

VU Research Portal

Behavioural Economic Perspectives on Inertia in Travel Decision Making

van Exel, N.J.A.

2011

document version

Publisher's PDF, also known as Version of record

[Link to publication in VU Research Portal](#)

citation for published version (APA)

van Exel, N. J. A. (2011). *Behavioural Economic Perspectives on Inertia in Travel Decision Making*. [PhD-Thesis – Research external, graduation internal, Vrije Universiteit Amsterdam]. VU University.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

E-mail address:

vuresearchportal.ub@vu.nl

“Why is it so difficult to persuade car drivers to use public transport more often?”. Despite the many policies encouraging us to reduce our car use and to consider alternative modes of transportation more often, car use has steadily increased during the past decades. This study investigates whether perspectives from behavioural economics could contribute to a better understanding of this inertia in our travel behaviour. The study investigates how differences between people in perceptions, preferences and strength of habit relate to the means of transport they consider to use. The study concludes that for more effective transport policy analysis it is important to account for how travel choice sets are formed and how people decide to travel given their choice set.

Behavioural Economic Perspectives on Inertia in Travel Decision Making



Job van Exel

Behavioural Economic Perspectives on Inertia in Travel Decision Making

Job van Exel

Behavioural Economic Perspectives
on Inertia in Travel Decision Making

commissie: prof.dr. J.C.J.M. van den Bergh
prof.dr. K.A. Brookhuis
prof.dr. W.F. van Raaij
prof.dr. G.P. van Wee
prof.dr. H.J. van Zuylen

ISBN: 978-90-5335-488-9

© Job van Exel, 2011

Cover: *99 most important words* (using www.wordle.net)

Printed by Ridderprint on FSC certified paper

VRIJE UNIVERSITEIT

Behavioural Economic Perspectives on Inertia in Travel Decision Making

ACADEMISCH PROEFSCHRIFT

ter verkrijging van de graad Doctor aan
de Vrije Universiteit Amsterdam,
op gezag van de rector magnificus
prof.dr. L.M. Bouter,
in het openbaar te verdedigen
ten overstaan van de promotiecommissie
van de faculteit der Economische Wetenschappen en Bedrijfskunde
op dinsdag 20 december 2011 om 15.45 uur
in de aula van de universiteit,
De Boelelaan 1105

door

Nicolaas Jacob Arnold van Exel

geboren te Amsterdam

promotor: prof.dr. P. Rietveld

Preface

Een proefschrift schrijf je in je eentje, maar niet alleen. Ik dank in het bijzonder mijn ouders Didi en Niek, mijn zussen Anna, Ines, Irene en Lydia, mijn thuis Anke, Fleur, Bregje en Sofie, T. Ad, mijn vrienden Gjalt, KJ, Michiel, Rob, Wagi en Werner, en mijn aanhoudend scherpe en geduldige promotor Piet Rietveld. Maar zeker ook alle overige familie, vrienden, collega's bij NEI en iBMG, en medestanders in de straat, op het plein, langs de lijn, en in het werk- en belangenveld die door de jaren heen belangstelling en betrokkenheid hebben getoond. Dankzij -en soms ondanks- jullie is dit proefschrift nu volbracht!

*Ter nagedachtenis van grootmoeder, opa en Jaap
voor hun onuitwisbare indruk.*

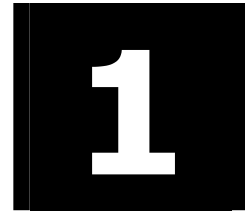
Contents

1	Introduction	1
1.1	What is a behavioural economic perspective?	3
1.2	What is inert behaviour?	8
1.3	Objectives and outline of this thesis	9
2	Travel behaviour on the move?	11
2.1	What has been the approach to individual behaviour in transportation research?	11
2.1.1	<i>Travel is a derived demand</i>	11
2.1.2	<i>Travel choice is hierarchical</i>	14
2.1.3	<i>Observed travel behaviour is the result of rational choice</i>	17
2.1.4	<i>People differ in preferences, strength of habit and choice set</i>	21
2.2	What is rational behaviour according to mainstream economics?	28
2.3	Which alternative approaches are proposed in behavioural economics?	38
2.3.1	<i>Bounded rationality</i>	39
2.3.2	<i>Prospect theory</i>	52
2.3.3	<i>Judgement of probabilities</i>	56
2.3.4	<i>Interdependence</i>	59
2.3.5	<i>Adaptive and relative preferences</i>	62
2.3.6	<i>Intertemporal choice</i>	67
2.4	Outlook to the following chapters	71
3	Public transport strikes and traveller behaviour	73
3.1	Introduction	73
3.2	Review of previous studies	75
3.3	The 1999 rail strike in the Netherlands	89
3.4	Discussion and conclusion	92

4	Anticipated and actual behavioural reactions to a rail strike	95
4.1	Introduction	95
4.2	Methods and data	98
4.3	Results	101
4.4	Discussion and conclusion	110
5	Could you also have made this trip by another mode?.....	113
5.1	Introduction	113
5.2	Methods and data	116
5.3	Results	120
5.4	Discussion and conclusion	129
6	Travel time perceptions and travel choice.....	133
6.1	Introduction	133
6.2	Methods and data	135
6.3	Results	138
6.4	Discussion and conclusion	142
7	“I can do perfectly well without a car!”.....	149
7.1	Introduction	149
7.2	Methods and data	151
7.3	Results	159
7.4	Discussion and conclusion	171
8	Discussion and conclusion	177
	List of tables.....	193
	List of figures.....	195

List of references.....	197
Summary	235
Samenvatting	241

Introduction



“Why is it so difficult to persuade car drivers to use public transport more often?” is probably one of the most discussed questions among transport researchers and policy makers. Despite many policy initiatives aimed at making alternative modes of transportation more attractive, car use has steadily increased during the past decades, in absolute as well as in relative terms. Each second person in the European Union (EU) now owns a car and about 85% of all passenger kilometres are made by car (Eurostat 2009). Considering the substantial differences in car ownership and use between EU Member States and with the US, this trend may be expected to persist.

The increase in car ownership and use has generated traffic congestion and has made travel time reliability an issue of concern among road users and transport policy makers. Particularly in the more densely urbanised areas congestion has become a common and persistent phenomenon¹, leading to frustrated personal mobility expectations, substantial problems in the accessibility of important economic and social centres and concerns over the viability of town centres. Next to these economic effects of road congestion, reducing car use has also become a focus of concern from the starting point of global and local environmental changes, and health and safety effects (Goodwin 1995).

¹ In 2005 the Netherlands *celebrated* 50 years of traffic-jams. Over this period, traffic congestion grew to 35,000 traffic jams per year with a total length of 115 thousand kilometres and a total time loss of 50 million hours. The average time loss on a trip of 30 kilometres with free flow travel time of 18 minutes amounts to 2 minutes and may increase to 12 minutes during peak hours. About 40% of this time loss is structural and predictable, 30% is structural and non-predictable and 30% is incidental and non-predictable. Direct costs of time loss were estimated at €900 million per year, total costs at €3 billion or 0.5% of GDP (KiM 2010; MoT 2004a; 2004b).

Chapter 1

Various reasons have been put forward for the increasing dominance of the car. For instance, during the second half of last century the real prices of travelling by car and public transport hardly changed, while during this same period the quality of travelling by car (including system quality) increased substantially relative to that of public transport (MoT 1991). A number of socio-economic and cultural trends during this period were associated with a rise in car ownership and use, among them increasing welfare (Jekel 2011; KiM 2010; Dargay et al. 2007; Cameron et al. 2004; Dargay 2001; Figure 1.1), and many countries, among them the Netherlands, responded with policies that were chiefly concerned with accommodating increasing demand for road capacity (SCP 2003; 1993; MoT 1997) –possibly not the optimal response from a societal perspective (Litman 2007).

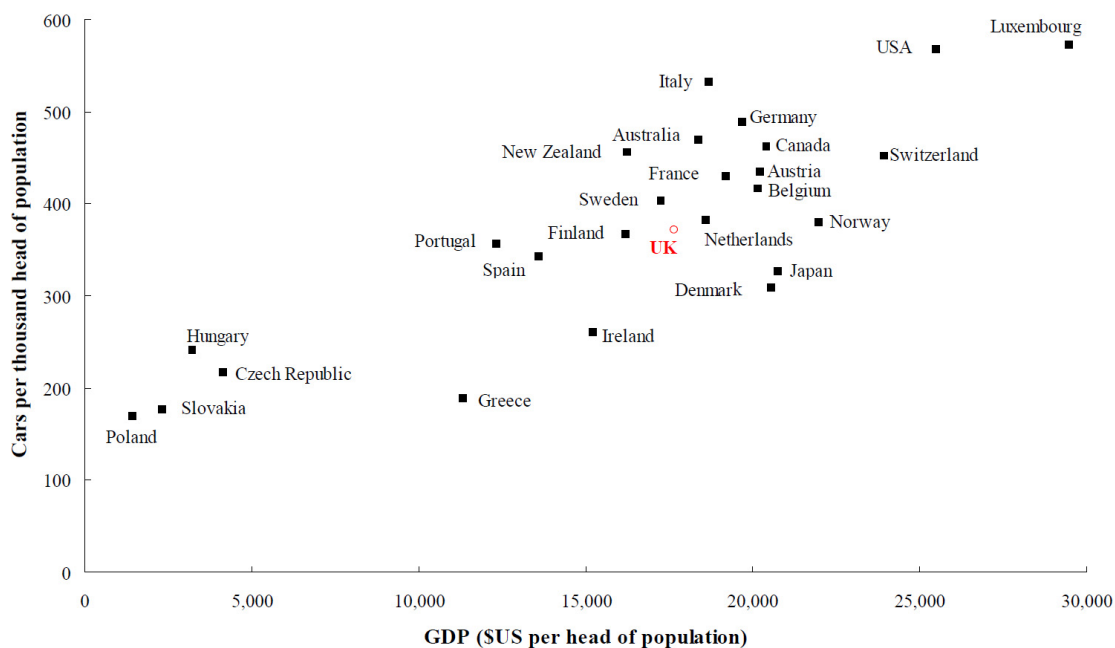


Figure 1.1 Income and car ownership ²

² Source: Transport Statistics Report: International Comparison of Transport Statistics 1970- 1994. London: Department of Transport, 1997.

While most car users may favour investments in the public transport system, they typically cannot be encouraged to use public transport more than occasionally, if at all. As Banister (2002) phrased it, the car “is generally believed to be the most desirable form of transport and will normally be used as the preferred form of transport, no matter how attractive the alternative might be. The user can always think of a reason why the car is necessary for that particular journey”. But why is it that car drivers who clearly understand and experience the downsides of travelling by car are so persistent in their choice for the car?

Although prominent, mode choice is only one example of individual travel choices that are sometimes difficult to explain for transportation researchers and policy makers. The aim of this thesis is to advance our understanding of individual travel behaviour by exploring this inertia from a behavioural economic perspective.

1.1 What is a behavioural economic perspective?

Non-economists generally identify the economic perspective on behaviour with *homo economicus*, the rational self-interested utility maximizer. Normative mainstream economists will tend to agree: economics is about agents behaving rationally in order to maximise their individual utility. *Homo economicus* (or economic man) is usually dated back to Adam Smith (1776), and is the toolbox generations of economists left university with. Hence, if as Bagozzi (1992) suggested longevity is taken as a measure of success of a theory, *homo economicus* undoubtedly has been successful. Nonetheless, for almost as long, this behavioural foundation of mainstream economic theory has been contested for its descriptive accuracy (McFadden 1999; Hennisman 1945).

In the course of the 20th century both the popularity and controversiality of *homo economicus* have developed alongside the increasing focus in

Chapter 1

economics on mathematical expression and modelling. The single objective for behaviour and the restrictive situational circumstances presumed in the mainstream economic approach have proven to be convenient for modelling all sorts of behaviour and such models have predicted many behaviours quite accurately. Sen (1998) however argued that this mathematical exactness of formulation proceeds hand in hand with remarkable inexactness of content; “the world is made to fit this momentous assumption, rather than the assumption being made to fit the world. The analytical discipline that confines itself to such constricted behavioral regularity is, by now, very extensively developed, with many technical achievements to its credit. This has tended to make the limiting assumption seem robust and natural. The analytical tools and the tradition of exacting and rigorous analysis associated with formal economics also militate against departures that may appear to be mushy and soft”. Most people, however, are not natural born economists (Cipriani, Lubian & Zago 2009). Rubinstein (2006) and Klamer (1987), among others, expressed the concern that, following these achievements, present-day economists learn how mathematical models work but no longer learn to reflect on why these models work and which factors are filtered out because they are not easily formalised and quantified, but may nevertheless be significant for understanding individual behaviour. If economists who use these equations and diagrams would read the original surrounding texts, Thaler (1997) posed, they would find that the classic economists were well aware of the influence of psychological factors such as self-control and fashion on behaviour, often left out of modern economic analyses. Morgan (2006) describes the varying characterizations of economic man since introduced by Adam Smith (1776). And already about a century ago, Clark (1918) stated that economists may attempt to ignore these other, psychological factors that may influence people’s behaviour, but that if economics poses to be a science of human behaviour this inevitably involves psychological assumptions, whether these are explicit or not. The popularity of *homo economicus* in the different subject areas where economic analysis has

been applied in the past even seems to be associated with the prevalence and relevance of such 'other factors': for instance, self-interested utility maximisation appears more commonly accepted as a behavioural model in transport and labour economics and less in environmental and health economics.

During the last decades a wide body of literature emerged accentuating anomalies that the mainstream economic approach has difficulties accounting for, pointing out that *homo economicus* may constitute not more than a partial account of behaviour. Tomer (2001) argued that different heterodox schools of thought were formed in the last decades in reaction to this accumulating evidence, as "groupings of economists who share common objections to economic man and who share a common view regarding what aspects of man should be emphasised to rectify the problems associated with mainstream economists' use of economic man". The various stripes of economics analysis, depicting alternative theories of individual behaviour, are commonly grouped under the label 'behavioural economics'. Although there is no undisputed definition or domain of behavioural economics, contemporary textbooks most resemble a common playground of economists, social psychologists and increasingly also scholars from other domains involved in the study of human nature and behaviour. Handgraaf and van Raaij (2005) described behavioural economics as a growing common perspective between economists and psychologists, based on mutual interest and increasing interaction between scholars from both disciplines, which meanwhile is leading to a separate perspective with converging language and methodological approaches. Loewenstein (1999) defined a behavioural economist as a methodological eclectic, an economist who brings insights from other disciplines to bear on economic phenomena. The Society for the Advancement of Behavioral Economics (SABE) gave the following description in the announcement of its 2003 conference: "Behavioral economics is an umbrella that encompasses a wide variety of research

Chapter 1

agendas that either extend or deviate from the traditional, neoclassical economics paradigm. By relaxing assumptions such as perfect foresight, unchanging preferences, costless optimisation, and market equilibrium, contributions in behavioral economics offer explanations for economic phenomena that depend upon how people behave. Psychological and sociological issues are often pertinent, making behavioral economics significantly interdisciplinary". These alternative assumptions and approaches taken together provide a behavioural economic perspective on behaviour.

Mainstream economists have not paid much attention to the attacks and achievements of behavioural economists during the last decades and have mainly pursued their own research agenda. Divergent ideas about how people do behave are considered of limited relevance for economics as a normative science and disregarded because individual utility maximisation is viewed as superior to concepts from other disciplines for the analysis of behaviour (Folmer & Lindenberg 2011; Folmer 2007; Bovenberg & van de Klundert 1999; Lea, Tarpy & Webley 1987; van Witteloostuijn 1988; 1991). This indicates that there is not a single, unified economic perspective on individual behaviour, but that different schools of thought coexist, with divergent approaches to the analysis of behaviour.^{3,4} According to Van Raaij (1995) and Loewenstein (1992), the distaste for psychology became widespread among economists in the first decades of the twentieth century, when they sought to stake out the independence of economics as a science. While Commons (1934), for instance, still argued

³ Roth (1996) discerned four main theories of behaviour operant within contemporary economics at large: (i) Bernoulli's (1738) risk neutral economic man, choosing between outcomes with a known probability function; (ii) Von Neumann and Morgenstern's (1953) expected utility maximising man, making choice under uncertainty; (iii) Kahneman and Tversky's (1979) almost rational economic man, choosing between uncertain prospects; and (iv) psychological man, acting according to a collection of mental processes elicited by different descriptions of options, frames, contexts, and choice procedures.

that human behaviour is basically goal oriented and purposive but at the same time heavily influenced by stupidity, ignorance, and passion, the psychological richness that characterised economics in the late 19th and the early 20th century (e.g. Pech & Milan 2009) was soon replaced by mathematical and graphical analysis that seemed to render psychology superfluous. A renewed interest in psychology originated in the 1970's and 80's, evident from the establishment of the Journal of Behavioural Economics in the early 70's -later continued as the Journal of Socio-Economics- and the Journal of Economic Psychology in the early 80's (van Raaij 1981). The International Association for Research in Economic Psychology (IAREP) and the Society for the Advancement of Behavioral Economics (SABE) were also established in the early 80's.

At the beginning of the new millennium, alternative behavioural assumptions again came to the centre of scientific economic interest when The Royal Swedish Academy of Sciences awarded the 2002 Nobel Prize in economics to Vernon Smith and Daniel Kahneman; the first for laying the foundation to the field of experimental economics, the latter for integrating insights from psychology into economics and demonstrating how human decisions under uncertainty systematically depart from predictions by mainstream economic theory (together with the late Amos Tversky; see van Raaij 1998). In the aftermath, a handful of scholarly handbooks and numerous popular books were published, popular magazines like The Economist spent generous attention to the subject, and very recently the Dutch Scientific Council for Government Policy made choice behaviour one of their topics for reconnaissance (WRR 2009; Tiemeijer 2011; 2009). This thesis is rooted in this renewed interest in alternative assumptions and approaches for the economic analysis of individual behaviour.

⁴ Socio-economics (Etzioni 2008; 2003; 1998) and institutional economics (Commons 1931; Hodgson 1998; Williamson 2000) could be regarded as main schools next to

1.2 What is inert behaviour?

Inert behaviour (or inertia) is generally aligned with common terms from literature such as invariant, constant, stable, steady, and settled behaviour. In mainstream economic literature inertia thus defined is viewed as an anomaly, an unanticipated stickiness of behaviour, and sometimes referred to as less rational, nonrational, irrational or even foolish behaviour (e.g. McFadden 1999; Janis & Mann 1977). Literature provides a variety of characterisations of inertia that share a notion of invariance. According to Assael (1992), "inert behaviour may be characterised by passive beliefs, low involvement, and little information processing. The decision maker only seeks some acceptable level of satisfaction. He does not care very much about the object of choice, e.g. because it is not closely related to the decision maker's personality and lifestyle characteristics or group norms and values. Decision making is associated with low motivation and little deliberation. If at all, decision is evaluated afterwards". More concise characterisations from economic and transportation literature include: whenever possible, consume exactly what was consumed in the past (Becker 1978); resistance to change (Ansoff 1987); carrying on as before (Sutton 1994); the effect of gaining experience or getting familiar in previous periods on current choice (Cherchi & Manca 2011; Train 2009; Cantillo, de Dios Ortúzar, Williams 2007); a relatively simple decision making process in order to save time and effort as a result of low involvement (van Kesteren & Meertens 1999); falling back on past behaviour (Heijs 1999); thresholds that need to be crossed before changing routine behaviour, factors which encourage keeping the status quo (Bovy & Stern 1990); thoughtlessly sticking to a chosen alternative until a bad experience or other major change occurs (Windervanck & Tertoolen 1998).

mainstream, neoclassical economics and behavioural economics, although the boundaries between the non-mainstream approaches are not unambiguously defined.

Here inertia is defined as invariant behaviour while from a mainstream economic perspective change of behaviour is deemed rational. The opposite of course is also possible; this is not discussed separately as the antecedents are expected to be similar (Janis & Mann 1977). In the context of travel behaviour inertia implies that people sometimes tend to stick to a particular travel pattern even though switching to an alternative pattern appears to be utility maximising for the individual.

1.3 Objectives and outline of this thesis

The aim of this thesis is to advance our understanding of individual travel behaviour by exploring possible causes for inertia from a behavioural economic perspective, and to investigate further some specific ideas emerging from behavioural economics in the context of inert travel behaviour.

Chapter 2 starts with an outline of how individual behaviour is generally treated in transportation research, followed by a discussion of *homo economicus* and the assumptions and circumstances under which it is regarded a satisfactory descriptive model of individual behaviour by mainstream economists. Then, an overview is given of alternative behavioural assumptions that have been proposed to explain the main anomalies economists have observed using *homo economicus* as a starting point and some examples from transportation research are discussed. All these departures from the mainstream economic approach will be discussed under the heading 'behavioural economics', as denominated by prominent scholars in the field (e.g. Thaler 1997; Tomer 2001).

Chapters 3 to 7 discuss the results of further investigations of a number of ideas from behavioural economics in the context of inert travel behaviour. *Chapter 3* addresses the effect of a strike on the travel behaviour of public

Chapter 1

transport users. Strikes are an interesting context for studying travel behaviour, because travellers' preferred alternative is removed from their travel choice set and they are forced to reconsider their travel opportunities. We review available studies of strikes in the public transport sector and present the results of a survey carried out after a short, unannounced railway strike in the Netherlands. *Chapter 4* continues on this subject and compares anticipated and actual behavioural reactions to a pre-announced strike of Dutch national railways. We use longitudinal data collected days before and after the strike to compare stated and actual travel choices, considering peoples' travel choice sets. *Chapter 5* investigates the accurateness of car drivers' perceptions of public transport travel time and their potential effect on the consideration of public transport as an alternative mode of transportation. *Chapter 6* discusses perceived travel possibilities of car and train travellers and associations with characteristics of the traveller and the trip. *Chapter 7*, finally, explores car and public transport travellers' preferences for middle-distance travel. Differences and similarities in motivation for travel, liking of travel modes, and levels of involvement and cognitive effort applied in travel decision making are used to uncover preference segments. The potential for inertia among travellers with these preferences is discussed.

Chapter 8 discusses the implications of the findings in this thesis for travel behaviour research and policy and concludes.

Travel behaviour on the move?



This chapter aims to explore possible causes for inert travel behaviour from a behavioural economic perspective, where inertia is defined as invariant behaviour while from a mainstream economic perspective change of behaviour appears to be rational. Section 2.1 starts with an overview of how individual behaviour has generally been approached in transportation research. Section 2.2 follows with an account of the basic assumptions underlying the mainstream economic approach to behaviour and highlights the central arguments of advocates and critics of this approach. Section 2.3 discusses alternative approaches that have been proposed in contemporary behavioural economic literature and gives some examples of applications from transportation literature. Section 2.4 gives an outline of how a selected number of causes for inertia will be further investigated in the following chapters.

2.1 What has been the approach to individual behaviour in transportation research?

2.1.1 Travel is a derived demand

A basic premise in transportation research is that travel demand is derived from the need or desire to participate in activities spread over space and time, despite the fact that travel may sometimes also have an intrinsic process utility and be valued for its own sake (Basmajian 2010; Mokhtarian et al. 2001). About half of the growth in mobility in the Netherlands between 1970 and 2000 resulted from increased individual mobility associated with socio-economic and cultural trends towards more

Chapter 2

individualized and intensified lifestyles (SCP 2003; 1993; MoT 1997). This individualisation process was associated with an increase in female labour market participation, a reduction in household size, a larger share of two-earner households⁵, a shift to more out-of-home activities and, subsequently, to an increasing number of people combining in-home and out-of-home responsibilities. Intensifying activity patterns were a consequence of higher activity participation and activity diversification, leading to higher time pressure and a higher need to combine activities efficiently. In addition, trends in the labour market like the shift toward service industries, higher specialisation and flexible working hours have led to a greater geographical dispersion in activity patterns and lower interconnectivity of time schedules.⁶ In a way the same is true for the leisure market, where increasing differentiation and specialisation has led to a greater propensity to travel to search out niche markets and visit special interest events (Mackellar 2006). Thus, as a consequence of more individualised and intensified lifestyles, people have engaged in more activities at different space-bound locations, for shorter periods of time, leading to higher levels of mobility and need for flexibility, and therefore to a higher dependence on individual modes of transport, predominantly the car. About 80% of the growth in car use in the Netherlands in the period between 1985 and 2008 was associated with increased individual mobility, resulting from people travelling more often and farther both for commuting and leisure purpose (KiM 2010; 2007; RVW 2010; Jekel 2011). These trends obviously are not specific to the Netherlands, although this growth in mobility and the resulting congestion has made that the average commuting time in the Netherlands is longer than in any

⁵ Leading to additional spatial dependencies in the choice of home and work locations (Maat & Timmermans 2009; Rich 2001; van Wee 1994).

