeling with ordinal variables using LISREL. Available via http://www.ssicentral.com/lisrel/techdocs/ordinal.pdf

Accessed 23 Apr 2009

Krizek K, El-Geneidy A (2007) Segmenting preferences and habits of transit users and non-users. Journal of Public Transportation **10**, 71-94

Manchester City Council. Statistics and census information. Available via http://www.manchester.gov.uk/site/scripts/documents.php?categoryID=200088 Accessed 23 Apr 2009

Molin EJE, Timmermans HJP (2006) Traveler expectations and willingness to pay for Web-enabled public transport information services. Transportation Research part C: Emerging Technologies **14**, 57-67

Olinsky A, Chen S, Harlow L (2003) The comparative efficacy of imputation methods for missing data in structural equation modeling. European Journal of Operational Research **151**, 53-79

Perugini M, Conner M (2000) Predicting and understanding behavioral volitions: the interplay between goals and behaviors. European Journal of Social Psychology **30**, 705-731

Peirce S, Lappin J, (2004) Why don't more people use advanced traveler information? Evidence from the Seattle area. Paper presented at the 83rd Annual Meeting of the Transportation Research Board, Washington, D.C, USA, January 2004.

Taniguchi A, Fuji S (2007) Promoting public transport using marketing techniques in mobility management and verifying their quantitative effects. Transportation **34**, 37-49

Transportation Research Board (2003) TCRP Report 95 Chapter 11 Transit information and promotion - traveler response to transportation system changes. Available via http://onlinepubs.trb.org/Onlinepubs/tcrp/tcrp_rpt_95c11.pdf Accessed 6 Sep 2009

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

Van Exel NJA, Rietveld P (2009) Could you also have made this trip by another mode? An investigation of perceived travel possibilities of car and train travellers on the main travel corridors to the city of Amsterdam, The Netherlands. Transportation Research Part A **43**, 374-385

Van der Horst R (2006) Getting there & away. The role of travel information in recreational day trips, with a specific focus on the mode and destination choice. Dissertation, Utrecht University, Utrecht, the Netherlands. Available via: http://igitur-archive.library.uu.nl/dissertations/2006-1121-201558/index.htm Accessed 23 Apr 2009

Verplanken B, Aarts H, Van Knippenberg A (1997) Habit, information acquisition, and the process of making travel mode choices. European Journal of Social Psychology **27**, 539-560

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