⁶ For instance, only 3% of the Dutch work force lives close enough to walk to work (mean distance 1 km; mean travel time 7 min) and 5% to cycle (4 km; 14 min). Main reasons for not moving residence: nice living environment, social attachment, and use of commuting time as private time, for dealing with stress, and for switching between work and home mindsets (www.cbs.nl).

other European country (OECD 2010). Most western countries have experienced similar changes in household structure and lifestyles during the past decades, resulting in a growth of mobility, car ownership and car dependence (e.g., Banister & Marshall 2000; Cameron et al. 2004; Mackellar 2006; Stopher & Lee-Gosselin 1997). Lyons et al. (2000) argued that these mobility trends will pose new policy challenges. The proportion of repetitive trips -in terms of regularity and fixed temporal and spatial orientation- will decline and that of discretionary trips will rise, increasing the dependency on individual modes of transport and the inertia to policies aimed at a modal shift toward collective modes of transport. These issues have been studied extensively in the 1980's and 90's.

Van Wee (1994; 1997) analysed the interaction between the choice of location of space bound activities and travel resistances, (perceptions of) the travel costs and time to cover the distance between two space bound activities. As for many households housing and work are the most space bound activities and commuting is the most frequent trip, the latter was expected to play a substantial role in decisions to move home or change job. Van Wee (1997) however found that the decision to leave the current home or the selection of a new one was affected by a range of interdependent factors⁷, but that accessibility by car or public transport played only a minor role. Raux and Andan (1997) reported similar results.⁸ Tillema, van Wee and Ettema (2010) found that in residential

⁷ For instance, household members' needs and desires regarding housing and activities, the supply and relative importance to the household of services at specific locations, their satisfaction with activities and their location, and the family's lifecycle, budget, commitments (e.g., investments, personal careers and activity patterns) and attachments (e.g., to persons, neighbourhoods).

⁸ They analysed household migration decisions and found eight motives for mobility. Two were internal (or autonomous, controlled) -i.e., based on household preferences and a deliberate search process- and six were external (or dependent, imposed) -i.e., based on external pressure or advice and reactive to market opportunities that come across. The large majority (83%) of migrations was dominated by financial constraints, lack of information and the pressure of the housing market, only a minority of households (17%) was in full control of their own migration.

Chapter 2

location choices people are more sensitive to travel and housing costs than to travel time, and more to travel costs than to housing costs.

Windervanck and Tertoolen (1998) argued that commuters evaluate travel alternatives once, after they change home or work location, but subsequently stick to the chosen alternative thoughtlessly, until a bad experience or some major change occurs in the transport system or in their personal lives. For instance, van Ommeren (2000) found commuting time to be an appropriate measure of search effort for a new housing or work location. Moreover, studies have observed that households find their travel behaviour subject to fairly similar, predictable pressures and constraints related to their lifecycle stage (Maat & Timmermans 2009; Dargay 2004; Jones et al. 1983; Clarke & Dix 1983). Despite the emergence of new forms and more flexible scheduling of activity participation following the increasing adoption of information and communication technologies (Alexander, Dijst & Ettema 2010), a significant proportion of all travel still has a few fixed destinations as core stops (e.g., work, school, shops, gym) and these serve as anchors for much of the other household members' travel behaviour (Hanson & Huff 1988). Day-to-day travel choices thus appear to be subordinated to longer-term mobility related choices. For understanding and predicting travel behaviour it is then important to acknowledge and consider the sequential and conditional decisions travellers make.

2.1.2 Travel choice is hierarchical

The findings discussed before imply that travel behaviour is embedded in prior mobility related choices and strongly influenced by longer-term decisions and commitments such as residential and employment location and car ownership (Fischer 1993; Ben-Akiva & Lerman 1985; Domencich & McFadden 1975). This hierarchical choice structure means that day-to-day travel choices about destination, departure time, travel mode and

route for trips are made given the prevailing opportunities and constraints in the travel choice set and that the likelihood a travel alternative will be considered may depend on prior choices and considerations at least as much as on present motivations and constraints (Raney et al. 2000; Louvière & Street 2000). In other words, for understanding and predicting travel behaviour it becomes relevant to distinguish between choice set formation and actual choice given the prevailing choice set (Fischer 1993; Ben-Akiva & Lerman 1985; Domencich & McFadden 1975). Travel choice sets have been advanced as one of the main reasons for the gap between observed and rational travel behaviour, making the predictions of transport models relying on this assumption less accurate and the transport policies based on them less effective (Raney et al. 2000; Mokhtarian & Salomon 1997). When analysing travel choices it is thus important to distinguish between travellers with different choice sets and to explain why choice sets differ (Wardman & Tyler 2000; Fischer 1993).

Travel choice set formation may be influenced by a variety of factors, such as the supply of travel alternatives, geographic and socio-economic circumstances, individual preferences and perceptions of characteristics of travel alternatives, past travel experience, and habituation (e.g., Kingham et al. 2001, Wardman & Tyler 2000; SCP 2000; van Wee 1997; Rooijers & Welles 1996; Fotheringham & O'Kelly 1989; Ben-Akiva & Lerman 1985; Burnett & Hanson 1982; McFadden 1981). In addition, there is a difference between objective and subjective choice sets (Burnett & Hanson 1982; Punj & Brookes 2001). A person's objective choice set (or opportunity set) is determined by the location of activities, the travel alternatives theoretically available (i.e., road infrastructure, public transport provision, transport policy and fiscal regulations), and the person's capabilities to walk, cycle, use public transport and drive a car. A person's subjective choice set (or consideration set) concerns the set of alternatives the person is aware of and considers viable and acceptable.

Chapter 2

For instance, the choice set of a captive traveller may consist of a single mode, perhaps even in combination with a mandatory route or departure time. This may represent either objective or subjective lack of choice. However, if at all, the subjective choice set is the one actively considered in the choice process.

Some studies have investigated objective and subjective choice sets more in depth. Brög et al. (1977) studied travel opportunities in a sample of people living in a densely populated area well served by public transport and found that although almost 60% of car users had a public transport alternative for the trip they were making, 85% of them had not considered using public transport because of its perceived suitability, lack of information, attitude towards public transport and preference for travelling by car. In a follow-up study, Brög and Erl (1983) found that half of a sample of car drivers had the objective opportunity to use public transport for the trip they were making, but that only five percent perceived to have a real choice between car and public transport (Figure 2.1a). In addition, they found that not more than half of the non-captive car users would switch to public transport following increases in petrol prices of up to 200%. Most car drivers indicated they would rather cancel their trip than switch to public transport. Kropman and Katteler (1990) replicated this study and found that 83% of a sample of morning peak car drivers had the objective possibility to switch to public transport for the trip they were making, but that only 17% actually perceived to have freedom of choice as a result of various constraints on their travel behaviour (Figure 2.1b).⁹

⁹ Perceived freedom to switch to public transport varied with gender (women 36% / men 14%), age (<35 years 25% / ≥35 years 13%), trip purpose (business 4% / commuting 18%), trip frequency (daily 14% / infrequent 22%), travel distance (<40 kms. 20% / 12% ≥40 kms.), type of car (company 2% / leased 10% / private 21%), experience with public transport (users 33% / non-users 14%) and stated preference (strongest preference for car 8% / least strong 22%).

Travel behaviour on the move

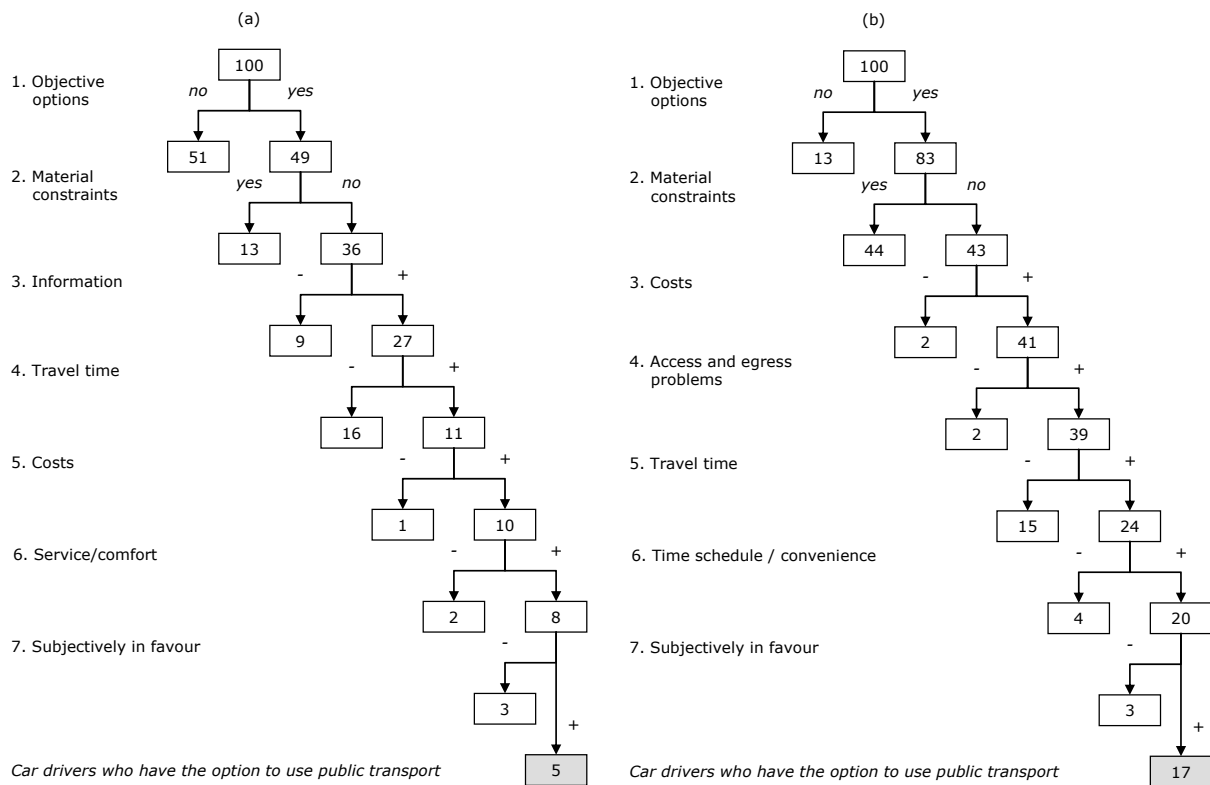


Figure 2.1 Hierarchical identification of car drivers with opportunity to use public transport¹⁰

2.1.3 Observed travel behaviour is the result of rational choice

With its roots in engineering and geography, the development of ideas in travel behaviour research generally has been in terms of econometric models, largely working under the assumption that observed travel behaviour is the result of rational choice; “the field has been predominantly entrenched in a quantitative paradigm” (Clifton & Handy 2003). Three main types of travel behaviour models have been prominent: (1) four-stage models; (2) disaggregate behavioural models; and (3) activity-based models (Blauwens, de Baere & van de Voorde 2010; Hensher & King; 2001; Banister 2002; Fischer 1993).

¹⁰ Source: (a) adapted from Brög and Erl (1983); (b) adapted from Kropman and Katteler (1990); a “+” (“-”) indicates that public transport is (not) a suitable alternative for the car driver.

Chapter 2

The traditional four-stage aggregate transport planning model was developed in the 1950's and 60's. The aim of the model was to predict aggregate traffic flows between zones on the basis of empirically established relationships between travel, land-use and socio-economic variables, for the purpose of regional and infrastructure network planning. Travel behaviour was seen as the result of four consecutive rational choices, which were modelled independently: whether to travel, where to travel, which mode to use, and what route to follow (e.g., Lee-Gosselin & Pas 1997; Banister 2002; Fischer 1993).¹¹ Although the separate models have been improved considerably since the early days, the theoretical basis for four-stage models is weak, the analytical framework has proven to be inflexible and costly, whereas predictions have often been inaccurate (e.g., Fischer 1993; Banister 2002; De Dios Ortúzar & Willumsen 2001). For instance, studies comparing longer-term travel forecasts with later observed levels demonstrated that forecast errors would have been no larger if the transport models had started from the assumption of no change in the exogenous variables (Jones et al. 1983). The main theoretical objections concern the sequential structure and absence of feedback between the stages, the focus on aggregate data, and the lack of theoretical underpinning (Blauwens, de Baere & van de Voorde 2010). The four-stage model is entirely empirically based and makes no attempt at understanding why people travel, the constraints and uncertainties people face, and what happens when travel patterns become routine or habits are formed.

¹¹ First, a *trip generation* model estimates the number of trips for different purposes from a certain (urban) zone, based upon characteristics of that zone such as the type and size of economic activity and the type, number and income of households. Second, a *trip distribution* model determines the destination of trips for each purpose, usually based on generalised travel costs minimisation. Third, a *modal split* model estimates the number of trips with car and public transport between zones, based on mode choice models. Finally, a *route assignment* model addresses route-choice for any trip between two zones, based again on generalised travel costs minimization.

The increasing availability of computer hard- and software in the 1970's and 80's allowed for much more efficient handling of large data sets. Newly developed disaggregate utility models of travel behaviour turned the focus to the individual (or the household) rather than zones as the unit of observation in an attempt to develop models with higher policy sensitivity (McFadden 2001; Lee-Gosselin & Pas 1997; Banister 2002; Fischer 1993).¹² Disaggregate utility models explain travel behaviour by relating observed behaviour to characteristics of the individual and the transport system. These models are based on the mainstream economic theory of rational behaviour and assume that people have full information and control over all alternatives from the travel opportunity set, are able to rank these alternatives according to their preferences and to choose the alternative that maximises their utility, constrained only by time, budget, the physical environment (Noland & Small 1995; Ben-Akiva & Lerman 1985) and reliability (Noland & Polak 2002; Bates et al. 2001; Bates 2001). Despite their wide application and current level of sophistication and power (Rietveld & Nijkamp 2003), disaggregate utility models have been criticised for: (1) their failure to take into account that travel is a derived demand and the hierarchy between mobility- and travel-related choices; (2) their focus on modal choice on single trips as separate events, ignoring linkages in time and space between components of travel patterns (or trip chains), the interrelations between travel behaviour of persons in a household, and the intertemporal dependence between travel choices; (3) their reliance on unrealistic assumptions about rational behaviour; and (4) their focus on elegant mathematical model structures and statistical associations (e.g., Folmer, Oud & Saris 2010; Folmer 2007; Maat, van Wee & Stead 2005; Lanzendorf 2003; Hensher & King 2001; Gärling & Young 2001; Mehndiratta et al. 2003; Ben-Akiva et al. 1999; Banister 2002; Fischer 1993; Jones et al. 1983; Burnett & Hanson 1982;

¹² See McFadden (2001) for a retrospective on disaggregate travel demand models.

Chapter 2

Heggie 1978); “we have outgrown the simplistic notion that the accurate modelling of human behaviour awaits only sufficient data and computing power directed to discovering underlying principles analogous to physical laws” (Lee-Gosselin & Pas 1997).¹³ Later applications have relaxed some of the assumptions, have attempted to integrate attitudinal factors into disaggregate utility models and have tested alternative behavioural assumptions to better explain observed behaviour (Banister 2002; Jones et al. 1983). These models accommodated concepts such as partial information and travel time uncertainty (e.g., Hensher & King 2001; Banister 2002), used psychometric scaling techniques to investigate and quantify subjective variables such as comfort, convenience and reliability (Lee-Gosselin & Pas 1997) and addressed subgroups with deviating travel cost structures or preferences (e.g., Larsen & Rekdal 2009; Sohn & Yun 2009).

Activity-based models, which view travel as a part of general patterns of behaviour and accommodate notions of the human activity approach (Jones et al. 1983) and time-space geography (Hägerstrand 1970), emerged in the mid 1980’s. The basic idea is that people undertake activities in order to satisfy basic needs (e.g., sleeping), personal preferences (e.g., leisure and lifestyle related activities), role commitments (e.g., child care and other lifecycle related activities) and institutional requirements (e.g., school, work). Travel is required to participate in activities at different points in space and time and therefore treated as a derived demand (Fischer 1993; Burnett & Hanson 1982; Jones 1978). So far the complexity of the interactions between all the constraints (e.g., the linkages between children’s after school activities, their travel needs and their parents’ activity-travel patterns; Paleti,

¹³ Accuracy is lost in various stages of the information chain: perception and reporting of behaviour by traveller, administration and interpretation by interviewer, coding of response, modelling and interpretation of results; and this just for the factors under consideration (Mackett 1983).

Copperman & Bhat 2011) has inhibited the realization of a comprehensive theoretical and analytical framework (Clifton & Handy 2003; Goulias 2003; Fischer 1993). The potential complexity of activity patterns becomes apparent when one considers how activities may differ in aspects such as their timing (absolute, or relative to dominant activities such as work), duration, location, frequency (or repetition), sequencing, importance (absolute, or relative priority), planning horizon, accessibility of travel modes, and their degree of specificity (or substitutability) in any of these aspects (Burnett & Hanson 1982).

Nonetheless, applications of activity-based models have given insight in the types of constraints that affect peoples travel choices¹⁴ and indicate that activity scheduling considerations may be much more central to day-to-day travel behaviour than characteristics of travel modes (Lee-Gosselin & Pas 1997; Banister 2002; Fischer 1993; Goodwin 1983).

2.1.4 People differ in preferences, strength of habit and choice set

The models of travel behaviour discussed above largely rely on travellers making rational choices, either from the full opportunity set or a constrained consideration set. Alongside their development and despite their current level of sophistication, criticism remained about the rational choice assumption as being unrealistic or lacking descriptive accuracy, and many argued more attention should be paid to differences in preference and the influence of habit formation (Anable 2005; Götz et al. 2003; Dargay 2001; Raney et al. 2000; Wardman & Tyler 2000; Goodwin 1995; Burnett & Hanson 1982). That is, as Goodwin (1995) phrased, there is one

¹⁴ Travel choice sets lie within a time-space prism shaped by authority, complementarity, capability and coupling constraints. Authority constraints refer to limitations imposed from outside, such as public transport service areas/timetables. Complementarity constraints refer to the (im)possibility for activity chaining, such as interoperability and interconnectivity of transport systems. Capability constraints refer to individual limitations in time, capacities and means. Coupling constraints refer to interdependence and need to synchronise joint activities, such as between members of a household.

Chapter 2

simple but important proposition for travel behaviour research and policy arising from past research: people differ. Travellers should therefore not be considered as a homogeneous group and policies should not be directed at the average car driver, but it is important to recognize distributions of preferences among individuals, understand their opportunities and constraints and design policies addressing sizeable subgroups which display a certain kind of behaviour in response to specific circumstances or changes therein. Wardman and Tyler (2000), for instance, proposed to distinguish between groups of travellers with different travel choice sets, and Diana and Mokhtarian (2009) according to the degree of acquaintance with different travel modes.

Various studies have been conducted in the past addressing heterogeneity in travel behaviour. In the 1980's trip and traveller characteristics were used to segment travellers into groups with, for instance, homogenous travel behaviour (Hanson & Huff 1982; 1988¹⁵; Huff & Hanson 1986¹⁶), according to stage in the family lifecycle (Jones et al. 1983)¹⁷ or whether choice is forced or permissive (Heggie & Jones 1978). In the 1990's interest shifted to preferences, leading to segments of travellers sharing

¹⁵ They argued that travel-activity patterns are organized around a few core stops that serve as anchors for the rest of activity / location choices and travel behaviour. As an example, working men and nonworking women demonstrated a high level of repetition in travel-activity behaviour.

¹⁶ They identified five travel behaviour groups using observed travel characteristics from 35-day travel records (e.g., number of trips, trip purpose, proportion single-stop trips). They found that the level of trip making, spatial-extent of the travel-activity pattern and trip complexity were important discriminators between the five groups, and that the five groups had distinct socio-demographic characteristics, in terms of gender, household size and establishment density close to home.

¹⁷ They found stage in family lifecycle to be a useful classificatory variable for identifying differences and regularities in behaviour patterns and underlying decision rules. The lifecycle groups distinguished included: younger (married) adults without children; families with pre-school children (under 5); families with pre-school children and young school children (6-11); families with young school children; families with older school children (12-15); families of adults, all of working age; older adults, no children in the household; retired persons.

similar tastes for travel (e.g., Pas & Huber 1992)¹⁸ or with different levels of car dependence (e.g., Kropman & Katteler 1990)¹⁹. More recent studies have focussed on segmentation based on attitude theory. Popuri et al. (2011) investigated the importance of attitudes in the choice of public transport to work. They discerned six attitudinal factors²⁰ related to commuting and found that these contributed considerably to the explanation of mode choice to work. Shiftan, Outwater and Zhou (2008), Lieberman et al. (2001) and Prousaloglou et al. (2001) conducted similar studies.

Anable (2005) identified six travel behaviour segments in terms of predisposition to use alternatives for car²¹ and found willingness to switch to be associated with more favourable attitudes and greater perceived control over alternative modes, less psychological attachment to the car, and stronger moral norms. People may thus exhibit similar current travel behaviour, but may have made this choice in different ways and for

¹⁸ They identified five segments of intercity rail travellers (functional traveller, day tripper, train lover, leisure-hedonic traveller, and family traveller) and characterized them according to personal/household characteristics, the most likely train trip by the respondent, factors travellers need or care about, do not want or do not find important (i.e., where poor service will be tolerated), and factors regarding other modes that would encourage train use. They argued this indicates that the intercity rail travel market has a more complex structure than the commonly-used classification into business and non-business travellers and that adapting services and policies to the different segments of needs and preferences would improve the effectiveness of marketing and policy.

¹⁹ They distinguished travellers in three groups: strongest preference for car, i.e., always choose car (37%), fairly strong preference for car (33%), and least strong preference for car (30%). Men more often than women showed a strong preference for car, and car dependence increased with age and decreased with train experience.

²⁰ The six attitudes were: need for reliable and stress-free commute, need for privacy and comfort, complexity of trip-making behaviour, tolerance to waiting and walking, general attitude toward public transportation, and perceived safety of the travel environment.

²¹ The six travel behaviour segments were: (1) malcontented motorists (30%), willing to reduce car use for altruistic motives or to avoid congestion, but held back by weak perceptions of behavioural control; (2) complacent car addicts (26%), not willing to reduce car use because they do not see the point of it; (3) die hard drivers (19%), with a strong resilience to reducing car use; (4) aspiring environmentalists (18%), with a practical approach to car use and a high propensity to use alternatives, but constraints limit choice; (5) car-less crusaders (4%), with a high sense of environmental awareness and concern and a strong preference for other modes than the car; (6) reluctant riders (3%), that use alternative modes less voluntarily but because of constraints on behaviour. Segments 1 to 4 were car owning, 5 and 6 not.

Chapter 2

different reasons, and have different levels of commitment to current behaviour. Murray, Walton and Thomas (2010) investigated public transport attitude among car drivers and found that level of prejudice to public transport was associated with among other things use of public transport and beliefs about public transport and the environment. Because social norms played an important role in the prejudice among non-users, investments in the quality of service may have little effect on their attitudes and use. Promoting ridership, they argued, should therefore focus more on framing public transport usage as normal. Cheng (2010) looked at passenger anxiety as a challenge for travelling by train. Delays, transfers, crowding, access to the station and searching for the right train/platform contributed most to anxiety, while considerable differences were found between subgroups based on gender, age, and frequency of use. Gatersleben & Haddad (2010) observed four stereotypes of the typical bicyclist²² and showed how these perceptions related to bicycling behaviour and intentions, whereas Heinen, Maat and van Wee (2011) found three attitudinal factors related cycling to work, i.e. awareness, trip-based benefits and safety, with different effects over various commute distances. Götz et al. (2003) investigated the relation between various attitudinal, motivational and lifestyle dimensions and variability in travel behaviour and so identified five basic mobility orientations²³. Bamberg and Schmidt (2001) used attitude toward policy measures restricting private

²² The four stereotypes were: responsible bicyclists, who use the bike safely and responsibly; lifestyle bicyclists, who are keen on cycling and spend time and money on their bike; commuters, professionals who use the bike to go to work; and hippy-go-lucky, kind people who use the bike for regular non-work activities. These perceptions varied between bicyclist and non-bicyclists and with frequency and motivation of past cycling behaviour.

²³ The five basic mobility orientations were: (1) traditional domestics, oriented towards family and security and no specific modal preference; (2) reckless car fans, oriented towards career and achievement and with a very strong car preference; (3) status-oriented automobilists, oriented towards prestige, with a preference for car and a strong sense of insecurity regarding other modes; (4) traditional nature lovers, oriented towards preservation of nature, enjoy walking and have tram as favourite mode of transport; and (5) ecologically resolute, a young and technically minded group that rejects the car for ecological reasons and have bicycle as favourite mode of transport.

car use as basis for segmentation. Raney et al. (2000) discussed the influence of a variety of non-traditional transport-related motives (i.e., work, family, leisure, independence, ideology) through which behavioural reactions are filtered. Transportation research has long neglected these motivational factors, despite the accumulating evidence of their potential to account for heterogeneity in travel behaviour (Popuri et al. 2011; Gardner & Abraham 2008; Cao & Mokhtarian 2005a; 2005b; Choo & Mokhtarian 2004; Steg, Vlek & Slotegraaf 2001; Steg, Geurs & Ras 2001); Kitamura et al. 1997); travel surveys mostly still do not ask for people's motivation for travel other than trip purpose and in transport models motivational factors are usually modelled as a part of a "catch all" error term (Burnett & Hanson 1982).

Others have argued that habituation can importantly distinguish between travellers. Much of travel behaviour is highly repetitive, with commuting as a dominant travel pattern. Experiences with trips and travel modes are an important source for learning, enabling people to make travel choices in a rather mindless, habitual manner for trips that have become sufficiently familiar. Past behaviour could thus well account for differences in travel behaviour and in sensitivity to changes in the transport system between people, as much of the screening of alternatives has taken place in the past (Murray, Walton & Thomas 2010; Diana & Mokhtarian 2009; Mondschein et al. 2006; Punj & Brookes 2001; Kitamura 2000; Verplanken et al. 1994; Salomon et al. 1993). Car dependence mostly is associated with a travel choice set that excludes any alternative but the car, because of mode captivity or car being the dominant best alternative, by an objective lack of alternatives or by commitments that require a car (Brindle 2003a; Goodwin 1995). But there is also increasing evidence that, based on their preference for car, people develop their lifestyle around car availability, eventually making them dependent on it for most regular and occasional trips (Brindle 2003a; Goodwin 1995). Dupuy

Chapter 2

(1999) distinguished three positive, accumulating effects of the automobile system supporting car dependence for its users: the club effect (by obtaining a driver's license), the fleet effect (by acquiring a car), and the network effect (by using the car). This 'magic circle' of positive effects, Dupuy argued, makes it essential for travellers to belong to the system and increasingly difficult for 'members' to do without a car; even substantial economic disincentives may then be unlikely to lead to significant reductions in car use (Jakobsson et al. 2002). Goodwin (1995) however pointed to the fact that although 50 to 80 percent of people perceive themselves to be generally dependent on car use, only between 10 and 30 percent of their trips can unambiguously be identified as both strictly necessary and provided with no alternative, making it relevant to distinguish between car dependent people and car dependent trips. Jekel (2011) observed similar figures for the Netherlands, Litman (2003) and Kenworthy (1995) discuss international comparisons of car dependence.

Hailu et al. (2005) showed that mode dependence may also relate to habit or preference to a specific activity location. Huff and Hanson (1990) also argued that locational persistence may account for a considerable part of the systematic regularities in travel behaviour, with activity locations playing a substantial role in structuring individual travel patterns and restricting the opportunity set. This also points to travel being a derived demand, sub-ordinate to mobility-related decisions that define a person's travel choice set, and that inertia of travel behaviour may thus the more relate to such prior decisions. One way or the other, studies of travel behaviour should include measures of dependence or habituation, such as the past and current commitments to car (driving license, ownership) and public transport (season-ticket ownership) that tend to lock people into inert travel patterns (Mondschein et al. 2006; Anable 2005; Simma & Axhausen 2003; 2001). Rooijers and Welles (1996), for instance, distinguished five subgroups of travellers based on the nature and

strength of their travel habits and the associated implications for policy²⁴. What's more, they argued that habits are not only an unavoidable feature of travel behaviour, but a functional one as well; policies can be aimed at breaking habits that are considered to be undesirable but also at the formation and perpetuation of habits that are considered to be desirable.²⁵

People may thus differ in their travel preferences and experiences and the nature and strength of their travel habits, and consequently have different travel choice sets; i.e, people with objectively comparable characteristics (e.g., trip purpose) and opportunity sets may have different consideration sets. Some have argued that people are likely to have more than a single consideration set, a behavioural repertoire consisting of different choice sets for different choice contexts (e.g., activities, times of day, locations, trip purposes) so that there is reason for expecting both repetition and variability in a person's travel behaviour (Anable 2005; Mokhtarian & Salomon 1997; Hanson & Huff 1988; Huff & Hanson 1986). Although much of transportation research still relies on travellers making reasoned choices, the extent to which travel behaviour is reasoned or inert may thus differ between people as well as between choice contexts for any individual person. The next section first discusses the basic assumptions underlying rational behaviour in mainstream economics, followed in section 2.3 by alternative approaches proposed in behavioural economic literature that may help advance our understanding of differences between people in the apparent rationality of their travel behaviour.

²⁴ Travellers with a strong and undesirable travel habit; a weak and undesirable travel habit; hardly, if any, travel habit; a weak and desirable travel habit; a strong and desirable travel habit. A strong and undesirable car habit can only be broken by external, restrictive push-measures making car use less feasible (e.g., banning cars from city centre, restricting road capacity) or considerably less attractive (e.g., limiting or pricing parking, maintaining traffic congestion). Pull-measures aimed at influencing the rational consideration of alternatives will only become effective after sufficient discouragement and breakdown of existing habits (see also Steg 2003).

²⁵ Habits may however only be predictive of future behaviour when circumstances remain relatively stable (Bamberg & Schmidt 2001; Bamberg, Ajzen & Schmidt 2003).

2.2 What is rational behaviour according to mainstream economics?

Mainstream economists try to explain the world by assuming that the phenomena they observe are the outcome of rational decisions by people maximising their individual utility (Becker 1978). The behaviour of *homo economicus* is assumed to be motivated by self-interest, which is often traced back to Epikouros. This ancient Greek philosopher stated that the pursuit of happiness and the avoidance of pain are the first impulses of animals and of newborn babies, and therewith a fundamental stimulus of human behaviour (Russell 1995). Also Bentham (1879) noted: "nature has placed mankind under the governance of two sovereign masters, pain and pleasure [...] they govern us in all we do, in all we say, in all we think". But perhaps better known, Smith (1776) stated: "it is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from their regard to their own interest [...] their self-love [...] their advantages". In the pursuit of his self-interest, *homo economicus* is assumed to choose the best bundle of goods and services available in the market place, consistent with his limited resources, and using utility maximisation as the decision rule.

Bentham (1879) aligned utility with well-being, defining it as: "the property in any object [...] to produce benefit, advantage, pleasure, good or happiness" or "to prevent the happening of mischief, pain, evil or unhappiness". Van Praag (1993) argued that the attitude of economics towards the concept of utility is ambiguous and that its exact meaning (and measurability) continue to be a matter for discussion. Two prominent ways of interpreting utility presented in literature are hedonic welfare (or happiness) and preference satisfaction (or desire-fulfilment) (Sen 1995; Cohen 1993; Brouwer et al. 2008). The first considers utility as a desirable state of happiness; Bentham's definition above is an example. The second interpretation considers utility as a way of treating how people

make preference orderings of states of the world with their preference being more satisfied as higher ranking states are reached; take for instance Boulding's (1981) definition of utility: "a hypothetical measure of well-being of a person or group, particularly as expressed in their individual preferences. Utility is that which goes up when a change produces a situation that is preferred to the previous situation in the mind of some evaluator". Either way, motivation for behaviour in mainstream economics is typically consequentialist, that is, decision makers derive utility from the outcomes of behaviour and not from the behaviour itself or the underlying intentions (Brouwer et al. 2008). Moreover, individual preferences are assumed to be exogenous, determined outside the economic system; mainstream economists are primarily interested in the bundle of goods and services a person prefers, not so much in why the person derives most utility from any particular bundle. Preferences "are assumed not to change substantially over time, not to be very different between wealthy and poor persons, or even between persons in different societies and cultures" (Becker 1978); "one does not argue over tastes for the same reason that one does not argue over the Rocky Mountains – both are there, will be for the next year, too, and are the same for all men" (Stigler & Becker 1977); people "are presumed able to choose in accordance with their own preferences, whatever these may be, and the economist does not feel himself obliged to inquire deeply into the content of these preferences" (Buchanan 1987). The economist's task simply is to trace the consequences of any given set of preferences (Friedman 1962).

The choices of *homo economicus* are supposedly rational, with rationality referring to the logic of choice. People are expected to make consistent and transitive decisions based on utility maximisation. In order to make this possible, individuals are assumed to have complete information of the utility providing attributes of all available alternatives and the environment of choice, including perfect foresight, and that they are not

Chapter 2

hampered by any cognitive limitations and thus able to perform all computations required to determine the optimal outcome of choice (Allais 1953; Von Neumann & Morgenstern 1953; Hogarth 1986). The assumption of complete information does, however, not necessarily imply that the individual knows everything; he may have to make 'choice under risk'. The individual then knows the set of possible consequences, but is uncertain about the exact relation between choice and consequence. Choice under risk now requires not only preferences among consequences, but also the use of probability and caution factors about the relation between actions and consequences (Fisher 1930; Arrow 1996). Since the days of Bernoulli, early 18th century, economic man was assumed to be 'risk neutral' and to choose among uncertain outcomes of choice according to their 'expected utility', the utility of each outcome weighed by his knowledge or beliefs of their probability of occurring (Von Neumann & Morgenstern 1953; Savage 1972; Samuelson & Nordhaus 1995; Tversky & Kahneman 1981; Allingham 1999). Choice under risk is not a wild guess, but an informed prediction using 'certainty equivalents'. Such rational expectations, while not necessarily correct, supposedly are not systematically biased (Baumol & Blinder 1999; Samuelson & Nordhaus 1995).

Considering the time it has functioned as the mainstream economic approach to individual behaviour, despite persistent criticism for its descriptive accuracy, *homo economicus* must be regarded a successful theory of individual behaviour. Its success and influence as well as its controversiality within and beyond economics manifest itself in the usually rather polemic discussions between critics and advocates and in the metaphors and anecdotes used to enforce the arguments (some of which will be quoted below).

Advocates

According to Becker (1978), one of the principal arguments in favour of *homo economicus* as an economic theory of individual behaviour concerns its appeal: "a comprehensive one that is applicable to all human behaviour, be it behaviour involving money prices or imputed shadow prices, repeated or infrequent decisions, large or minor decisions, emotional or mechanical ends, rich or poor persons, men or women, adults or children, brilliant or stupid persons, patients or therapists, businessmen or politicians, teachers or students". This, however, has to be considered within the proper choice environment. Buchanan (1987) and Williamson (1963), among others, posed that *homo economicus* should be viewed as a theory of individuals who choose on markets and that the nature of the process on markets assures proper motivation; "Markets are institutions of exchange; persons enter markets to exchange one thing for another. They do not enter markets to further some supra-exchange or supra-individualistic result" (Buchanan 1987). Competitive markets thus force people to be effective in following the economic rationale. Otherwise they will be exploited and eventually withdraw; "Since only the fittest survive, we need only a theory of the fit" (Cyert & March 1963). Lucas (1986) posed to restrict the application of such a theory to circumstances which may be considered as approximately stationary, when people have had sufficient time and opportunity to adapt to the performance incentives operating in their choice environment. Camerer (1999), Vlek (1990) and Thaler (1981) argued that behaviour will be closer to the normative model, the larger the stake; but in practice, only decisions that have a large impact get the amount of attention that may lead to an 'optimal' solution. The implication of narrowing the scope obviously is that the range of phenomena to which the model can be applied is seriously limited (Hogarth 1986).

Chapter 2

But perhaps more important to note, the assumptions underlying *homo economicus* -more or less homogenous and stable preferences and consistent and transitive choice using a single decision rule- were not chosen for their descriptive accuracy, but for the purpose of analytical convenience (Becker & Mulligan 1997). In economic analysis, realism of the behavioural assumption is sacrificed to avoid a diversion from the proper focus (Akerlof 1970). After all, the focus of mainstream economic analysis typically is on the outcomes of aggregate behaviour in the context of changes in conditions, institutions and policies (Arrow 1994; Hogarth 1986; Heiner 1983). For this purpose, individuals are assumed to behave *as if* they were rational (Friedman 1962). In reality people, however, need not necessarily be conscious of their efforts to maximise nor be able to describe in an informative way the reasons for the systematic patterns in their behaviour. Although people may sometimes behave erratically, it is assumed to be of random nature. Hennisman (1945) and Akerlof (1984), among others, have advanced the idea of *homo economicus* as a useful heuristic device for generating hypotheses to explicate empirical phenomena in areas where little data exists; rational choice then serves as a 'benchmark' (Handgraaf & van Raaij 2005; van den Bergh, Ferrer-i-Carbonell & Munda 2000; Keuzekamp 1999; Loewenstein 1992), an 'operational definition' (Hogarth 1986), a 'standard of comparison' (Akerlof 1984) or a 'starting point for theorizing' (Van Raaij 1985). If we know what would happen under these hypothetical conditions, we may better understand what does happen under actual conditions (Fisher 1930).

All in all, Becker (1993b) posed, mainstream economists primarily advocate *homo economicus* as a method of analysis, applicable to individuals participating in market interactions under certain well-described circumstances, not as an assumption about particular motivations of individual decision makers, who in reality may be driven by

a much richer set of values and preferences. Economic man strives for optimal solutions in a simplified world.

Critics

Samuelson (1937) posed that it is “extremely doubtful whether we can learn much from considering such an economic man, whose tastes remain unchanged, who seeks to maximise some functional of consumption alone, in a perfect world, where all things are certain and synchronised”. The prevailing dissatisfaction with *homo economicus* within economics²⁶ was clearly portrayed by Tomer (2001): “Economic man is far from being a self-actualised human, a mature fully integrated human who has realised a significant degree of his personal potential. And economic man is still further from being an enlightened being. Economic man, as he is ordinarily understood, is not capable of empathy, significant intellectual or intuitive insight, transcendental oneness or other capabilities of a transverbal nature. Nor for that matter does economic man have personal problems; he does not have psychological hangups or evil intentions. Economic man, after all, is simply a machine-like version of a person who has achieved a somewhat typical level of development in a modern capitalistic country”. The principal critiques against *homo economicus* following from these quotes concern the descriptive accuracy of the underlying assumptions of rationality and the reliance on context-free individual utility maximisation as the single decision rule. Spiegel (2011) argued that the mainstream approach may be a useful benchmark to understand behaviour, but that not all observed behaviour can be rationalized and models departing from rational behaviour assumptions can be more useful to explain phenomena. Savage (1972) took a firmer

²⁶ Characterizations include: rational fool (Sen 1977), pleasure machine metaphor (Thaler 1985), elegant and normatively sanguine theoretical edifice (Laibson & Zeckhauser 1998), convenient fiction (Stiglitz 1989), robot-like expert (Thaler 1980), the spitting image of a completely emotionless being such as “Star Trek’s Mr Spock” (Kaufman 1999), a man with an irrationally rational passion for dispassionate calculation (Clark 1918), a boy’s game in a sandbox (McCloskey & Murray 1996).

Chapter 2

position stating that the rationality assumption does not correspond even roughly with reality; with a wink to Epikouros he noted: “formal reasoning presumably plays no role in the decisions of animals, little in those of children, and less than might be wished in those of men”.²⁷

Simon (1976) posed that behaviour conforms only reasonably close to what mainstream economists consider as rational in situations that are sufficiently simple and transparent. Understanding how people would behave under assumptions of complete information and perfect reasoning and motivation, however, is of limited value in all other situations, when for instance alternatives are not clearly defined in advance and information and computational ability are limited. In general, people do not seem to apply a rational strategy, particularly when facing uncertainty; tend to neglect the problem or to avoid uncertainties, leading to bias and systematic errors (Thaler 1991; Ajzen 1977; Cyert & March 1963), and are only occasionally sufficiently involved with choice situations to collect and consider information carefully (Van Raaij & Ye 2005). Likewise, Anderson (2000) noted: “we are not very good at judging probabilities; we do not think about risks in the way decision theorists think we ought; we do not order our preferences consistently; we care about sunk costs; and we systematically violate about every logical implication of decision theory. There is probably no other hypothesis about human behavior so thoroughly discredited on empirical grounds that still operates as a standard working assumption in any discipline” (see also Folmer 2007). Roth (1996) accentuated that even when market competition would provide the proper motivation for

²⁷ In a more anecdotal style: “the economist’s traditional picture of the economy resembles nothing so much as a Chinese restaurant with its long menu. Customers choose from what is on the menu and are assumed always to have chosen what most pleases them. That assumption is unrealistic, not only of the economy, but of Chinese restaurants. Most of us are unfamiliar with nine-tenths of the entrees listed; we seem invariably to order either the wrong dishes or the same old ones. Only on occasions when an expert does the ordering do we realize how badly we do on our own and what good things we miss” (Scitovsky 1976).

behaving rationally, the validity of the mainstream model can be expected to be a property of the environment -or culture (Hofstede 2010)- as much as of the individual.

Rationality confined to internal logic of choice makes it a rationality of means, focussing only on how given objectives are achieved, whatever those objectives may be (Baumol & Blinder 1999). This focus on simple and easily characterizable motives and the disregard of the deeper and more sacred aspects of life is insufficient and also one of the oldest and more fundamental critiques of economic thinking (Sen 1987; Arrow 1997; Bell 1982; Bovenberg & van de Klundert 2006; Folmer 2007). Zafirovski (1999) posed that "the utility optimisation principle is usually extended to all human behavior and so treated as an explanatory deus ex machina of a virtually infinite range of social economic phenomena" and that some economists "show a remarkable facility or 'unbearable lightness' in (mis)using the utility function, by placing virtually anything in it". Spash and Biel (2002) argued that under this assumption "nothing but egoism is easily explained and altruism, habits, addiction, lexicographic preferences, social norms, basic values and fundamental ethical beliefs are among the list of ignored aspects of human psychology".²⁸ Decision makers "ought to be highly detached, cool, and utterly objective when calculating the expected utility of whatever choices they make" (Janis & Mann 1977).

Tomer (2001) added that the preoccupation of *homo economicus* with his individual utility is deficient in two ways. First, although it may be fair to claim that people generally pursue their self-interest, it is the question to what extent it is their main preoccupation. A second question concerns what actually is meant by self-interest and individual utility. The self-interest of *homo economicus* is often equated with independence and

²⁸ They drew a comparison with the saying "all roads lead to Rome": with no choice of destination, it is not very interesting to maintain that those who arrive in Rome did so as a preference and to dismiss of those who did not, presumably by random error.

Chapter 2

insensitivity and disregards the common need to belong and to be socially acceptable. Zelizer (1998) and Rose-Ackerman (1998) pointed to the alleged impersonality of markets; by assuming away the social interactions between payers, recipients and third parties, transactions can be based on objective information on the characteristics and prices of products; and logically, the process of trading itself and effects on others do not become a source of (dis)utility. Hofstede (2010) and Etzioni (2003; 1991) argued that individuals are not free standing but tend to be encapsulated in social and cultural contexts that may have a substantial effect on the acceptability and attractiveness of choice alternatives. According to Beilock (2000), individuals derive utility not only from material gains, but also from two categories of psychological factors: their individual basic belief structure, culture and socialisation, and their individual patterns of likes and dislikes for others. Consequently, the utility derived from a transaction ultimately depends on the characteristics of the good or service as well as on those of the transaction (e.g., the counterpart or the payment method). Tomer (2001) posed that this separateness of *homo economicus* estranges mainstream economic theory most from other social sciences engaged with the study of individual behaviour. Or as Sen (1987) put it, "the coolly rational types may fill our textbooks, but the world is richer".

Hennipman (1945) argued that in the quest for economic laws for capricious human nature, economists have resorted to tricks; "The thought, that it is not only sufficient but also necessary, that economics restricts itself to a single assumption concerning human behaviour, a thought initially mostly silently accepted by theorists, was more and more explicitly advocated and permeated larger circles, until theorists came to regard it as a virtually incontestable truth". Consequently, Sen (1982) argued, mainstream economists tend to assume that society consist of clones that are "unable to distinguish between perfectly distinguishable

questions about one's happiness, one's desires, one's view of one's own welfare, one's motivation, one's maximand in choice behaviour". Stiglitz (1989) ventilated the concern that "in many cases, this traditional view is fundamentally incomplete, incorrect and misleading. It is incomplete, in the sense that there are many aspects of the market which it simply fails to explain; it is incorrect, in that its predictions concerning the behavior of the market are often wrong; and it is misleading, in that it often leads to policy prescriptions of dubious validity". In a similar vein, Folmer (2007) and Camerer (1999) argued that the mainstream approach is deficient in explaining individual behaviour because crucial sociological, psychological and spatial determinants of behaviour are omitted from economic models; their predictions therefore are often wrong and have limited practical or policy relevance.

What is then a good theory of behaviour? Stigler (1965) argued that an economic theory must meet the triple criteria of generality, manageability and congruence with reality. This is in line with Hennisman (1945), who argued that a single theory of human behaviour is only acceptable in case it is generally applicable and provides unambiguous explanations that are empirically correct, and with Duesenberry (1959), who claimed that "the validity of a concept depends entirely on the correspondence between the actual observations and those implied by the concept". Whether the mainstream economic approach to behaviour satisfies these criteria is questionable. It makes no real interpersonal distinction in preferences, motivations or levels of skill, between availability, perception and use of information, or decisions involving high or low emotional involvement. As Shiller (2000) phrased it: "real-world decisions are clouded by emotions and a lack of clearly defined objectives, and people do not generally behave as if they have thought things through well in advance".

Is *homo economicus* then not a good theory of behaviour? Friedman (1962) took the view that the validity of an assumption is solely

Chapter 2

determined by its capacity of explaining and predicting real-world events. A pool player's shot, as Friedman's example goes, is best explained and most accurately predicted by the laws of velocity, momentum and angles from classical physics. However, although they all play as if, even most expert players undoubtedly do not understand the precise physical principles behind the game of pool. Loomes and Sugden (1982), in turn, "do not doubt that misperceptions and miscalculations occur, and sometimes in systematic rather than random ways. Nonetheless, our inclination as economists is to explain as much human behaviour as we can in terms of assumptions about rational and undeceived individuals". According to Fisher (1930), "no scientific law is a perfect statement of what does happen, but only of what would happen if certain conditions existed which never do actually exist. Science consists of the formulation of conditional truths, not of historical facts, though by successive approximations, the conditions assumed may be made nearly to coincide with reality". These statements echo the debate between advocates and critics of the mainstream approach and relate to standpoints about economics as a positive or normative science. An alternative perspective in this discussion is to aim for some form of synthesis (Folmer & Lindenberg 2011; Folmer, Oud & Saris 2010; Etzioni 2008; 2003; 1998; Folmer 2007; Lindenberg 2001; Camerer 1999). However, so far there is no support within economics for a new unifying model accounting for capricious human behaviour. Machina (1987) doubted whether this is at all feasible, or even desirable.

2.3 Which alternative approaches are proposed in behavioural economics?

During the last decades, the criticism of the descriptive accuracy of the assumptions underlying *homo economicus* and the many anomalies that

have been observed in empirical work constituted a fertile breeding ground for alternative assumptions and approaches to individual behaviour within economics. On the whole, these alternatives aimed to complement or correct mainstream economic analysis by relaxing some of the assumptions and by considering the impact of alternative motives and the social, temporal and spatial context on individual behaviour (Folmer 2007; Zelizer 1997; Akerlof 1984). This section discusses six principal alternative approaches that have emerged in behavioural economics that may be associated with inertia, i.e. bounded rationality, prospect theory, judgement of probabilities, interdependent utility, adaptive and relative preferences, and intertemporal choice, and gives some examples of applications in transportation research.

2.3.1 Bounded rationality

Over the years, the most perseverant critique of *homo economicus* probably has been the unrealistic cognitive demand of rational decision making. Simon (1965) argued that people are limited in their capacity to gain and process information, because of their limited memory or computability and insufficient resources or willpower. People have an 'imperfect ability to choose' (De Palma, Myers & Papageorgiou 1994).

The larger the gap between the capabilities of the decision maker and the complexity of the choice problems, the greater the uncertainty in decision making and the tendency to produce errors and surprises; a meaningful model of individual behaviour should thus presume 'bounded rationality' (Simon 1965; Heiner 1983). According to Commons (1934), the principal causes of such 'errors and surprises' are ignorance (i.e. incomplete information), stupidity (i.e. limited cognitive capacity) and passion (i.e. emotional arousal).

Chapter 2

Incomplete information

People may be bounded in their capacity to acquire and process the information they need for making rational choices. According to Langlois (1998), people can be ignorant of structural knowledge (i.e. the context and nature of the decision making problem) and parametric knowledge (i.e. the value of a particular parameter), but also uncertain about how to use the information they do have available. For instance, difficulties with selecting the information that is relevant for their choice problem, translating the information about the various alternatives into a common denominator, and comparing and evaluating the alternatives (Heiner 1983; Langlois 1998).

Tversky (1972a; 1972b) argued that people may display apparently inconsistent preferences because, in order to simplify decision making, they tend to disregard aspects that alternatives have in common and to focus on those that distinguish them. In this 'elimination by aspects' model decision makers view choice alternatives as consisting of aspects they regard desirable (or undesirable); in consecutive steps the decision maker selects an aspect and eliminates from his choice set all alternatives that do not have the desirable aspect (or do have the undesirable aspect), until a single alternative remains. Consequently, the preference for an alternative depends on its own utility value, but also on how similar it is to other alternatives in the choice set and how the alternatives were decomposed into common and distinctive aspects during the decision making process. In the same line of thought, Cyert and March (1963) introduced the concept of 'local rationality'. They argued that people tend to divide complex decision problems into manageable sub-problems, but are then faced with the challenge how to solve all these sub-problems and still achieve an optimal overall outcome. They raised that, in order to maintain consistency and bring the overall problem to a close in a timely and satisfactory fashion, people attend to the sub-problems sequentially,

applying acceptable rather than optimal aspiration levels. A point of concern with this sequential approach is that the overall outcome may depend considerably on the order in which the sub-problems are solved, and that the overall outcome may turn out to be a local optimum; small adjustments may lead to a decrease in utility, but a considerable change – which, however, is not under consideration in this approach- may lead to an increase. Or, as Kahneman and Thaler (1991) portrayed it: “one could well be trapped at the peaks of rather lowly hills”.

In this context, learning may play an important role in the way people interpret and deal with complex decision problems. In the course of time people develop solutions for the choice problems they encounter. Solutions that turn out satisfactorily are turned into rules of conduct and added to the person’s collection of behavioural rules. When faced with a complex choice problem, people rely on their ‘mountain of experience’ to resolve such problems in their best interest (Dolfsma 2002). According to Langlois’ (1988) ‘expertise model’ of behaviour, people develop such behavioural rules largely through repeated behaviours in routine situations. With accumulating expertise, people tend to narrow their choice set and to invest less effort in choice. When faced with a complex choice problem in a non-routine situation, people apply this expertise largely through tacit rule-following, falling back on rules which demonstrated to be satisfactory in comparable situations. Depending on the setting, these rules may be highly specific and detailed, or more abstract and general but appropriate in a wider range of states of the world. Axelrod’s (1984) “tit-for-tat” strategy is a well-known example of tacit rule-following behaviour.

Further, in the absence of sufficient information or experience, people tend to resort to suggestions, recommendations and persuasion obtained through social channels, like family, friends, media and respected authorities. Denzau and North (1994) argued that under conditions of

Chapter 2

incomplete information all sorts of ideologies, dogmas, half-baked theories and myths may come to play a significant role in decision making. Simon (1993) called this 'docility'. In this context, Banerjee (1992) introduced 'herd behaviour', the tendency to do what others do or to rely on collective information, despite the fact that private information may suggest taking an alternative course of action. According to Shiller (1995), herd behaviour can be information- and conversation-based. In the information-based interpretation, herding is likely to occur under such conditions of stress and uncertainty, in complex situations and under time pressure. People then choose to infer information from observing the behaviour of others they feel were faced with the same decision problem (e.g. Simon 1990; Banerjee 1992; Welch 2000; Effinger & Polborn 2001). The conversation-based interpretation argues that individual judgement is influenced by continuous patterns of exchange of ideas and opinions within peer groups. Through frequent interaction groups of people build up convergent mental models, ideologies, (sub)cultures, or institutions, which then serve as sources for interpreting choice situations and as their reference for what is considered appropriate behaviour (e.g. Hofstede 2010; 1991; Shiller 1999; Denzau & North 1994; Triandis 1989).^{29,30}

Limited cognitive capacity

Because *homo economicus* makes rational choices under conditions of perfect computability and complete information, his transactions are costless. Boundedly rational individuals, however, are short of reasoning

²⁹ Hofstede (1991) distinguished four fundamental values on which people ground a cultural profile of their social environment: power distance; individualism; masculinity versus femininity and uncertainty avoidance. These values exert an external influence on peoples' behaviour by affecting, for instance, risk attitude, the relative importance of individual and pro-social motives and freedom of choice (and therewith the importance of social norms and rules of conduct).

³⁰ Triandis (1989) posed that culture influences behaviour by the way people sample three kinds of selves: the private self (cognitions of individual traits, tastes and behaviours), the public self (cognitions of the generalised other's view of the self), and the collective self (cognitions of the self in some collective -like family, friends- defined by common goals, fate or external threat).

power and information and have to make their decisions under uncertainty.³¹ Decision making then becomes time-consuming and requires effort, evoking the use of scarce resources and, as a consequence, the transaction itself becomes a unit of economic analysis (Williamson 1986; 1989; Martin 1978; 1993; Douma & Schreuder 1991). Such transaction costs depend, for instance, on the importance, frequency (i.e. recurrent, occasional), durability and specificity of the transaction, the complexity of the situation and the degree and type of uncertainty involved. Such transaction costs may result in choices that deviate from what is expected in mainstream economics, and may occur at the planning, implementing or monitoring and adjusting stages of the decision making process (Williamson 1986; 1989; Martin 1993).

The transaction costs associated with planning decisions relate primarily to the search for information. Because searching is time- and resource-consuming and the returns of additional search are uncertain, individuals have to decide how much effort to devote to the search process. Common search models suppose people apply a double criterion. First, people identify potential search methods and sources of information and evaluate which strategy offers the best opportunity to find the information required. The choice of search method depends on expectations about time and effort required and the effectiveness of the method. Second, people select an acceptance level that indicates when to end shopping for

³¹ Snyder and Mitchell (1999) argued that all people are endowed with the mental capacity to perform lightning-fast integer arithmetic calculations, but that in general this skill is not readily accessible because through learning our minds become highly concept driven, allowing most of our information processing to occur automatically and unconsciously. They concluded this from studying the extraordinary skills of some children with early infantile autism, like calendar calculation, recall for meaningless detail, perfect pitch, and ability to keep time accurately to the second for extended periods. Unable to learn, these autistic savants retain privileged access to lower pre-conceptual levels of neural information and thus rely on memory rather than on cognitive effort (Snyder & Mitchell 1999; Miller 1999; Young & Nettelbeck 1994). Well-known examples include film personality "Rain Man" and the characters described by Oliver Sacks in "The man who mistook his wife for a hat and other clinical tales". Lester and Yang (2009) discuss the implications of brain dysfunction for decision-making capacity.

Chapter 2

additional information (Cyert & March 1963; Stiglitz 1989; Gorter 1991; Koning, van den Berg & Ridder 1997). Several factors may bias information search processes considerably. Cyert and March (1963) accentuated the effects of prior experience, interaction between hopes and expectations, and emotional arousal. Other studies have found that search effort increased with uncertainty, and search performance to be associated with differences in ability, temperament (or impatience) and sheer luck (e.g. Mazursky 1998; MacLeod & Pingle 2000). The transaction costs associated with implementing decisions bear upon individual perceptions of risk and commitment. In mainstream economics individuals are supposed to be 'risk neutral', that is, indifferent between a certain outcome of choice and an outcome under risk that is of equal expected value. Boundedly rational individuals, however, may be 'risk averse', preferring a certain outcome over a risky alternative with the same expected outcome, or 'risk seeking', preferring a gamble over an equally sized certain outcome (Kahneman & Tversky 1982; Becker 1976). Generally speaking, a person's risk attitude depends on the extent to which the 'thrill of victory' outweighs the 'agony of defeat' (Bell 1985), as determined by personal and situational factors.³² In addition, while mainstream economic theory dictates that decisions should be based on incremental costs and benefits, studies have found that people may feel committed to a prior decision while it does not affect incremental costs and benefits, or ignore a prior decision while they should not. This failure to assess the position of prior choices in relation to current choices was called the 'sunk cost effect' or 'sunk cost fallacy' (Thaler 1980; 1991; Field 1998; van Dijk & Zeelenberg 1999). Tversky and Kahneman (1981) attributed this effect to 'mental accounting', which refers to the ways

³² Personal factors include prior experience and involvement with the decision and tendency towards optimism or pessimism. Situational factors concern the extent to which risk is voluntary or known, the spread in outcomes, the probability of outcomes beyond some threshold or of catastrophic scale, and the irrevocability of the outcomes (Hogarth 1987; Machina 1987; Vlek 1990; Rothman & Salovey 1997; Cookson 2000).

people record, summarise, analyse and report monetary transactions in order to keep their keep spending under control; in this process, people may value money in one account different from money in another account, depending for instance on where the money comes from, how it is spent, or the size of the transaction (Tversky & Kahneman 1981; Belsky 1999; Thaler 1991).³³ The transaction costs associated with monitoring and adjusting decisions are most eminent in the case of decisions that are complex and sizeable, with outcomes in the longer term and under conditions of uncertainty. A person may consider the possibility to cancel, reverse or adjust a prior decision when he anticipates that the outcome of choice will be unsatisfactory. The size of the 'costs of adjustment' (van Dijk 1986) or 'costs of change' (Banister 1978) depend on the nature of the commitment (i.e. sunk, reversible or resalable) and the point in the lifecycle of the commitment at which the individual desires to reconsider it; for instance, if the individual was to engage in a new decision making process in the short term any way, the costs of advancing the process may be small and easily compensated by the expected benefits from adjusting behaviour.

Emotional arousal

Simon (1965) located the source of bounded rationality primarily in 'ignorance' and 'stupidity', but others have argued that 'passion' may be an important additional source (e.g. Commons 1934, Janis & Mann 1977; Luce 1998; Kaufman 1999). People making decisions under uncertainty may experience positive or negative feelings of excitement. This emotional arousal may relate to decision conflict, regret and disappointment. People may experience decision conflict when the outcome of deliberation is

³³ An example from Tversky and Kahneman (1981): Imagine you are about to purchase a jacket for \$125 and a calculator for \$15. You are told that the same calculator is on sale for \$10 at an other branch of the store 20 minutes away. Would you make the trip? They found that 58% of respondents would go. The same experiment, only now with the calculator of \$125 on sale for \$120 (i.e. the same \$5 discount and the same distance), showed that only 29% of respondents would go.

Chapter 2

ambiguous or leads to concern about the possibility to attain a satisfactory outcome at acceptable risk, and, as a result, may experience stress and be reluctant to make a decision; “beset by conflict, doubts, and worry, struggling with congruous longings, antipathies, and loyalties, and seeking relief by procrastinating, rationalizing, or denying responsibility for his own choices” (Janis & Mann 1977).³⁴ The stress may be more intense when there is need for closure, the stakes are high, the possibility of a certain threshold outcome is low or losses are anticipated whatever alternative is chosen. People then tend to shift around the formulation and interpretation of the problem until a dominant solution emerges, and actual reasoning may be minimal or even absent (Vlek 1990). Alternatively, people sometimes dwell on trivial decisions because they tend to associate difficulty with importance and therefore spend excessive time on getting the decision right (Sela & Berger 2011).

Under conditions of uncertainty people may decide differently from what is deemed rational because next to achieving an optimal outcome of choice they attempt to minimise the possibility to experience feelings of regret and disappointment (Thaler 1980; Salkeld, Ryan & Short 2000; Zeelenberg & Pieters 1999; Zeelenberg 1999; Grant, Kajii & Polak 2001). According to Bell (1985), people making choice under uncertainty form a prior expectation about the outcome of choice. Expectations are “ideas, evaluations and probabilities about the future” (van Raaij 1991).³⁵ After the uncertainty is resolved and the outcome of choice is known, they may

³⁴ “Even if [rational choice] were somehow worth striving for, the fact that human beings, programmed as they are with emotions and unconscious motives as well as with cognitive abilities, seldom can approximate a state of detached affectedness when making decisions that implicate their own vital interests [...] thinking about vital, affect-laden issues generally involves hot cognitions, in contrast to the cold cognitions of routine problem solving” (Janis & Mann 1977).

³⁵ “Sources of expectations are memories of actual experiences, perceptions of current stimuli, and inferences drawn from related experiences such as trial of other objects. These expectations are formed by trial and error learning over time.” Moreover, “not only the facts as such, but also their presentation format or framing [...] affect the formation of accurate [subjective] expectations.” (van Raaij 1991)

experience disappointment (or elation) when the outcome falls short of (exceeds) their expectations. Loomes and Sugden (1982) posed that the utility associated with a decision depends on the outcome of choice as well as on anticipated feelings of regret (or rejoice) associated with possible outcomes that are perceived as more (less) pleasurable. The level of regret or disappointment is conditional on the effort that went into the decision (Bell 1982; Loomes & Sugden 1982), the knowledge of rejected alternatives and their anticipated outcomes (Zeelenberg 1999) and the level of ambiguity between alternatives (Inman & Zeelenberg 2002). In order to avoid the associated 'costs of guilt/responsibility', people tend to simplify decision making by restricting their choice set (Thaler 1980).

Emotion is viewed as central to motivation for behaviour (Leenheer & Pieters 2010; Zeelenberg & Pieters 2006; Kaufman 1999; Damasio 1994; Michalos 1985; Katona 1975). Emotions originate from some change in the person or the environment affecting the current or a desired end state. Emotional arousal takes a particular form (e.g. love, hate, anger) depending on the person's appraisal of the origin, cause and consequences of this change, while its intensity depends on the perceived discrepancy between outcomes before and after the change.³⁶ Kaufman (1999) posed that the relationship between emotional arousal and cognitive performance is bell-shaped. Optimal cognitive performance requires a moderate level of emotional intensity, while insufficient or excessive emotional involvement reduce performance; "decision making loses much of its logical, reasoned character and behavior becomes dominated by impulse, obsession, and instinctive physical reactions (suggested by popular expressions, such as 'driven by desire' and 'paralyzed by fear')" (Kaufman 1999) (see Figure 2.2).

³⁶ Michalos (1985) distinguished seven possible discrepancies a person may perceive: i.e. with what he needs, he feels he deserves, he wants, relevant others have, the best he has had in the past, what he expected to have now 3 years ago, what he expects to have after 5 years from now.

Chapter 2

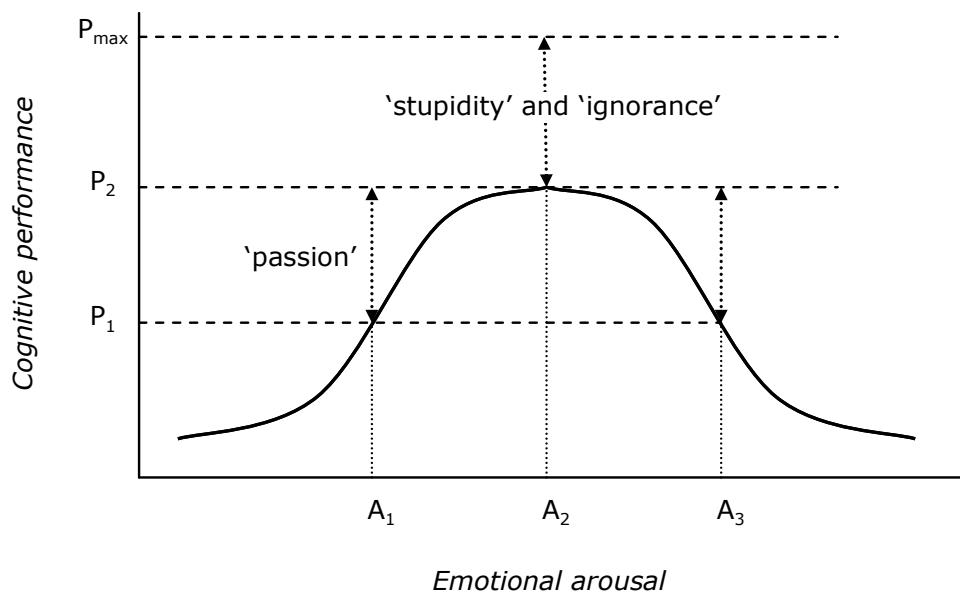


Figure 2.2 Relation between emotional arousal and cognitive performance ³⁷

Satisficing behaviour

Subject to ignorance, stupidity or passion, people tend to resort to satisficing behaviour. Expected utility maximisation still is their central motivation for behaviour, but, because of limitations in cognition, information and willpower, the resources involved in decision making are taken into consideration as well and 'behavioural rules' become a significant part of the behavioural repertoire (Simon 1965; 1976; Wolfson 1998; Hogarth 1987; Tommasi & Ierulli 1995; Blaas 1992). Behavioural rules concern all sorts of routines, rules of thumb, administrative procedures, and social customs and norms –or more general, institutions-

³⁷ Source: Adapted from Kaufman (1999). Lower levels of emotional arousal (e.g. A_1) are associated with low involvement with the decision, limited energy devoted to information gathering and problem solving, and thus lower quality decision making (e.g. P_1). Up to a certain point (A_2), increasing emotional arousal leads to a tighter mental focus, higher effort, and therewith to increased decision making quality. Beyond this optimal level, further increases in emotional arousal disorganize logical or inferential thought processes and cause deterioration in quality of decision making (e.g. from P_2 to P_1), over and above the effect of other cognitive limitations ($P_{\max} - P_2$). In general, the curve is flatter for persons who are better able to exercise self-control over their emotions (also referred to as 'willpower'). The optimal level of emotional arousal is lower for more complex decisions.

that help people to deal with uncertain and complex situations and to economise on decision making (e.g. Bovenberg & van de Klundert 2006; Heiner 1983; Hodgson 1997). Such rule-following behaviour, however, restricts the flexibility to change behaviour and comes with a lack of alertness to information that might prompt to do so, and may thus lead to inertia. Satisficing behaviour may, however, also be an expression of low involvement; if wants are subject to satiation or if people set aspiration thresholds (i.e. acceptable rather than optimal outcome levels), the motivation to pursue utility maximisation may drop to a negligible level once this aspiration level is met, as it no longer exerts any emotional arousal (Kaufman 1990; 1999).

On the other hand, Rachlin (2003) and Shiller (2000) argued that behavioural rules underline the rationality of behaviour, as they represent the optimal course of action under conditions of bounded rationality. Stigler and Becker (1977), Janis and Mann (1977), Lindbladh and Lyttkes (2000), van Witteloostuijn (1988) and Hodgson (1997) also accentuated that routines and habits may well reflect utility maximising behaviour; it may seem (and be) a quite unconscious process, but individuals may make deliberate decisions about keeping or changing them and it may be the most sensible orientation, especially for many minor issues. But also in case of substantial uncertainty or costs of adjustment, changing routines may simply not be advantageous. Following this line of reasoning, acquisition of information and computation of alternative outcomes are simply included in a maximising framework as transaction costs.

Bounded rationality in transportation research

There is a considerable body of literature on bounded rationality in transportation research. Farag and Lyons (2008), for instance, found that some groups of travellers completely lack information about travel alternatives, while other groups of travellers have different preferences and default sources for information and will therefore differ in tendency to

Chapter 2

use available information. Van Vuuren (2002) identified a considerable 'take-up cost' for a reduced-fare rail pass, associated with a lack of information about ticket types and uncertainty about own future travel behaviour. Brög et al. (1977) found that a substantial part of a sample of car users living in a densely populated area well-served by public transport was so ill-informed about public transport services, even for frequent trips such as their commute and sometimes to the extent of complete unawareness that such services exist, that it was impossible to maintain that these travellers engaged in careful consideration of their travel alternatives. Outwater et al. (2011) report similar results. Nevertheless, based on a review of the literature on the effects of information provision on travel decisions of car-drivers, Chorus et al. (2006) indicated that effects may be limited when involving changes in mode-choice. Farag & Lyons (2010) found that car users consult information about public transport only when they actually intend to use it.

Quite a few studies discuss costs of change in the car replacement decision, attributed to brand loyalty associated with satisfactory past experience and preference for a particular brand (Manski & Sherman 1980; Mannering & Winston 1985; Chandrasekharan et al. 1997). Brouwer et al. (1998) found evidence of reputation effects in the second-hand car market, with some brands showing relatively high depreciation rates that could not be attributed to technical inferiority. Friman, Edvardsson and Gärling (2001) and Friman and Gärling (2001) distinguished between encounter and cumulative satisfaction in relation to behavioural change. Encounter satisfaction concerns the fulfilment response to a single trip with a travel mode. Cumulative satisfaction develops over time and is related to both single critical incidents and the user's memory for the frequency of such incidents. Only when cumulative dissatisfaction exceeds some individual threshold, people will reconsider

their current travel behaviour.³⁸ Chorus, Arentze and Timmermans (2008) found evidence that travel choices are affected by the desire to minimize the negative feelings associated with regret. Bogers et al. (2006) observed that experiences with extreme long travel times on a route, in particular when unanticipated (as part of regular variance, traffic information), may be valued negatively and affect route choice behaviour. Bogers, van Lint and van Zuylen (2008) showed that people prefer a route that is mostly fast and only sometimes very congested over a route with variable travel times.

There is considerable evidence of people having a travel (or commuting) time budget, a maximum amount of time that people on average are willing or able to spend on travel (to work) each day. This travel time budget appears to serve as a resistance or threshold for behavioural change and as a reference for mobility-related choices. Metz (2010; 2005) found that, despite significant changes in income, technology, infrastructure and land use over the last decades in the UK, travel time and trips per person remained relatively constant at one hour per day and 1,000 trips per year; The benefit of improvements to transport infrastructure to travellers apparently are in access to activities at more distant destinations (Metz 2010; 2008; van Wee & Rietveld 2008). Between studies, the travel budget varies from 30 minutes for a one-way commute to 60-90 minutes for total daily travel, varying with individual and family lifecycle characteristics, activity type, urban sprawl, traffic congestion and public transport service schedules (Metz 2010; 2008; van Wee, Rietveld & Meurs 2006; Mokhtarian & Chen 2004; Armoogum et al. 2003; Schwanen & Dijst 2002; Levinson 1998; Rosetti & Eversole 1993; Pulles 1990; Jones et al. 1983). Mental accounting has also been

³⁸ Encounters that are particularly (dis)satisfying because they deviate significantly from what the traveller anticipates, such as, for instance, the (consequences of) random effects in public transport supply resulting from vehicle breakdowns and signal failures (Bates et al. 2001).

demonstrated. De Jong et al. (2009) found that households place a higher value on a change in fixed car costs than a change in variable car costs of the same size. Vrtic et al. (2010) found that people place different values on fuel, toll and parking costs.

2.3.2 Prospect theory

In a series of experiments Kahneman and Tversky observed phenomena that appeared to invalidate expected utility theory as a descriptive model of decision making under risk. They proposed 'prospect theory' as an alternative approach and a general critique of expected utility theory (Kahneman & Tversky 1979). Prospect theory views decision making under risk as a choice between prospects and distinguishes an editing and an evaluation phase in decision making (Kahneman & Tversky 1979; 1982; Tversky & Kahneman 1974; 1981; 1992; Fennema & Wakker 1997; Thaler 1980; Hogarth 1986; Van Raaij 1998). In the 'editing phase' decision makers analyse and transform the prospects at hand to simplify subsequent evaluation and choice, for instance: decompose prospects into riskless and risky prospects; discard of shared components and extremely unlikely outcomes; simplify by rounding probabilities and outcomes; and reject dominated alternatives. These editing operations may be performed in differing sequences and may thus be context dependent. In the 'evaluation phase' the transformed prospects are evaluated using a value and a weighting function. The value function supposes that individuals evaluate prospects relative to a reference point,³⁹ and thus are perceived as a loss or a gain. The function is concave for gains and convex for losses, reflecting the principle of diminishing marginal utility, and steeper below than above the reference point, reflecting the general observation that people respond more intensely to losses than to gains. The value of a

³⁹ The reference point is an individual benchmark level that may coincide with the status quo, past experience, expectations, a social norm or just be an arbitrary guess, based on a learned fact or a faint idea that seems reasonable.

prospect is then multiplied by a decision weight, derived from the probability weighting function; this function is more sensitive to changes in probability near the end points than to changes in moderate probabilities.⁴⁰ Cumulative prospect theory can be regarded as a generalisation of expected utility theory, as in the special case when the reference point is set to zero, so that outcomes are in terms of end states, and weights are equal to probabilities, yielding the traditional expected utility function, the decision problem is formulated in agreement with expected utility theory (Fennema & Wakker 1997).

Kahneman and Tversky viewed the editing and evaluation of information as the principal sources of many observed anomalies. One regularly observed phenomenon in decision making under risk is that people choosing between two prospects with the same expected value tend to overweigh outcomes that are certain over those which are merely probable, while mainstream theory proclaims they should be indifferent. This 'certainty effect', attributed to Allais (1953) and also known as 'loss aversion', contributes to risk aversion in the choice between gains and in risk seeking in the choice between losses, and is regarded as one of the bedrock principles of behavioural economics (Belsky 1999). For example, for most people the certainty equivalent of the prospect \$1,000 with a probability of 0.5 lies between \$300 and \$400 (Kahneman & Tversky 1979).

A well-known example is Tversky and Kahneman's (1981) Asian disease problem which accentuates the effect of the phrasing of probabilities and

⁴⁰ The functional form for the weighting function originally was not well behaved near the end points and violated stochastic dominance. Cumulative prospect theory (CPT; Tversky & Kahneman 1992) solved this: the weighting function is estimated separately for gains and losses, and decision weights are obtained as differences between transformed values of cumulative probabilities (for gains, the chance of receiving a specific outcome or anything better; for losses, the chance of receiving a specific outcome or anything worse).

Chapter 2

outcomes of prospects on peoples' preferences⁴¹, called the 'framing effect'. Levin, Schneider and Gaeth (1998) reviewed two decades of framing experiments and reaffirmed that simple variations in the presentation of prospects may have a significant effect on how decision makers encode the information, leading to preference shifts and, occasionally, preference reversals.

Two phenomena closely related to loss aversion are the endowment effect and the status-quo bias (Kahneman, Knetsch & Thaler 1991; Rabin 1998; Antonides 1998), which lead to choice under a 'veil of experience' (Salkeld, Ryan & Short 2000). The 'endowment effect' refers to the phenomenon that people tend to value goods more highly once they own or have experienced them. As a result, people will demand more to give up an object once they own it, than they would be willing to pay to obtain it (Thaler 1980; Kahneman, Knetsch & Thaler 1991).⁴² The 'status quo bias' refers to the phenomenon that people rather stick to the current state than switch to a prospect of equal expected value, in particular under conditions of limited information or a sizeable choice set (Kahneman, Knetsch & Thaler 1991; Samuelson & Zeckhauser 1988). Inman and Zeelenberg (2002) related the status quo effect to decision regret. Choice under a 'veil of experience' may thus lead to inertia.

⁴¹ Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the programs are as follows:

- [*version 1: formulation in terms of gains*] If Program A is adopted, 200 people will be saved; if Program B is adopted, there is a 1/3 probability that 600 people will be saved, and 2/3 probability that no people will be saved. Which of the two programs would you favour? (observed choice probabilities in this version: 72% for A / 28% for B).
- [*version 2: formulation in terms of losses*] If Program A is adopted, 400 people will die; if Program B is adopted, there is a 1/3 probability that nobody will die, and 2/3 probability that 600 people will die. Which of the two programs would you favour? (observed choice probabilities in this version: A 22% / B 78%).

⁴² This effect has been put forward as a possible explanation for observed disparities between willingness to pay and willingness to accept for the same good, with the latter typically higher than the former (Kahneman, Knetsch & Thaler 1990; Shefrin & Caldwell 2001; van Exel et al. 2006).

Prospect theory in transportation research

Over the past 15 years a modest number of transport studies used prospect theory, mostly related to the effect of travel time variability on route and departure time choice, and in particular the concepts of reference-dependent preferences and loss aversion appear useful in the context of transportation research (Li & Hensher 2011; van de Kaa 2010; van Wee 2010). Travellers may, for instance, have a preferred commuting time (e.g., Calvert & Avineri 2011), arrival time (e.g., Caplice & Mahmassani 1992) or use a public transport time schedule (e.g., Bates et al. 2001), and take this as a reference. Deviations from this reference point towards delays are valued more negatively than equally sized early arrivals are valued positively, and people generally tend to value travel time savings lower than travel time losses (e.g., Small 1979; MoT 1998; Steer & Willumsen 1983; Rietveld et al. 2001; Parthasarathi et al. 2011). Travel time variability is associated with stress (Bates et al. 2001) and “is clearly an added cost to a traveller making a specific journey [and] of and by itself, results in disutility” (Noland & Polak 2002). Asensio and Matas (2008), Bates et al. (2001) and Peeters et al. (1998) found that both car and public transport travellers value uncertainty about travel time much higher than travel time itself or any other trip characteristic. Most travellers have a preferred arrival time and search for a route and departure time that yield a satisfactory chance of arriving on this preferred arrival time (Asensio & Matas 2008; Caplice & Mahmassani 1992). Delays are valued highly and failure to arrive in time or at the preferred time has an additional negative value by itself, independent of the size of the delay; commuters generally prefer to arrive early (Noland & Polak 2002; Lam & Small 2001; Bates et al. 2001; Wardman 2001; Noland & Small 1995).

De Borger and Fosgerau (2008) used a reference-dependent preferences model to explain valuation of travel time. They found that loss aversion

Chapter 2

played an important role, and that loss aversion was greater with respect to time than to costs. Avineri and Prashker (2004) observed underweighting of high probabilities and inflating of small probabilities of travel time in route-choice stated preferences. Camerer et al. (1997) observed that many taxi drivers in New York tend to work longer on quiet days and shorter on busy days because they set a daily revenue target that covers their costs and desired income.

Van de Kaa (2010) concluded, after a meta-analysis of a considerable number of observed travel behaviour studies, that prospect theory appears a promising approach to a better understanding of individual behaviour. Li and Hensher (2011) reviewed recent applications of prospect theory in transportation research and, apart from supporting the conclusion of van de Kaa here above, highlight a number of issues with the approach and recent applications, as for instance, the specification of the reference point (see also Masiero & Hensher 2011; van Wee 2010).

2.3.3 Judgement of probabilities

When people are uncertain about the probability distribution of outcomes of choice, they need to make a judgement about their likelihood. This judgement of probabilities, for which people tend to use an 'anchoring and adjustment' strategy, is generally recognised as a source of bias in decision making (Hogarth 1987; Einhorn & Hogarth 1986; Silberman & Klock 1989; Chapman & Johnson 1999). Anchoring and adjustment means that individuals make an initial guess of the probability by reference to cues they have available or appear reasonable, but may be uninformed or arbitrary,⁴³ and arrive at a final judgement of probabilities by adjustment from this initial guess, which is typically insufficient because people tend to hold on to their initial guess ('starting point bias'). Several phenomena

⁴³ For example, experiments demonstrated that judgements are significantly affected by the prior observation of the spin of a wheel of fortune (Hogarth 1987).

were shown to influence this process. Judgement by 'representativeness' (or 'causality') refers to the tendency people have to rely on their intuitive understanding of the choice situation, a coherent story that provides a reasonable explanation for it. As a result, people tend to regard outcomes that support an idea they already have in mind as more likely and to undervalue information that does not provide evidence of their intuition (Ajzen 1977; Machina 1987; Dawes 1999). Judgement by 'availability' refers to the tendency to base probability judgements on historical instances of the event that can be brought to mind, facilitated by familiarity, imaginability and memorable facts.⁴⁴ Finally, judgements may also be affected by 'hindsight bias' (Fischhoff 1975; 1982). In retrospect, people tend to misremember past evaluations and to believe that they have anticipated events much better than was the case, leading to overconfidence (or 'magical thinking') (Shiller 1999; Rabin 1998).

Judgement of probabilities in transportation research

Research about probabilities in transportation research has largely concentrated on perceptions of risk and travel time reliability. De Blaeij and van Vuuren (2003), for instance, analysed risk perceptions of traffic accidents. They found that people have problems interpreting small probabilities, like those of actual accident probabilities (≤ 0.01), and concluded that people tend to base their evaluation more on the anticipated outcome of traffic accidents (in particular bad, irrevocable outcomes) than on their real probabilities. A number of studies have shown that car users have a tendency toward comparative optimism in relation to their driving and safety behaviour. People perceive themselves as more skilful and their risk of being involved in an accident lower than the average driver or their peers. This optimism or overconfidence was

⁴⁴ For instance, Hogarth (1987) found that the probabilities of much publicised diseases and other causes of death like homicide, cancer or tornadoes were overestimated, whereas less visible but highly prevalent ones like asthma and diabetes were underestimated.

Chapter 2

shown to be associated with behaviour that compromises safety, e.g. by insufficient adaptation to changing traffic circumstances, leading to overrepresentation in traffic incidents (Gosselin et al. 2010; de Craen et al. 2008; Harré & Sibley 2007; Ulleberg 2001; Lichtenstein et al. 1978).

In research of perceptions of reliability a difference is made between objective and subjective reliability (Bogers, van Lint & van Zuylen 2008; Tseng et al. 2008; Bates et al. 2001; Rietveld et al. 2001; Peeters et al. 1998). Objective reliability concerns the actual probability that a trip is made within a certain time or the variability in travel time on that trip. Van Lint, van Zuylen and Tu (2008), and van Lint and van Zuylen (2005) discuss different measures of travel time reliability. Subjective reliability concerns the traveller's perception of the probability that a trip is made according to prior expectations regarding travel time, or costs, comfort. This distinction may also be relevant in this context. Brög et al. (1977), for instance, found that among car drivers with subjective freedom of choice between car and public transport, the willingness to consider public transport was positively associated with their estimation of travel time and service convenience. Rooijers (1998), however, observed that regular users perceive the reliability of public transport to be higher than infrequent and non-users. They possibly underestimate public transport unreliability as a result of habituation and adaptation, and no longer pay attention to the frequent but perhaps relatively small deviations from schedule; these captive travellers may have learned to cope. In a stated preference experiment, Bogers et al. (2006) found that car users weighted a long travel time experience more on a non-habitual and less on a habitual route when updating their travel time expectations. The explanation given is that people do not want to acknowledge that the habitual route may not be the best choice, and solve the resulting cognitive dissonance by suppressing this information and convincing

themselves that the chosen route actually is the best choice and that the bad experience was an exception.

An additional issue here may be that in transportation research reliability is often considered on a single trip level and rarely on a trip chain level (Rietveld et al. 2001). Public transport trips typically involve some access- and egress-transport or a transfer, which adds to the complexity of variability in service on different segments of the travel chain and the possibility of missing connections, making trips more unpredictable and reliability a more prominent problem (Noland & Polak 2002). Trip chains are not equally sensitive to changes in service level or reliability as single trips. Therefore, choice theories that rest on notions of marginal response may not apply as the independence assumptions underlying these theories are not met (Burnett & Hanson 1982).

2.3.4 Interdependence

A fundamental assumption in mainstream economics is that preferences are independent and dominated by self-interest; for *homo economicus* transactions are an anonymous, non-social activity (Becker 1976; Simon 1993; Rose-Ackerman 1998; Zelizer 2001); "Heroes who help others will eliminate themselves in doing so, and their strains will tend to die out in the population" (Samuelson 1993). However, recurring evidence from the fields of psychology and sociology indicates that preferences are, in fact, interdependent and that sentiment for others may have a significant influence on individual behaviour (Duesenberry 1959; Sen 1982; Kahneman, Knetsch & Thaler 1986). Becker (1976; 1993a) proposed to incorporate altruistic motives into mainstream economic models in terms of 'interdependent utility', indicating that a person's utility function depends positively on the well-being of a significant other. People still maximise their expected utility, but with an added caring-based (or pro-social) motive (Boulding 1981). Hoffman, McCabe and Smith (1996) found

Chapter 2

the importance of altruistic motives to depend on the social distance to the significant other(s) and related this to reciprocity expectations;⁴⁵ altruistic motives were more important when the social relation was stronger, while under conditions of anonymity people were more likely to behave like *homo economicus*. Fehr and Gächter (1998) called this the altruism of 'homo reciprocans'.

People may also display other-regarding behaviour under conditions of anonymity, based on warm-glow preferences⁴⁶ (Paltrey & Prisbrey 1997) or concerns for relational wealth⁴⁷ (Diwan 2000). In this view, altruism is related to bounded rationality (Simon 1990; 1993; Beilock 2000; Zelizer 2001). Interdependence between persons in a transaction may affect the quantity of information exchange and processing. People generally tend to avoid and exclude themselves from persons (and subjects) they do not like and to take interested in those they do like. Alternatively, a transaction with a likeable counterpart may save 'recognition costs' (Stark 1995) or 'costs of scrutiny' (Frank 1988). As Figure 2.3 shows, the quantity of information exchange thus is positively associated with benevolence, while the quality of information processing is negatively associated with divergence from neutrality (or anonymity). The information value is expected to be optimal at moderate levels of benevolence.

⁴⁵ Reciprocity is the impulse or desire to be kind to those who are kind to us and strike back those who do us harm, in accordance with the principle "an eye for an eye, a tooth for a tooth" (Fehr & Gächter 1998) / "tit-for-tat" (Axelrod 1984).

⁴⁶ Warm-glow preferences refer to a utility gain from the act of contributing, independent of its effect on recipients (Paltrey & Prisbrey 1997), which relates to concepts like process utility (Brouwer et al. 2005) or procedural utility (Frey & Stutzer 2005).

⁴⁷ Relational wealth is connected to factors like social capital (e.g., concerns for solidarity, equity, fairness; see, for instance, Bohnet & Frey 1999; Eckel & Grossman 1996; Johannesson & Persson 2000) and natural capital (e.g., concerns for ecological and living environments), and refers to the well-being effects of time spent with family and friends or for civic engagement and community.

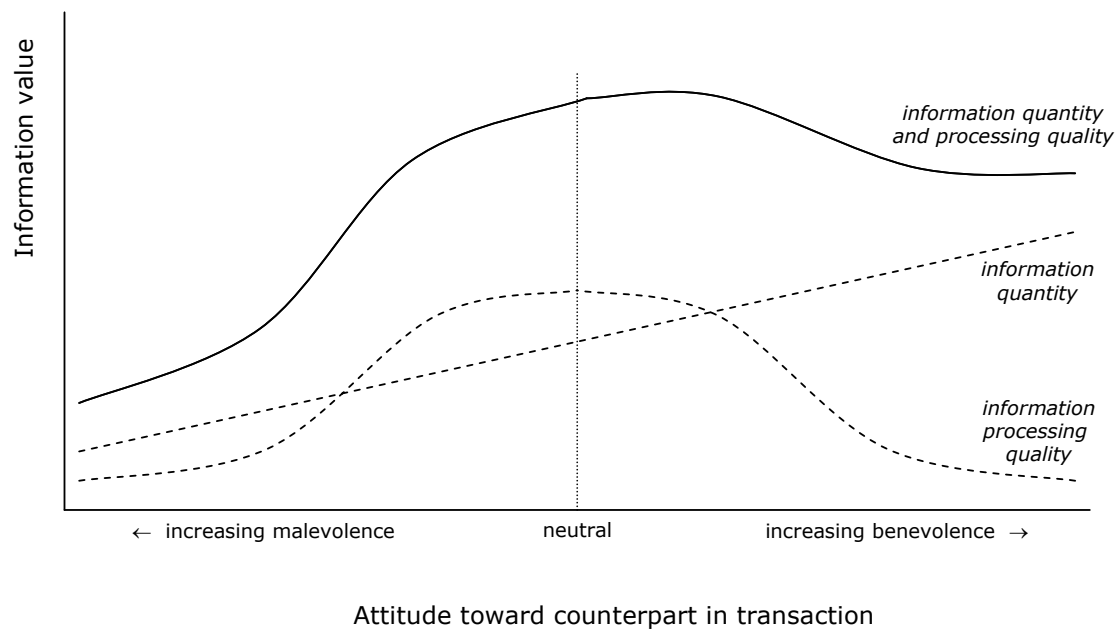


Figure 2.3 Interdependence and information value ⁴⁸

Interdependence in transportation research

Jones et al. (1983) observed a substantial influence of the household on the travel behaviour of its members and referred to this as the “process of travel organisation”. Household members all have to fulfil their in-home and out-of-home role commitments and responsibilities and, for that, to participate in independent (or individual) and interdependent (or joint) activities. They need to apportion time to these activities, synchronise these activities with others, and establish a satisfactory day routine. This process involves establishing household decision rules, “accepted frameworks for day-to-day family living within which individual preferences might be exercised”. After all, interaction with others requires that certain portions of behaviour are temporally and spatially fixed on a recurrent or any other predictable basis (Huff & Hanson 1986). Maat and Timmermans (2009) observed that this interaction is even more complicated in dual-earner households. Based on a six-week travel diary

⁴⁸ Source: Adapted from Beilock (2000).

Chapter 2

survey, Frusti et al. (2003) found that about half of the people have at least one compulsory activity a day that was inflexible in destination, time of day and sometimes travel mode, and that the likelihood of having such a commitment increased with the number of household members as a result of more in-home activities and the need to work and plan around more (and different) schedules. They argued that individuals are unlikely to change fixed commitments in reaction to policy measures, so that not taking into account this fixity in activity-travel patterns will likely lead to overestimation of policy impacts. Others have argued that observed travel-activity behaviour is characterized by "systematic variability", several sets or sequences of behaviours that are integrally related and recur together, mostly anchored around core activities / stops. These repeating patterns are functionally interdependent, but need not be predictable in time (Hanson & Huff 1988; Huff & Hanson 1986).

Bamberg and Schmidt (2001) found subjective norm, particularly in terms of perceived social support, to play an important role in the intention to use bus among students, more important than that of attitude toward bus. Bamberg and Schmidt (2003) found role beliefs to be associated with intention to use car among students. Anable (2005) also found that targeting peoples' beliefs related to environmental concerns and moral norms provides additional motivation to change travel behaviour.

2.3.5 Adaptive and relative preferences

Another central assumption in mainstream theory is that *homo economicus* is solely concerned with the end states of choice alternatives (Simon 1993). Accumulating evidence, however, suggests that people also care about how end states compare to those attained in the past and by others, and that such adaptive and relative preferences may affect behaviour considerably.

First of all, people tend to adapt and habituate to their current state and come to experience it as neutral or default (Clark 1999; Kahneman & Thaler 1991; Becker 1992). The 'consumption norm' at any point in time consists of a physiological component ('needs') and a psychological component ('wants'), with the latter depending on past levels of consumption (Pollak 1976; Thurow 1980). Van Praag (1971) called the reinforcing interaction between changes in wealth and changes in preferences 'preference drift', Easterlin (1995) 'adaptive preferences'.⁴⁹ Schor (1997) and Diwan (2000) argued that economic growth may have increased peoples' material wealth considerably but at the same time has reduced their relational wealth, so that the overall effect on quality of life is ambiguous.⁵⁰ Veenhoven (1997), Frank (1998) and Thurow (1980), among others, argued that people living below subsistence level may be concerned with absolute levels of wealth, but that those who live above this level tend to perceive their well-being much more in terms of relative levels of wealth than absolute levels. Preferences are influenced by comparison, by the desire to "live up to the Joneses" (Scitovsky 1976); or as John Stuart Mill allegedly phrased it: Men do not desire to be rich, but to be richer than other men. Duesenberry (1959) and van de Klundert (1999) indicated that, apart from fundamental needs, it appears people do not really know what makes them better off and, therefore, they tend to take the behaviour of peers as reference for what is attainable at that place and time. These peers may be friends and co-workers, mostly somewhat higher on the socio-economic ladder, but the mass media are also widely recognised as a source of social information (Fisher 1930;

⁴⁹ Thurow (1980) discussed polls in which people were asked "What is the smallest amount of money a family of four needs to get along in this community?" Response over time turns out to be a constant fraction of the average income at the time. Schor (1997) quotes that the "dream come true" income level for Americans doubled between 1987 and 1994 from \$50.000 to \$102.000.

⁵⁰ Kaufman (1999) argued that the increased competitive pressure in advanced economies is associated with higher conditions of bounded rationality, leading to higher emotional arousal in decision making, lower quality of decision making (see also Figure 2.2) and, consequently, reduced individual well-being.

Chapter 2

Katona 1975; Schor 1997; Bilton et al. 1989); this relates to the concept of herding (Banerjee 1992). Peoples' drive for self-esteem makes them strive to match or even excel their peers by engaging in 'status consumption' (Schor 1997; Bovenberg & van de Klundert 1999) or 'conspicuous consumption' (Veblen 1931). Kapteyn (1977) referred to this phenomenon as 'reference drift', Easterlin (1995) as 'relative preferences'. Alessie and Kapteyn (1991) stated that individuals may even demonstrate 'price dependent preferences', because they gain additional utility from the social confirmation they get of their relative ability to pay for such goods.

Evidence for relative and adaptive preferences can for instance also be found in happiness research.⁵¹ Easterlin (1974; 1995) investigated the association between income and happiness and found a positive causal relation between income and happiness when comparing individuals within countries, but no clear evidence when comparing between countries differing in wealth or within countries with increasing wealth over time (see also Blanchflower & Oswald 2001; Clark 1999; Veenhoven 1997; Kahneman & Thaler 1991). Apparently, Easterlin (1974) concluded, there is a 'consumption norm' within a community, a common standard of reference for self-appraisals of well-being making that members of the community who find themselves below this reference point feel less happy and those above it feel more happy. Some twenty years later Easterlin (1995) concluded that this norm also appears to be time dependent, based on his finding that raising the income of all did not increase the

⁵¹ Veenhoven (1997) defined happiness as "*the degree to which a person evaluates the overall quality of his present life-as-a-whole positively*" and distinguished three categories of determinants of happiness: (1) quality of society (consisting of material affluence, security, freedom, equality, cultural and social climate, population pressure and modernity), (2) individual position in society (social status – age, gender, income, education and occupation – and social ties – intimate ties and social participation) and (3) individual characteristics (health, ability and personality). Happiness (or subjective well-being) can be regarded a satisfactory empirical approximation of individual utility (Frey & Stutzer 2002; Ferrer-i-Carbonell & Frijters 2004).

happiness of all; apparently the norm on which judgements of well-being are based increased in the same proportion.

Adaptive and relative preferences in transportation research

Tertoolen (1994) observed that, in reaction to an attempt to influence car use by information on environmental impact and costs, regular car users with a positive attitude towards the environment adapted their attitude in order to reduce cognitive dissonance and shifted more of the responsibility for environmental problems to others. This effect was larger for people who made an ex-ante commitment to reduce their car use, but eventually did not. Regular car users receiving cost information developed more negative attitudes towards car pricing policies and the responsible authorities. Tertoolen et al. (1998) investigated the effect of self-monitoring, feedback on environmental and financial consequences of current car use, information on travel alternatives and self-expressed commitment to reduce car mileage on car attitudes and use. They found effects on attitude, but not on behaviour. Car drivers showed psychological resistance against the attempt to reduce their car use, for instance by putting less weight on financial or environmental consequences, or reducing their willingness to reduce mileage.

Mokhtarian et al. (2001) found that people travel more than they may need in socio-demographic terms, and that people engage in excess travel both in the context of recreational and mandatory activities. The amount of excess travel was associated with, among other factors, attitudes toward travel, personality, lifestyle, mobility constraints and demographic characteristics. This finding is inconsistent with the traditional notion that travel is a derived demand, purposive and that people view travel as a cost or disutility that should be minimized. Mokhtarian and colleagues argued that travel apparently is not only valued as a means of reaching a destination, but may also have a positive process (or procedural) utility (Frey & Stutzer 2005; Brouwer et al. 2005). Travel may thus arise from

Chapter 2

fundamental human needs for mobility, freedom, independence or status, and so be valued and pursued for its own sake. In the same line of thought, Hupkes (1982) distinguished derived and intrinsic components of travel utility. This process utility of travelling may be expected to contribute to inertia of travel demand with respect to measures aimed at reducing travel.

Fujii and Gärling (2003) made a case for distinguishing between core and contingent travel preferences. Core preferences are determined by an invariant utility function, and therefore stable over time and across situations. These may apply in choices between travel alternatives people have experience or are familiar with. Contingent preferences may vary depending on, for instance, cognitive constraints and framing of alternatives, and therefore are context dependent and non-stable. Inconsistencies between stated and revealed preferences would, as a result, be systematic and stated preferences could therefore better be interpreted as behavioural intentions. Accordingly, they found that travel behaviour was predicted more accurately by intentions not to perform the behaviour than by intentions to perform.

Lyons et al. (2000) discuss a sort of subsistence need for travel, "man's in-built desire for mobility and contact with others", as a fundamental reason why transport policy might be less successful in reducing the number of trips people make. As a result of this need for travel, "the suppression of business and commuting trips could lead to an increase in leisure trips leading to less predictable temporal and spatial patterns of travel and traffic" (Lyons et al. 2000). These notions of a (minimum) need for travel and a (maximum) travel budget indicate that people may be reluctant to reduce their total travel, but may reconsider their mobility-related and travel choices in reaction to structural changes in circumstances; for instance, substantial improvements in travel speed

may induce an enlargement of the search area for housing and employment.

2.3.6 Intertemporal choice

Expected utility theory assumes that people maximize lifetime utility. All present and future effects are taken into account in decision making and reduced to comparable magnitudes by proper time discounting, for computational convenience under the assumption of a single and constant discount rate and stable preferences (Fisher 1930; Samuelson 1937). However, observed behaviour often does not comply with the discounted utility model, for instance as a result of habit formation⁵² (Chaloupka & Warner 2000; Loewenstein 1992; van Praag 1971), and many have disputed the assumption of constant time preference. Fisher (1930), for instance, acknowledged that individual discount rates (or 'impatience') consist of an objective and a subjective element.⁵³ The objective element of time preference relates to market opportunities for increasing the current value of the expected lifetime income stream. The subjective element of time preference refers to personal characteristics, including foresight ('thinking'), self-control ('willing'),⁵⁴ habits, fashion, expectations of life⁵⁵ and concern for other generations. In addition, choice alternatives may differ in their possibility for being postponed. Behaviour is significantly affected by present money and time budgets and

⁵² Some view addiction as a strong habit, others characterize it by reinforcement (i.e., a positive relation between current and future consumption) and tolerance (i.e., a negative relation between current consumption and utility derived from future consumption of same amount) (e.g., Becker 1992; Becker & Murphy 1988). The fine line between habit and addiction is a matter of discussion.

⁵³ This has lead Thaler (1997) to nominate Fisher a pioneer of modern behavioural economics.

⁵⁴ According to Gattig (2002) patience comes from nurture rather than nature, as patience in children is positively associated with their parents' education level, wealth and valuation of patience and responsibility. Patience is positively associated with study effort and healthy behaviour, and negatively with deviant behaviour, smoking, drinking and drug use.

⁵⁵ For instance, expectations of length and quality of life in relation to the ability to earn and enjoy income (Brouwer & van Exel 2005).

Chapter 2

expectations about future income. If these expectations are optimistic, people shift away from time intensive to money intensive commodities and spend more time on discretionary activities. However, if expectations about future income are pessimistic, people tend to spend more time on productive activities and accumulation of wealth for future security (Becker 1978; Katona 1975; van Raaij 1991). Time preference may also differ between hedonic and investment goods or between basic necessities and luxury goods (Gattig 2002; Browning & Crosley 2000; Verhallen & Pieters 1984), and between multiple selves⁵⁶ (Shefrin & Thaler 1992).

There is now substantial evidence for decreasing timing aversion ('hyperbolic discounting'); people tend to postpone behaviours involving immediate costs and delayed rewards, and to advance those with immediate rewards and delayed costs (Becker & Mulligan 1997; Gattig 2002; O'Donoghue & Rabin 1999). Fehr and Zych (1998) ascribe these present-biased preferences to the uncertainty associated with bounded rationality, O'Donoghue and Rabin (1999) to naive and overly optimistic expectations about future self-control.

Intertemporal choice in transportation research

Much of individual travel behaviour is highly repetitive, with commuting as a prominent repetitive travel pattern. Through repetition people gain experience with journeys and travel modes and this learning eventually enables them to make travel choices in a rather mindless, habitual manner for trips that have become sufficiently familiar. For frequent travel patterns such as commuting much of the screening of alternatives may thus have taken place in the past. People will therefore probably evaluate the alternatives in their choice set only subconsciously in routine contexts and perhaps more consciously in unfamiliar choice contexts (Punj &

⁵⁶ E.g., a far- and a short-sighted personality. Shefrin and Thaler's (1992) 'planner-doer' model sees self-control as a conflict between two parts of the self: the "planner", with consistent preferences over time, and the "doer", with present-biased preferences.

Brookes 2001; Verplanken et al. 1994; Fischer 1993). Repetition thus is an important source for learning and the formation of habit and dependence, and consequently past behaviour may account significantly for current behaviour as well as for differences in behaviour between apparently similar people in similar situations. In addition, repetition can make travellers (comfortably) numb to day-to-day variations in the characteristics of the journey but also to more structural changes in travel opportunities (Kitamura 2000; Salomon et al. 1993; Fischer 1993). Nevertheless, even beforehand many car drivers are not interested in improved public transport (Jager and Vlek 1991).

Simma and Axhausen (2003; 2001) stressed the importance of including people's current and past mobility-related and travel choices in studies of travel behaviour. They found past commitments to locations (e.g. home, work) and modes (e.g. driving license, car and season-ticket ownership) to have a considerable influence on present mode choice, by locking people into habits that need to be unlearned before reasoned choice can occur. Many studies provide evidence of mode dependence. People increasingly tend to develop their lifestyles around car availability, eventually making them car dependent for most of their regular and occasional trips (RVW 2010; Brindle 2003a). SCP (1997) found that 30% of car drivers did not have other modes in their choice set, half of whom claimed they could not reasonably have made their trip by public transport. Tertoolen (1994) found that 13% of car drives never used an alternative mode of transport for trips they could make by car and that 16% considered it impossible to decrease their current car use, with habituation, preference for car and employer reimbursement schemes as principal reasons. Kropman and Katteler (1990) found that during morning peak 74% of car users and 55% of train users in an intercity corridor always used the same mode for this trip, while 78% of car users and 39% of train users indicated it would have been impossible to make the trip by

Chapter 2

another mode. Goodwin (1995) however argued that although perhaps 50-80% of people perceive themselves to be generally dependent on car use, only between 10-30% of their trips can unambiguously be identified as both strictly necessary and provided with no alternative. Because resistance to change car ownership may be higher than to change car use, it is relevant to distinguish between car dependent people and car dependent trips (Brindle 2003b; Dargay 2004).⁵⁷

Inertia may, however, also be evident in location dependence. Huff and Hanson (1990) argued that activity locations play a substantial role in structuring individual activity-travel patterns and that systematic regularities in travel behaviour are anchored on these locations. Hailu et al. (2005) also found that preference and habituation to specific locations of activities affected travel behaviour. Bolduc and McFadden (2001) provide an alternative perspective on location dependence, as a form of self-selection. People with a favourable attitude toward public transport will prefer housing that is conveniently located near a railway station (perhaps even a specific service line), while people with a preference for car will probably seek housing with good road connectivity. Models based on observed behaviour, that do not account for the effects of such unobserved taste variation, may attribute mode choice entirely to relative travel times and costs and, as a result, overestimate the willingness to use public transport.

⁵⁷ Anten et al. (1984) investigated how people who disposed of their car experienced a car-free life. The most important reasons for getting rid of the car were financial (72%), practical (10%) and idealistic (7%). The main facilitators for the decision were limited use of the car, availability of good public transport and high level of facilities like schools and shops in the neighbourhood. Long-distance mobility – now mainly by rail – decreased, because of longer travel time and the planning involved, while short-distance mobility – now mainly by bicycle – remained fairly stable. A majority indicated that they did not miss the car, probably affected by justification and cognitive dissonance reduction, especially in people who had to sell their car as a result of financial problems or who received mixed / negative reactions from their social environment; 14% wanted to buy a car again, the others (definitely) not. The main disutility of a car-free life came from the decreased frequency in highly valued long-distance visits to family and friends, and changes in types of holidays.

Axhausen et al. (2001) argued that the best opportunity to influence travel behaviour is during transition periods (e.g. change of residence, employment, lifecycle stage), when people tend to re-consider their commitments anyway. Van Beynen de Hoog (2004) investigated the interest in public transport alternatives of people moving to new housing estates with different levels of public transport service availability. He found that the large majority of people did not inform about the available public transport services at all and were primarily concerned with road and parking capacity. Bamberg, Rölle and Weber (2003) conducted an experiment in which people moving to a new residence in a neighbourhood with a high quality public transport connection were actively provided with information and a free public transport ticket, and found it influenced peoples' preferences and mode choice. Like Axhausen et al. (2001), they concluded that people appear more likely to absorb and process information that is personally relevant around major life events such as moving house, changing job or retirement. Fujii and Kitamura (2003) argued that also a temporary change of behaviour can have a permanent impact; they offered habitual car users a one-month free bus ticket and found this lead to more positive attitudes toward bus, increased frequency of bus use and decreased car habit. Thøgersen and Møller (2004) conducted a similar experiment and observed a similar effect, but also found that this effect had disappeared a few months after the experiment. Apparently the experience with public transport had not changed the baseline evaluation of travel alternatives and car had remained the dominant alternative for most.

2.4 Outlook to the following chapters

This chapter started with an overview of how individual behaviour has generally been approached in transportation research (Section 2.1). Basic

Chapter 2

premises are that: travel is a derived demand; travel choice is hierarchical; and observed travel behaviour is the result of rational choice. Travel choice sets were advanced as a principal reason for inertia in travel behaviour, and how and why they differ between people as an attracting area for further research. Discussion of the basic assumptions underlying the mainstream economic approach to behaviour (Section 2.2) indicated that conformation with expected utility maximization may vary across people, decision problems, and social situations. Alternative approaches to behaviour proposed in contemporary behavioural economic literature include: bounded rationality; prospect theory; judgement of probabilities; interdependence; adaptive and relative preferences; and intertemporal choice (Section 2.3). The latter section also provided examples of applications of these alternative approaches in transportation research. The number of applications found was limited, leaving much causes for inert travel behaviour to be explored further.

Because it was identified as one of the main gaps between observed and rational travel behaviour, the following chapters will focus on the subjective choice set: how it is affected by perceptions; how it affects travel decisions; and its relation with preference segments. *Chapters 3 and 4* look into what happens when travellers' preferred alternative is removed from their travel choice set following a strike and they are forced to reconsider their travel opportunities, and compare stated and actual travel choices. *Chapters 5 and 6* address perceived travel possibilities of car and train travellers to use the other mode and associations with characteristics of the traveller and the trip, including the effect of (biased) perceptions of travel time. *Chapter 7* explores preference segments for middle-distance travel by looking at differences and similarities in motivation for travel, liking of travel modes, repetition and variability in travel and levels of reasoning involved in travel decision making.

Public transport strikes and traveller behaviour



Chapter 3 is based on: Van Exel NJA, Rietveld P (2001) Public transport strikes and traveller behaviour. *Transport Policy* 8(4): 237-246 [[http://dx.doi.org/10.1016/S0967-070X\(02\)00016-1](http://dx.doi.org/10.1016/S0967-070X(02)00016-1)]

3.1 Introduction

In many countries strikes hit the public transport sector from time to time. Some generally known examples of public transport strikes are those in Paris, Lyon and London in February 2001 and in the Netherlands in April 2001. Given the nature of public transport, hoarding is not possible, travellers are directly affected by a strike. Public transport strikes are important for transportation research for several reasons. First, strikes have an impact on the perceived reliability of public transport services. Single or multiple strikes may therefore alter travellers' subjective valuation of actual public transport travel costs. Second, a strike implies that suddenly the preferred alternative is removed from the traveller's choice set. According to Goodwin (1977), "the traveller does not carefully and deliberately calculate anew each morning whether to go to work by car or by bus. Such deliberation is likely to occur only occasionally, probably in response to some large change in the situation". Individuals often demonstrate resistance to changing their behaviour because of a "reluctance to upset an ordered and well-understood routine, perception thresholds below which changes in the relative attractiveness of the modes are not noticed, and barriers to the relevant information reaching the individual" (Goodwin 1977). As previously chosen travel patterns remain unchallenged for longer periods, the role of habit increases and

Chapter 3

rational factors become less dominant. Van Praag (1984) calls this tendency to persist in sub-optimal habits due to short term costs of search and adaptation 'rationally irrational', and Goodwin (1977) "a 'rational' contribution to peace of mind". The disturbance of established travel patterns through a strike might induce a shift from inert, habit-driven behaviour towards reasoned choice, as alternatives are once again considered on the basis of their costs and benefits.

Strikes occur more frequently in public transport than in most other economic sectors. Possible explanations include the high degree of unionisation and the regulatory reform of public transport taking place in many countries. Throughout most of Europe, the public sector has for many years effectively handled the losses of public transport companies, so that the risk of bankruptcy and job losses was virtually absent. The current process of commercialisation and privatisation is an unknown factor that potentially creates unrest among personnel about job security and possibly induces a greater readiness to strike. Even though strikes occur regularly, few studies are available on the effects of public transport strikes on travellers and the transport system. There are the published results of a recent study of a national 26-day bus strike in Norway (Bjørnskau 1999) as well as a strike in Los Angeles (The Economist 2000). Well-known but somewhat dated studies also include strikes in New York City (1966), Pittsburgh (1976), Leeds (1978), and The Hague (1981). A literature search added more recent references, such as a total public transport strike in the Ile-de-France region in France (1995), a regional bus strike in the Netherlands (1995), a London underground strike (1996), and a bus strike in Los Angeles (2000).

The main reason for the scarcity of studies of strike actions, as often stated by the authors of these studies, is that strikes are not easily anticipated and can therefore only be studied retrospectively. Not only is

basic information on travel behaviour unavailable but strikes may also not last long enough to allow for an appropriate study design and realisation.

We will next review available studies of strikes in public transport, followed by a discussion of the circumstances that determine the kind and size of effects of a strike emerging from these examples. Finally, we present and discuss the results of a survey we undertook following an unannounced strike in the Netherlands.

3.2 Review of previous studies

This section reviews 13 studies of public transport strikes between 1966 and 2000 in Europe and the United States. Each study is briefly described in terms of the type of action, the behavioural reaction of public transport travellers, the resulting impact of the strike on the transport system, and policy measures taken to mitigate these effects. The main findings are summarised in Table 3.1.

New York City (US)

On New Year's Day 1966 a 13-day subway strike started in New York City. At the time, subways and buses carried more than 1,836 billion passengers per year and employed 35,000 people. Marmo (1990) describes the first days as follows: "Many pedestrians walked across the Manhattan Bridge despite the fact that the bridge has no passenger walks [...] one-half of the city's 12,000 taxis were on the street [...] vehicle density in the city was very heavy and the average speed very low [...] at the bus terminal, private cars delivering and picking up passengers who normally would have taken subways or buses created a chaotic situation. By the early afternoon, cars were three deep in front" and people "fought for possession of a cab at Kennedy Airport". New York City Transit Authority (1967) studied the effects of the strike through home interviews

Chapter 3

with 8,000 regular public transport users. During the strike two out of three commuters drove to work, 75% in their own car and 25% as passengers. On the first working day of the strike all on-street parking was prohibited to ease the movement of cars, taxis, bicyclists, and private buses arranged by employers. Traffic streaming into the city was lighter than usual. Half of Manhattan's labour force, especially low wage 'no show, no pay' workers, stayed home and rush hour spread over four rather than two hours. Commuter rail lines experienced considerable increases in the number of passengers, ranging from 15% to over 50%. Over the whole strike period, 90% of people employed downtown had continued working. Hotels did good business, but church attendance decreased 30% during the strike, restaurant business decreased 20 to 30%, cultural and entertainment activities decreased 50 to 90%, and retailers received only 20 to 25% of their expected business. According to the New York City Transit Authority study (1967), the loss of post-strike public transport ridership for trips to work was 2.1%, for shopping 2.6%, and for other purposes 2.4%. A separate study showed a seasonally adjusted 1% loss in revenue six months after restoration of the service (Ferguson 1992).

Los Angeles (US)

The public transportation system, consisting of 1,869 buses servicing 650,000 riders daily, was operationally shut down during a 10-week strike in 1974 (Crain & Flynn 1975; Gallagher 1975). Most regular bus users switched to the car, as driver (50%) or carpool passenger (25%). Despite the low modal share of bus (2-3%), the strike caused considerable congestion (Crain & Flynn 1975). On one important freeway the additional delay was 10-15 minutes in the morning and 5 minutes during the afternoon peak. To relieve congestion, an exclusive bus lane was opened to carpools of three or more persons. This improved travel time for lane users by 20-30 minutes, 50% of whom had previously never been in

carpools. On the regular freeway the travel time improvement was six minutes in the morning and negligible in the afternoon (Gallagher 1975).

Pittsburgh (US)

In December 1976, public transport in Pittsburgh was down for one week due to strike action (Blumstein & Miller 1983). Of the 600,000 daily commuters to the central business district (CBD), 62% normally used public transport. As result of the strike, car traffic on the access roads to the CBD increased 20 to 30% during the morning peak, as most public transport users were driven to work by other household members. A spread of peak hours was also observed. The increase in the evening peak was lower, probably because public transport users were driven home by colleagues, rather than being picked up again by household members. About a quarter of the public transport users with no car in the household stayed home on the first day of the strike.

Knoxville (US)

Wegmann et al. (1979) reported on a 6-week bus strike in 1977 in Knoxville. The study focused on the impact of the strike on groups expected to be the most affected, i.e. the elderly and economically disadvantaged. They found few cases of severe hardship and, although many discretionary trips were foregone, most were able to make the necessary trips with the help of relatives, friends and social service agencies. Downtown merchants lost substantial business and bus ridership declined by 7 to 16% on different routes.

Leeds (UK)

Urban public transport in Leeds was hit by a 5-week strike in 1978 (MoT 1984). Approximately two out of three public transport commuters found their way to work by car: either by company car (14%), with a colleague or friend (37%), as driver (5%), or as passenger (10%) in own car. This remarkable distribution is due to the low rate of household car ownership

Chapter 3

in the UK at the time (55%); and, as a result, the increase of car traffic was limited. The other public transport users arrived to work by walking (22%), by taxi (2%), by bike (4%), or in other ways (8%). A notable finding is that about 15% of secondary school pupils missed school, three quarters of whom missed school for the entire 5-week period.

The Hague (NL)

For nearly three weeks in May 1981, all urban public transport in The Hague was affected by a strike (MoT 1984). Nevertheless, about 95% of regular trips to school or work were still made in this period, mostly by bike (50%) and car as passenger (25%) or driver (10%). This led to more traffic both in town, by car (10-20%) and bicycle (40-50%), as well as to and from town, by car (9%) and bicycle (20-30%). The large shift to bicycle was partly due to the excellent weather during the period of the strike. The modal shift due to the strike caused more congestion, longer travel times and a 27% increase in traffic accidents. Moreover, sales of train tickets, as well as those of downtown stores dropped by 10 to 15%, thus illustrating the importance of urban public transport as an access and egress mode for train travellers, as well as for leisure trips. About 40% of social and leisure trips usually made by public transport were cancelled. Parking problems were negligible, as bus lanes and tramways were made available for parking. Air pollution and energy consumption remained comparable to pre-strike levels, as the effect of additional car traffic was mitigated by the decrease in total volume and the higher modal share of bicycle use.

Rotterdam (NL)

In 1981, the employees of the urban transport company RET struck for about three weeks for better employment conditions (MoT 1984). What is notable about this strike is that it was 'traveller friendly'; the action was directed solely at the company. Employees gave advance notice that tickets would not be inspected for the duration of the strike; in other

Public transport strikes and traveller behaviour

words, free public transport was offered to all. This resulted in a 12% increase in passenger volume during the strike period, mainly off-peak and especially for shopping and people under age 18. For the most part, this higher volume comprised an increased use by infrequent public transport users and incidental relocation of leisure activities. No significant decrease in car or bicycle traffic was observed.

Orange County (US)

Buses in Orange County were out of service due to a strike for 21 days in February 1981 and 15 days in December 1986. At the time, most of the 100,000 bus travellers in Orange County used the bus for non-discretionary trips. Main purposes were work (45-60%) and school (20-30%); most users were female (55-60%), from the low income segment (45-50%) and had few, if any, alternatives (75-80% had no car available). The modal split for bus was 2%. According to Ferguson (1992), the magnitude of effects of both strikes was similar, some 15 to 20% loss in ridership. However, the focus of the study was on the impact profile in the aftermath of the strike, i.e. the relative speed of recovery to pre-strike ridership levels. This 'lingering effect' was different for both strikes. The 1981 strike had a more permanent, prolonged effect, whereas the 1986 strike had a more intermediate effect. Ferguson found that the main reasons for this effect are the length of the strike, the fact that the 1986 strike occurred in a month in which ridership is traditionally lower, and because in 1986 partial replacement of the service was provided on about 25% of the routes. In 1983, two years after the 1981 strike, approximately 70% of the effect of that strike on bus ridership remained. But in 1988, two years after the 1986 strike, only 15% of the effect remained and 85% of the effect of that strike had faded away.

Ile-de-France (F)

An almost complete public transport strike (95% of services) paralysed the region of Ile-de-France (Paris and surroundings) for nearly one month

Chapter 3

in late 1995 (Coindet 1998; Lapierre 1998). According to the Coindet (1998) study, almost 50% of those normally using public transport (with a 40% modal share in commuting) switched to the car, thus leading to considerable congestion on the road and a 70% increase in the journey time to work by car. Of those who switched to car, about 50% drove themselves and 50% arranged carpools. The modal share of car increased from 51% to 62%). Almost 11% of commuters were unable to attend work regularly, especially on the longer-distance trips, and 1% worked at home during the strike. On average, departure time was advanced by between 30 minutes and one hour, and the morning and afternoon peak were broader and flatter. After the strike commuting behaviour almost fully returned to pre-strike patterns. Although Lapierre (1998) concerns a car-sharing project and does not relate to the strike directly, the report provides an interesting alternative perspective. During the month of the strike the modal share of carpooling doubled from 5 to 11% in the Ile-de-France region. This car-sharing mostly arose from spontaneous solidarity and was sometimes organised by companies for their employees. According to Lapierre (1998), the month-long experience with car-sharing “strongly diminished [...] the complexity of mental representations of car-sharing” and “people have been convinced of the interest of car-sharing in disturbed periods, when choices are limited, and timing constraints are more flexible”. Thus, the strike provided travellers with an opportunity to develop more positive attitudes towards car-sharing, and companies and other private actors began to promote car-sharing.⁵⁸ The loss in public transport ridership may, however, prove to be temporary rather than permanent, because the average carpool lasts no longer than 6 to 18

⁵⁸ The main reasons for satisfaction with car-sharing were financial gains (the initial incentive), friendship, and solidarity (a key success factor), protection of the environment (a secondary incentive), and gain in time and comfort (specific to 35% of the car sharers who travel by public transport when not sharing a car). The main obstacles were variable schedules and successful matching.

months (Ferguson 1992). The likelihood is high that, after that period, travellers will have chosen to return to their previous modes of travel.

The Netherlands

In 1995 there was a 4-week strike of regional bus services throughout the country. During the first week, the strike was complete, but, after a court order directed that the action be curtailed because of its social impact, bus services were down between 10 a.m. and 3 p.m. only during the final three weeks (Perdok & Kalfs 1995). The behavioural reaction of bus travellers according to trip purpose and their perception of the impact of the strike were studied retrospectively. On average, 50% of bus trips were unhindered by the strike, 30% used an alternative mode (mainly car, as passengers), 10% of trips were postponed to another time or day, and 10% of trips were cancelled. Least hindered were commuting trips to work and school, especially in the final three weeks of the strike at which time peak service was resumed. Shopping trips, visiting friends and going out were most flexible, especially concerning the time of day; these types of trips were carried out using another mode (30-40%) or postponed (12-18%). Retail and market clientele dropped by 15% to 20% during the strike. Visits to the doctor were most impeded and were either replaced by home visits (18%), postponed (19%) or made with an alternative mode (with a relatively high use of taxicabs). In contrast, when interviewed about their perceptions of the strike's impact, commuters felt the most restrained of all, particularly those who were dependent on the bus for transportation. These 'bottleneck trips' comprise between 28 and 53% of all trips in the area, of which only 4% to 9% are off-peak (Perdok & Kalfs 1995). Travellers who were adequately informed of the time schedules during the strike felt less hindered than those who were not informed. Based on the percentages of affected travellers with a driving licence and the potential availability of a car, the long term decrease in demand for bus services is estimated at between 0.3% and 2.0%.

Chapter 3

London (UK)

The London underground strike in 1996 is a side issue in a paper discussing a diary questionnaire survey on the use of concessionary travel permits for the elderly and the disabled/blind in London (Bonsall & Dunkerley 1997). However, as in the LA bus lane and French car-sharing examples, it adds a specific dimension to the understanding of public transport strike effects. The diary survey period contained six days in which the underground service was disrupted to some extent. "By comparing the trip rates observed on strike days with those observed on the same days of the week but without a strike, we were able to estimate the effect of the strikes" (Bonsall & Dunkerley 1997). The researchers noted a reduction of 33-67% in the number of trips by permit holders, i.e. the elderly and the disabled/blind. Moreover, a decrease in the use of surface rail services was observed on strike days, presumably due to the loss of linked trips, emphasising the importance of considering public transport as an interrelated system and trips as door-to-door chains. Use of buses increased by about 8%, indicating that a segment of the underground trips was substituted by bus trips. There was a net reduction in the total number of public transport trips on strike days. No evidence was found of increased underground or rail use on the days before or after the strike, i.e. of rescheduling trips as a result of the strike.

Norway

Nearly all regular bus transport was cancelled during a 26-day strike in Norway in 1998 (Bjørnskau 1999). A telephone survey of over 1,000 people showed that most commuters did arrive at work and school. In the Oslo region commuters normally travelling by bus switched to the car as a driver or passenger (20%), to alternative public transport (50%), bicycle, or walking. In less urban areas and at greater distances, a higher volume of car (40 to 60%) and train (25%) traffic was observed through traffic data from toll authorities and additional traffic counts. As result of the

Public transport strikes and traveller behaviour

strike, urban car traffic increased by 3% and interurban increased by 11 to 17%. A majority of the respondents were not seriously affected by the strike; 15% of bus passengers worked more at home or took time off, trips for purposes other than work or school were largely reduced. Most affected by the strike were people not living in Oslo, i.e. in less densely populated and service-remote areas, people below age 30, and those without driving licences or access to cars. After the strike, at the time of the survey, some former bus passengers continued using other modes, thus implying a definitive loss of market share for bus companies.

Los Angeles (US)

In September 2000, a strike of 4,400 Los Angeles bus drivers meant that 450,000 commuters, of whom 350,000 normally use the bus and 100,000 the train, had to find alternative modes of transport to work (The Economist 2000). Most travellers switched to car, increasing road congestion by 5%. Others walked, went by bicycle or paid for rides on unofficial services offered by entrepreneurial van-owners; "If nothing else, the bus strike has solved the question, so puzzling for many in Beverly Hills, of how exactly Juanita and Maria come to work" (The Economist 2000).

Kind and size of effects of public transport strikes

Table 3.1 summarises the main findings from these 13 studies. It shows that 10-20% of public transport users who travel for commuting or school purposes cancel their trip when faced with a strike. This percentage is much higher for trips by the elderly and the disabled, as well as for leisure trips. The switch to car as a solo driver also tends to be limited.

Table 3.1 Overview of observed effects in 13 studies of public transport strikes

Strike	Year	Spatial scale	Mode	Trips cancelled	Trips switched to		Increase car traffic volume	Estimated post-strike loss of PT ridership
					car	other modes		
New York City (US)	1966	urban	all	50% ^a , 10%	67%	23%		2.1 ^e -2.6% ^f , 1% ^q
Los Angeles (US)	1974	regional	bus		50% ^d , 25% ^{e, i}			
Pittsburgh (US)	1976	urban	all	25% ^a			20-30%	
Knoxville (US)	1977	urban	bus					7-16%
Leeds (UK)	1978	urban	all	15% ^b	60% ^c , 5% ^d	35%		
The Hague (NL)	1981	urban	all	5% ^e , 40% ^f	25% ^c , 10% ^d	50% ^g	10-20%	
Rotterdam (NL)	1981	urban	all	-12%				
Orange County (US)	1981/86	regional	bus					15-20%
Ile-de-France (F)	1995	regional	all	11%	28% ^d , 21% ^{c, i}	51% (13% ^g)	9% (>100% ⁱ)	negligible
The Netherlands	1995	national	bus	10%	30%	60% ^j		0.3 – 2.0%
London (UK)	1996	urban	metro	33-67% ^k			8% ^l	
Norway	1998	national	bus		20% ^m , 40-60% ⁿ	50% ^{m, h} , 25% ^{n, o}	3% ^m , 11-17% ⁿ	small
Los Angeles (US)	2000	urban	bus				5% ^p	

^a only first day; ^b secondary school pupils, whole period; ^c car as passenger; ^d car (as driver); ^e trips with work and school as motive; ^f trips with leisure motive; ^g bike; ^h urban public transport; ⁱ carpool; ^j unhindered and postponed bus trips; ^k only elderly and disabled/blind; ^l bus; ^m urban traffic; ⁿ interurban traffic; ^o train; ^p congestion; ^q long term.

As the examples show, the sort and magnitude of effects of a strike may vary considerably according to the type and circumstances of action. Hereafter we discuss the characteristics of strikes following from the examples (see Table 3.2) and relate these to potential short and long term effects (Goodwin 1992).

Table 3.2 Characteristics of strikes

Characteristic	Description
Spatial scale	Urban, regional, national and international
Type of action	No service, limited or delayed service, free service
Coverage	Complete (all services of affected transport company) versus limited (some services)
Modality	Bus, tram, metro, taxicab, train, aviation
Modal split	Market share of public transport modality
Market context	Number of competing public transport operators or public transport alternatives
Duration	Short (some hours) versus long (a month or even longer)
Captivity of passengers	Type of travellers (commuters, school children, elderly) and their alternatives (modes, possibility to re-schedule appointments, telework, and so on)
Pre-announcement	Travellers are well and timely informed about the action, or not

The spatial scale of a public transport company is important for at least two reasons. First, the larger the spatial scale, the more travellers may be confronted with the strike. For example, a strike of a national railway company is clearly different in scope from that of a local bus operator. Second, the spatial scale of a strike is mostly also a determinant of the type of travellers affected and their travel alternatives. Interurban traffic is more common for necessary trips such as commuting to work or school, whereas urban traffic to a larger extent also concerns travellers with social motives for their trips, including visiting friends or a club, or shopping. Necessary trips are potentially strongly affected by a strike; other trips can more easily be postponed or foregone. In metropolitan areas travellers affected by a strike may have more alternative modes for making their trip: cycling, walking, taxicab, sharing a ride with a colleague

Chapter 3

or a household member. An exception to this may be interurban travellers, who use urban public transport as an access or egress mode, and probably do not have many alternatives, as highlighted in the The Hague example. In rural areas and interurban traffic most of these options do not really apply either, because of trip distance and the trip discretion, which makes carpooling less attractive (Rietveld et al. 1999; Ferguson 1992). Mostly the private car or alternative public transport, i.e. bus instead of train, are the only options remaining.

The market context in which the strike occurs may also be relevant. In the event of competing public transport companies, the effects of a strike in one company may largely be mitigated by the (additional) service offered by the competitor. The same applies in cases where, for example, bus and metro operate more or less on the same routes. Though this effect of market context does not directly follow from our examples, this factor will become increasingly relevant as a result of the ongoing commercialisation and privatisation of public transport services. Another important factor is the duration of a strike. Depending on the nature of the conflict, strikes can last from a day to even several weeks. Short strikes can be avoided more easily and with fewer side effects by taking a day off, re-scheduling appointments, or bringing work home. This becomes increasingly difficult with longer strikes, as most people have a limited number of days off and better ways to spend the time. But more importantly, one cannot stay away from work or school for long periods, and the employed will be obliged to find alternative ways to reach their destinations. Similar arguments hold for the coverage of the strike, i.e. whether the strike is complete or only limited to specific services or time periods, the type of action (none, limited, or free service) and the modalities involved. Moreover, large differences in effects may be observed according to the modal split of trips. In urban transport, especially in metropolitan areas, the modal share of public transport may be up to 60%, whereas in rural

areas public transport market share is sometimes negligible. The number of public transport travellers affected, and the alternative opportunities open to them obviously depends on this market share (Ferguson 1992).

Independent of spatial scale, length, coverage, and type of strike, some people may not be able to arrange alternative transportation easily. A segment of public transport travellers is 'captive', i.e. they are dependent on public transport for their transportation and, as a result, may exhibit inert behavioural reactions to changing circumstances. This captivity can be the result of free choice, for example, by pre-commitment through buying season tickets for public transport that cannot be rearranged in the short term. But, most often, captive travellers include the elderly, the disabled and young people who cannot afford to drive or are not yet, or no longer permitted to drive.⁵⁹

This latter group of captive travellers may be more common in urban traffic, but may still not have all the alternatives discussed above. The voluntary captives may be more common in interurban traffic, for example, in long distance commuters. Finally, especially in the case of short strikes, it makes a considerable difference whether the strike is announced well in advance. If travellers have the opportunity to plan alternative transport or reschedule appointments, they can alleviate the impact of a strike on their planned activities.

Most of these effects concern the direct short term effects of a strike on travellers, i.e. travel time and modal shifts or cancelled trips. However, the long term effects of strikes should also be noted. This long term effect does not primarily concern travellers, but has an impact on the entire transport system. Travellers affected by a strike, and perhaps even those who have only heard about the affected travellers, may develop negative

⁵⁹ Metz (2000) discussed "destination independent" benefits of travel for older people, for instance, the quality of life effects of mobility and involvement in the local community.

Chapter 3

attitudes towards that specific public transport mode or to public transport as a whole. This negative attitude can result in a decreasing chance that travellers will choose public transport in the future, in the event that they can choose, as was observed, for example, during the strikes in New York, the Netherlands and Oslo. This effect increases with the impact of the strike, e.g. with the spatial scale and the period of the strike, and with the subsequent media attention, as observed in the Orange County example. Moreover, when people are forced to try alternatives they seldom use, they may discover that it is not so bad after all and stay with it, or possibly increase the frequency of use at the expense of public transport use, as shown in the French car-sharing example. Thus, a strike may contribute to a negative attitude towards public transport, while at the same time opening up alternatives to travellers. Although it is inappropriate to be conclusive based on the evidence presented here, it is not difficult to imagine that longer term effects of a strike on public transport ridership will occur (Lamkin, Saunders & Hearne-Locke 1984; Ferguson 1992). This effect has been observed for, among others, the subway strike in New York City and the regional bus strikes in the Netherlands and Norway, and for the former was estimated to be between 0.3 and 2.5%. Considerable time will pass before public transport ridership regains its pre-strike level, if ever, depending in part on the policy response. According to Ferguson (1991; 1992), the preferred policy response is mitigation: attempting to avert the strike, reduce its length and/or alleviate impacts by providing a partial or complete replacement service. The alternative response is adaptation: trying to recoup the costs of the strike and ridership loss by either increasing fares and reducing service levels, or else by increasing operating subsidies after the strike. The acceptability of an adaptation strategy is highly dependent on whether the traveller, the public transport operator, or the policy maker's viewpoint is adopted.

3.3 The 1999 rail strike in the Netherlands

In late 1999 and early 2000 a series of one-day strikes took place in urban public transport in Amsterdam and the Dutch national railways (NS) (van Exel & Rietveld 2000). The main relation between these strikes probably was that the media attention attracted by the impact of the first strike increased the readiness to strike on subsequent occasions. The first strike was the result of violence against train personnel; it was organised spontaneously, and, consequently, most travellers were badly informed. The strike was short: train services were down only on a single day during the morning peak (until 10 a.m.) and recovered slowly in the course of that day; and it was not complete: action started as separate regional initiatives, but because important transfer and final stations for interregional train services were blocked, the action spilled over into other regions, and a much larger area was affected. As a result, there was no service at all in some regions, while in other regions service was mostly (severely) delayed. Because the strike was organised on the spur of the moment in different regions throughout the country, the whole situation was rather disorganised and most travellers were ill-informed.

In order to explore the effects of a train strike on the behaviour of travellers, we conducted a survey exactly one week after this strike. Similar to other studies, we were faced with the challenge to prepare and conduct this study in the very short term. We had no permission from the railways company to interview passengers in trains or on platforms and therefore asked people entering or leaving the station to complete the questionnaire on location (n=73) or send back by mail (n=93; response 28.4%). Because travellers who felt more inconvenienced by the strike may be more likely to respond, we checked for selection bias. We observed no significant difference between responses to interviews and by mail in terms of travel purpose, commuting distance, trip frequency, season-ticket ownership, reaction to the strike, and the anticipated effect

Chapter 3

of the strike on future use of public transport. The 166 respondents were commuters (76%), business travellers (10%), and students (14%). On the day of the strike 10% of the regular train passengers remained at home (see Table 3.3), mostly (88%) because they had no other mode available for the trip, or because they did not consider the available modes to be reasonable alternatives because of traffic congestion (car) or much longer travel times (bus). This figure is comparable to other regional or national scale strikes discussed above. The other 90% of regular train travellers departed from home for their usual commuting trips, and, for the most part (62%), also left at the usual time. Most regular train travellers continued to commute by train; 15% switched to the car; and 5% moved to other public transport alternatives (see Table 3.4).

Table 3.3 Reaction to strike according to travel motive

Trip motive	Stay home	Leave home at usual time	Leave home earlier than usual	Leave home later than usual
Commute	9%	62%	8%	20%
Business	13%	50%	31%	6%
School	17%	67%	4%	13%
Total	10%	62%	10%	18%

Table 3.4 Mode choice of travellers who left home on the day of the strike

Mode choice	Total	Leave home at usual time	Leave home earlier than usual	Leave home later than usual
Train	80%	53%	9%	19%
Car	15%	11%	3%	1%
Other public transport	5%	4%	1%	0%

The strike was arranged at short notice and insufficiently publicised, complicating commuters' arrangements for alternative transport. One third of respondents, leaving home on the morning of the strike, were completely unaware of the strike action. Business travellers (69%) and infrequent public transport users (80%) were better informed than commuters and other frequent travellers (50%). Of those who had heard

Public transport strikes and traveller behaviour

of the strike 21% did not expect to be affected by it, 56% expected to be delayed, and 23% thought they could not reach their destination by train at the usual time. The most interesting groups for analysing behavioural reactions to the strike are the latter two groups, concerning 79% of the respondents. Comparable percentages of travellers expecting delays and travellers expecting not to reach their destination left home at the usual time, while those who only expected delays changed their time of departure about twice as often (see Table 3.5). Travellers who stayed home took the day off (46%), called off work, appointment or school (38%), or worked at home (16%). For travellers who left home on the day of the strike, the following behavioural reactions to the strike were observed. Of the large group of travellers who expected delays but left home at the usual time (25% of respondents, i.e. 45% of the 56% of respondents who expected delays; see Table 3.5), a large majority of 93% left for the station. Thus, although informed about the strike, these travellers did not anticipate the expected delays by leaving earlier or by choosing another mode, but instead acted exactly as usual. More remarkable, of the travellers who expected not to reach their destination by train at the usual time, still 18% went to the station at the usual time.

Table 3.5 Reaction to the strike according to expectations of strike severity

Expected severity of the strike	%	Stay home	Leave home at usual time	Leave home earlier than usual	Leave home later than usual
Respondents who expected delays	56%	8%	45%	19%	27%
Respondents who expected not to have a chance to reach their destination at the usual time of travel	23%	31%	48%	8%	14%

Some of the travellers, however, did anticipate the expected delays, and either shifted their time of departure, chose another mode of transport, or both. Some left earlier than usual (see Table 3.5). Those who expected

Chapter 3

delays largely (82%) left home for the station 30 minutes early on average. Travellers who left home later than usual all went to the station. This mostly concerned commuters (86%) who had no alternative mode of transport for the trip. They awaited the announced end of the strike after the morning peak and all went to the station about two hours later than usual. This finding is in accordance with other studies, where commuters travelling to work and school are among those highly affected by public transport strikes; their flexibility in time of day for travel is limited, and they often are captive to public transport.

The average travel time by train of those affected by the strike ultimately turned out to be above twice the normal time. The strike also instigated greater congestion on highways in the affected regions (van Exel & Rietveld 2000). Taking into consideration that approximately 15% of long-distance commuting in the Netherlands is done by train and 80% by car (CBS 1999), and 15% of travellers in our sample switched to car on the strike day (see Table 3.4), highway traffic increased by approximately 3% as a result of the strike. This indicates how sensitive the current highway traffic flow, already at full capacity in large parts of the Netherlands, is to relatively small increases in demand. On the other hand, given the relatively low modal share of train or, as seen in other studies, of public transport in general, the impact of a short strike is limited.

3.4 Discussion and conclusion

Despite the strike, a large share of train travellers still left home for the train station at the usual time of day, often even when they anticipated that they would not travel at the usual time. This demonstrates a high level of inertia in commuting behaviour, and supports the finding of, for example, Khattak and De Palma's (1997) study on commuter response to adverse weather. Most train travellers are captive to the train; over 80%

of them have no alternative mode of transport, and most commuters appear to be highly inflexible even in their departure times.

Although this study mainly concentrates on peak-time travellers, the effects of this insufficiently publicised one-day train strike are fairly comparable to those of the studies discussed earlier. A significant proportion of travellers (10-20%), mainly commuters, the elderly and the disabled, is captive to their customary mode of transport, and has no other option than to stay home. Most travellers, however, reach their destination, either by themselves (by car, bicycle, or by alternative public transport) or with help from friends (by car, as a passengers). Available alternatives depend on, among other things, the spatial scale, duration, and coverage of the strike (see Table 3.2); but travel options also depend on local geographical conditions (hilly Leeds, rural Orange County) and weather (sunny The Hague) circumstances. Both during the New York and Ile-de-France strikes, rentals and sales of bicycles increased markedly. A limited share of the commuting trips is substituted by work at home. Leisure trips and trips made by the elderly and the disabled are more often than not cancelled or postponed.

A one-day strike may not be enough to break through established commuting patterns or habits. However, 15% of respondents state that such a strike will affect their future use of public transport. This point is especially relevant, because it mainly concerns either infrequent users, who can easily switch back to their common or habitual mode of travel, or young travellers, who currently depend on public transport, but who will someday be able to choose between alternative modes of transport. Travellers' positive experiences with a consumption good increases the likelihood that that same good will be consumed in the future. Therefore, future experience with public transport will shape these travellers' images of public transport, to possibly enhance and subsequently continue or even increase the use of public transport, or, conversely, to become

Chapter 3

dissatisfied and perhaps abandon it for another mode of transport. Longer term estimates from other studies suggest that some permanent modal shift will occur following a public transport strike, but at the much more moderate rates of 0.3% to 2.5%.

Our review of 13 studies demonstrates that the effect of a strike on public transport ridership varies and may be either temporary or permanent; traveller reactions depend on the type of strike, whether established travel patterns are sufficiently challenged, and the policy response to the strike. In the case of Orange County, partial replacement of service was provided on truncated routes. The government in the Netherlands took legal steps: a court order proclaimed that the action had to be limited to off-peak hours because of its social impact. Moreover, travel information is important. Travellers who are adequately informed about changed routes or time schedules during a strike period feel less constrained by the action. With respect to the increased car traffic as result of a strike, in New York on-street parking was prohibited to ease the movement of traffic through the city. In Los Angeles in 1974 bus lanes into town were successfully opened to carpools of three or more persons to relieve congestion. In The Hague, downtown bus lanes and tramways were made available for parking in order to ease parking problems. Conversely, examples from New York, Leeds, Ile-de-France and Los Angeles indicate that individuals and employers express great creativity in arranging alternative transport, i.e. private buses arranged by employers or spontaneous car-sharing out of solidarity with colleagues or neighbours. Goodwin's (1977) analysis of habit and hysteresis in mode choice indicated that, in general, it is more difficult to reverse a trend than to accentuate it. That is, the "fare subsidies, speed changes, etc., necessary to attract a given number of people back from car to public transport will be greater than the changes which recently caused them to shift from public transport to car".

Anticipated and actual behavioural reactions to a rail strike

4

Chapter 4 is based on: Van Exel NJA, Rietveld P (2009) When strike comes to town... Anticipated and actual behavioural reactions to a one-day, pre-announced, complete rail strike in the Netherlands. *Transportation Research Part A: Policy and Practice* 43(5): 526–535 [<http://dx.doi.org/10.1016/j.tra.2009.01.003>]

4.1 Introduction

In the autumn of 2004, the Dutch Government and the Labour Unions were in conflict over the kind and magnitude of social reforms necessary to cope with the unfavourable economic outlook at the time, and the future economic burden from the ageing of the population. One of the actions organised by the unions was a one-day, national, complete rail strike, on Thursday 14 October 2004. The strike was announced a few days in advance and received a great deal of publicity in the national media. Textbox 5.1 presents a synthesis of media reports in national newspapers and news websites on the day of the strike and the day after. At the time, rail had a modal share of 7.9% of all passenger kilometres, and was most popular in the age group 18-29 years (16.8%). Compared with the car, train was mostly used for longer trips, both in terms of travel distance (52.3 vs. 15.9 kilometres) and travel time (74.6 vs. 21.4 minutes) (CBS 2006).

Though strikes in public transport occur frequently, studies of strikes are rare. In Chapter 3 we reviewed a handful of studies and presented the findings of a new study. From the literature review we concluded that, in the short term, mainly captive travellers were affected (with 10% to 20%

Chapter 4

of their trips cancelled), and that most other travellers switch to the car, either as driver or passenger, leading to increased road congestion. In the longer term, public transport ridership decreases leading to a loss in market share of between 0.3% and 2.5%, with the size of the effect depending on the type of strike and the policy response to it (see Section 3.2 for more detail). From the study presented in Section 3.3, we concluded that announcing a public transport strike in advance enables travellers to anticipate, helps to restrict the impact on their activities and responsibilities, and may reduce long term effects on ridership. The only more recent study is by Lo and Hall (2006), who investigated the effect of a 35-day public transport strike in Los Angeles on highway congestion by comparing traffic conditions data from traffic management centres at different locations surrounding the city before and during the strike. They found that, despite the small fraction of transit in total travel, the length of the rush period expanded by as much as 200%, while average traffic speed declined by up to 20% (and 40% during peak hours).

The study we present here is based on a secondary analysis of data from a pre- and post-strike survey, collected by the Dutch national railways (NS) and generously made available for the purpose of this study, without restrictions. The main reason for this survey was to make an assessment of the impact of the strike on NS customers, and the potential subsequent financial consequences from ticket reimbursement claims.⁶⁰ This unique dataset gives the opportunity to compare public transport travellers' anticipated and actual behavioural reactions to having their preferred alternative removed from their travel choice set. We investigated the following questions: How did people anticipate they would react to the strike? How did people actually react on the day of the strike, and what characteristics of the traveller or the trip were associated with the

⁶⁰ NS has a money-back policy for customers who experience long delays or service interruptions.

Anticipated and actual reactions to a strike

reaction? How did the actual behavioural reaction compare with the anticipated one? And, how did people perceive the chosen alternative in terms of behavioural control and satisfaction?

Table 4.1 Media reports on the day of the 2004 strike and the day after

National polls found that people were 50-50 in favour/opposed to the strike. Most public transport users found the strike annoying, but not insurmountable. Many sympathised with the objective behind the strike, but at the same time found a public transport strike a too easy and exaggerated means, affecting too many people who were not part of the problem and neither could they contribute to its solution.

Because the strike was well announced, most train travellers had the opportunity to make other plans. And because it was complete, almost no travellers showed up at a train station to try their luck.

The expected chaos on roads did not happen. Congestion was only slightly higher than usual (50 traffic jams during peak hour with a total length of 232 kilometres, which is about 30 kilometres more than usual). Peak traffic however started about an hour earlier and lasted longer. Many people, anticipating congestion, shifted their departure time and left earlier or later.

The demand for information was high. The national public transport information line received thousands of calls more than usual during the morning, mainly from people who wanted to confirm that there really wasn't any train running. Access to websites providing real-time road traffic information was problematic because of the unusually high number of visitors.

Most frequent train users took the car, arranged a carpool or stayed at home. When possible, people shifted their activity to home. Others took a day off, mostly unwillingly. Most students, who receive a public transport pass from the Ministry of Education as a part of their scholarship and are often dependent on public transport, had to cut classes. Large exhibitions and events reported fewer visitors.

Some people had or wanted to be sure they would make it to their destination and took more drastic and costly measures; they stayed overnight in a hotel or at friends, hired a car or took a taxi. Hotels, car rental companies and taxi firms reported higher demand.

The most seriously affected group appeared to be inbound travellers from abroad, either by train or by plane. Some people could call upon family or friends to pick them up. For most foreign travellers taking a taxi or booking a hotel-room close to the airport were the only options. Taxi drivers had anticipated the transportation problems; long queues of taxis were reported at Amsterdam Schiphol Airport.

Economists debated that the direct impact of a one-day public transport strike on the economy would be negligible and not stand out in the national statistics for that year. Some, however, feared it might harm the attractiveness of the Netherlands as business location and so have indirect long term impact on the economy.

4.2 Methods and data

Data collection, cleaning & selection

In the two days prior to the strike, 10,000 NS season-ticket holders and infrequent customers with a known address from an NS database were approached with a web-based survey questionnaire. The questionnaire asked for people's opinion about the strike, whether they had planned to travel by train on the day of the strike, and, if so, how they were planning to solve their transportation problem resulting from the strike; 3,415 (34%) people completed this questionnaire (Wave 1). Next, respondents who had indicated in their wave 1 response they had planned to travel by train on the day of the strike (1,313 [38%] in the raw dataset) were approached again on the day after the strike with a survey questionnaire asking them how they had actually solved their transportation problem; 1,011 (77%) people completed the follow-up questionnaire (Wave 2).

Respondents who were not informed about the strike at the moment of completing the questionnaire (72 [2%]) and those with a missing value on a key outcome variable (78 [2%]) were discarded from further analysis. The final study sample of 3,265 respondents in Wave 1 therefore consisted of travellers who were well-informed about the upcoming strike. These respondents were thus assumed to have a well-articulated preference about how to react to the strike, or at least the opportunity to have formulated one. In the wave 1 sample, 1,263 (39%) respondents had planned to travel by train, 493 (15%) had planned to travel by car, and 1,509 (46%) had not (yet) planned to travel on the day of the strike. Of the 1,263 people who had planned to travel by train on the day of the strike, 976 (77%) returned a completed follow-up questionnaire (Wave 2; see Figure 4.1). Responders (n=976) and non-responders (n=287) differed statistically significantly ($p < .01$) in 'type of rail customer (ticket)': season-ticket holders responded more often than full-fare and reduced-fare ticket holders (57%/27%/16% versus 46%/32%/22%, respectively).

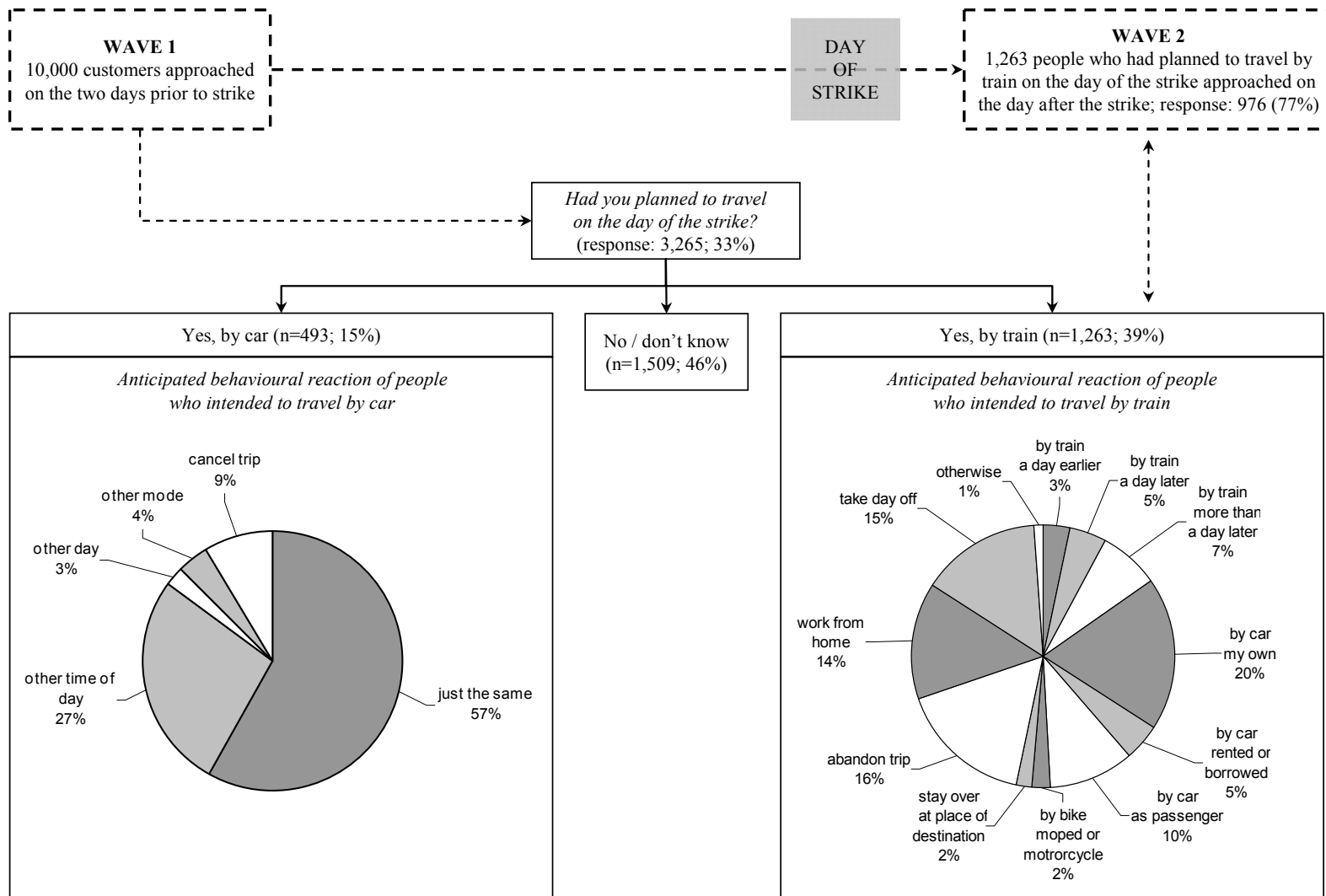


Figure 4.1 Data collection in two waves

Chapter 4

No differences were found in age, gender, frequency of train use, trip purpose on day of strike, opinion about the strike (ex-ante), agreement with unions' underlying objective for the strike (ex-ante) and opinion about damage to the image of NS as a result of the strike (ex-ante).

Data classification and analysis

Respondents were asked to indicate their anticipated (Wave 1) and actual (Wave 2) reaction to the strike regarding the trip and the activity they had planned for that day, by selecting one of 11 pre-defined possible reactions: (i) by train, a day earlier; (ii) by train, a day later; (iii) by train, more than a day later; (iv) by my own car; (v) by rented/borrowed car; (vi) by car, as passenger; (vii) by bike, moped or motorcycle; (viii) stay over at place of destination; (ix) abandon trip; (x) work from home; (xi) take a day off; or (xii) otherwise (see Figure 4.1). Using a simple 2x3 structure -pursue activity [yes/no] versus mode choice [train; car, as driver; other mode, as passenger]- we categorised the eleven options into four basic behavioural reaction types to the rail strike: (1) other day, by train [(i)-(iii)]; (2) same day, car (as driver) [(iv),(v)]; (3) same day, other mode (as passenger) [(vi),(vii)]; or (4) abandon trip [(viii)-(xi)]. In the analysis we have assumed that these four types are unordered. Associations of the behavioural reaction types with characteristics of the traveller and the trip collected in Wave 1 (see Table 4.2) were therefore analysed using multinomial logistic regression, with the option 'other day, by train' (i.e. same activity, same mode) as the reference category. Because the coefficients of multinomial logistic models are generally difficult to interpret directly, the marginal effects of each variable on each behavioural reaction were computed and are presented in the tables. Furthermore, in the interpretation of the results we have to reckon that respondents need not have all these four alternative options in their travel choice set, e.g. 'same day, car (as driver)' requires possession of a driving licence and, at least for that day, availability of a car. For people to adopt

one of the alternatives they must have the possibility, as well as be willing, to do so. Because the data does not contain information about peoples' choice sets, it will not always be possible to disentangle ability and willingness to change behaviour.

The origin and destination of the (intended) trip on the day of the strike were available as city names. Trip distance (city centre to city centre) was determined manually for each respondent in Wave 2 using web-based route planning software. For the analysis, trip distance was categorised into three classes, based on the expectation that travel choice sets change with trip distance: ≤ 10 kilometres (short distance; walking, bike, urban public transport, and carpool with colleague, neighbour or spouse); 10-30 kilometres (middle distance; interurban bus, perhaps carpool or bicycle, car); > 30 kilometres (long distance; predominantly car). In Wave 2, respondents were asked to assess the perceived behavioural control and satisfaction with the chosen alternative on a 4-point Likert-type scale. Because both measures are fairly crude, we sought the benefit of the combined data: respondents who scored the chosen alternative in the highest two categories on both variables were categorised as being generally 'happy' with the chosen alternative, others as 'not happy' (see Figure 4.4, the four dark bars). Associations between behavioural reaction and happiness with the chosen alternative were analysed using bivariate statistics and Pearson χ^2 tests.

4.3 Results

The sample characteristics are presented in Table 4.2. The mean age of the respondents was 47 years, 40% were female. Mean rail trip frequency was 7 times per month, mean trip distance 65 kilometres (commute 54 km; business 87 km; education 50 km; appointment 81 km; social/leisure 98 km).

Chapter 4

Table 4.2 Sample characteristics

Variable		Wave 1	Planned travel mode on day of the strike			Wave 2
			train	car	no	
Frequency of train use	4 days per week or more	28%	61%	7%	6%	62%
	1 to 3 days per week	18%	22%	10%	17%	22%
	1 to 3 days per month	23%	11%	27%	33%	11%
	Less than once per month	31%	6%	56%	44%	5%
Trip distance	≤ 10 kilometres (short)	-	-	-	-	3%
	20-30 kilometres (middle)	-	-	-	-	23%
	> 30 kilometres (long)	-	-	-	-	74%
Trip purpose on day of strike ^a	Commute	-	54%	-	-	55%
	Business	-	12%	-	-	12%
	Education	-	13%	-	-	13%
	Appointment	-	5%	-	-	6%
	Social/leisure	-	16%	-	-	14%
Type of rail customer (ticket)	Season-ticket holder	-	55%	-	-	57%
	Reduced-fare ticket holder	-	28%	-	-	27%
	Full-fare ticket	-	17%	-	-	16%
Opinion about the strike (ex-ante) ^b	Disapprove	64%	72%	61%	59%	-
	Neutral	4%	4%	3%	5%	-
	Approve	32%	24%	36%	36%	-
Opinion about the strike (ex-post) ^{b,c}	Disapprove	-	-	-	-	66%
	Neutral	-	-	-	-	5%
	Approve	-	-	-	-	29%
Agreement with unions' underlying objective for the strike (ex-ante)	No	16%	16%	16%	16%	17%
	Somewhat	26%	29%	28%	22%	28%
	Yes	58%	55%	56%	62%	55%
Opinion about damage to image of NS of the strike (ex-ante) ^d	No	55%	48%	55%	61%	50%
	Somewhat	24%	25%	24%	22%	24%
	Yes	21%	27%	21%	17%	26%
Opinion about information provision by NS (ex-post)	Good	-	-	-	-	49%
	Sufficient	-	-	-	-	46%
	Insufficient/bad	-	-	-	-	5%
Total		3,265	1,263	493	1,509	976

Notes: ^a 'Commute' concerns commuting trips; 'Business' concerns business trips and important private appointments (e.g. doctor/hospital); 'Education' concerns trips to school/education; 'Social/leisure' includes private/social, shopping, and recreational trips.

^b Question: "What is [with hindsight] your opinion about the strike at NS?". Response categories: 'not the right way to achieve their goals, train traveller is undeserved dupe' [disapprove]; 'no opinion' [neutral]; 'fine, the objective justifies the means' [approve].

^c Ex-ante opinion about the strike of Wave 2 sample: 72% disapproved, 4% were neutral, and 24% approved. ^d "Do you feel this strike does damage to the image of NS?"

Anticipated and actual reactions to a strike

Disapproval of the strike in this sample of rail users was somewhat higher than the national population average (see Table 4.1). Figure 4.1 shows the anticipated behavioural reactions of train and car travellers to the rail strike. Notably, of the people who intended to travel by car on the day of the strike, 43% expected to change their behaviour. These car users disapproved of the strike, disagreed with the unions' underlying objectives, and were of the opinion that the strike damaged the image of NS more often than others ($p < .05$). Eventually, 44% of the people who had anticipated travelling by train on the day of the strike abandoned their trip, while 56% pursued their activity; from this group, 43% switched to car (as driver), 25% switched to another mode (as passenger), and 32% stayed with the train and rescheduled the planned activity to another day.

Table 4.3 shows that the large majority of respondents who had planned to travel by train (86%) behaved as they had anticipated. This was more often so for frequent train travellers, season-ticket holders and people travelling for commuting, business or education purposes ($p < .05$).

Table 4.3 Actual versus anticipated behavioural reaction to the strike

Anticipated behavioural reaction	Actual behavioural reaction				Total
	Same day, car (as driver)	Same day, other mode (passenger)	Other day, by train	Abandon trip	
Same day, car (as driver)	89%	3%	4%	4%	225
Same day, other mode (passenger)	7%	85%	-	8%	131
Other day, by train	3%	1%	85%	11%	154
Abandon trip	5%	3%	8%	84%	466
Total (%)	236 (24%)	134 (14%)	177 (18%)	429 (44%)	976

Note: $n=976$; row %; Spearman correlation = .75.

Multinomial regression results are presented in Table 4.4. The model predicts 51% of the behavioural reactions correctly. The statistically significant, sizeable negative intercept value for 'same day, car (as driver)' indicates that this behavioural reaction had considerable lower odds (or a

Chapter 4

negative sympathy, preference, popularity) as compared with 'other day, by train' in this sample, independently of the value of the explanatory variables included in the model.

The marginal effects of each variable are presented in Table 4.5; the reference case is a male person of 20 years or older, who intended to make an infrequent longer distance trip for leisure purposes on a full-fare ticket, and who did not disapprove of the strike. The estimated average probabilities of the four behavioural reactions to the rail strike for the reference case were: .246 for 'same day, car (as driver)'; .138 for 'same day, other mode (as passenger)'; .478 for 'abandon trip'; and .137 for 'other day, by train'. Table 4.5 shows that, not surprisingly, people aged 19 or lower were much less likely to choose 'same day, car (as driver)'. The same is true for females, though the marginal effect is lower. People who had intended to make a short or middle distance trip on the day of the strike, or a trip they make very frequently (≥ 4 times/week), were more likely to pursue the activity on the same day travelling by, for instance, bike, urban public transport, or a carpool, and less likely to shift the activity to another day and stick to the train.

In addition, people on middle distance trips were less likely to abandon their trip. Trips with a commute or business purpose were considerably more likely to be conducted on the same day, travelling by car, and less likely to be shifted to another day. Moreover, business trips were much less likely to be abandoned. Trips with education or appointment purpose were less likely to be shifted to another day, while appointments were also less likely to be cancelled. Finally, season-ticket holders were less likely to travel on the same day by another mode (as passenger), while people who disapproved of the strike, which could be interpreted as a proxy for the perceived burden from the strike, were more likely to switch to car.

Table 4.4 Behavioural reaction to the strike; multinomial logit model

Variable		Same day, car (as driver) ^a		Same day, other mode (as passenger) ^a		Abandon trip ^a	
		Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Age ^b	≤ 19 years	-1.55 *	0.76	0.35	0.60	0.01	0.50
Gender	Female	-0.61 **	0.24	-0.15	0.26	-0.19	0.21
Trip distance ^c	≤ 10 kilometres	1.15	0.65	2.00 **	0.64	0.57	0.61
	20-30 kilometres	0.72 *	0.31	1.33 ***	0.32	0.28	0.29
Frequency of train use ^d	4 days per week or more	0.82	0.57	2.27 **	0.77	1.07 *	0.51
	1 to 3 days per week	-0.26	0.48	1.12	0.71	0.16	0.42
	1 to 3 days per month	-0.20	0.50	0.31	0.76	-0.58	0.45
Trip purpose on day of strike ^e	Commute	2.02 ***	0.44	1.32 **	0.47	1.01 **	0.34
	Business	1.86 ***	0.41	0.79	0.48	-0.16	0.36
	Education	1.92 ***	0.54	0.86	0.61	1.52 ***	0.43
	Appointment	1.23 *	0.49	1.13 *	0.53	0.23	0.42
Type of rail customer (ticket) ^f	Season-ticket holder	0.06	0.39	-0.52	0.42	0.29	0.36
	Reduced-fare ticket holder	-0.17	0.32	-0.38	0.36	-0.47	0.29
Opinion about the strike (ex-ante) ^g	Disapprove	0.57 *	0.25	0.26	0.27	0.28	0.22
Intercept		-4.92 **	1.60	-1.99	1.40	-0.28	1.07

Notes: *** p<.001; ** p<.01; * p<.05. Model fit: Pseudo R² (McFadden) = .13; -2 Log Likelihood = 318.6. Reference categories: ^a Other day, by train; ^b ≥20; ^c >30; ^d less than once per month; ^e social/leisure; ^f full-fare ticket; ^g neutral or approve (see Table 4.2 [Note b] for explanation).

Table 4.5 Behavioural reaction to the strike; marginal effects

Variable		Same day, car (as driver)		Same day, other mode (passenger)		Abandon trip		Other day, by train	
		dy/dx	S.E.	dy/dx	S.E.	dy/dx	S.E.	dy/dx	S.E.
Age ^a	≤ 19 years	-0.301 ** ^g	0.114	0.094	0.056	0.162	0.096	0.045	0.059
Gender	Female	-0.084 **	0.030	0.015	0.024	0.032	0.037	0.036	0.025
Trip distance ^b	≤ 10 kilometres	0.037	0.093	0.224 *	0.100	-0.172	0.090	-0.090 **	0.029
	20-30 kilometres	0.046	0.037	0.136 ***	0.034	-0.118 **	0.041	-0.064 *	0.025
Frequency of train use ^c	4 days per week or more	-0.041	0.088	0.156 *	0.068	0.038	0.104	-0.152 *	0.066
	1 to 3 days per week	-0.104	0.068	0.162	0.118	-0.030	0.108	-0.028	0.040
	1 to 3 days per month	0.010	0.091	0.096	0.121	-0.142	0.106	0.036	0.054
Trip purpose on day of strike ^d	Commute	0.203 **	0.064	0.024	0.047	-0.061	0.073	-0.167 ***	0.043
	Business	0.396 ***	0.088	-0.001	0.054	-0.317 ***	0.062	-0.079 **	0.023
	Education	0.144	0.100	-0.064	0.043	0.043	0.095	-0.123 ***	0.022
	Appointment	0.171	0.111	0.076	0.083	-0.177 *	0.090	-0.070 **	0.026
Type of rail customer (ticket) ^e	Season-ticket holder	-0.004	0.051	-0.087 *	0.039	0.102	0.059	-0.010	0.040
	Reduced-fare ticket holder	0.035	0.051	-0.009	0.035	-0.072	0.059	0.046	0.035
Opinion about the strike (ex-ante) ^f	Disapprove	0.061 *	0.031	-0.006	0.026	-0.011	0.039	-0.045	0.028

Notes: *** $p < .001$; ** $p < .01$; * $p < .05$. Reference case: a male person of 20 years or older who intended to make an infrequent trip of over 30 kilometres distance for leisure purpose on a full-fare ticket, and who did not disapprove of the strike. The marginal effect (dy/dx) is for the discrete change of the dummy variable from 0 to 1. Reference categories: ^a ≥ 20 ; ^b > 30 ; ^c less than once per month; ^d social/leisure; ^e full-fare ticket; ^f neutral or approve (see Table 4.2 [note b] for explanation). ^g With a basic estimated probability for 'same day, car (as driver)' of .246, the probability of this alternative for the lower age group becomes -statistically not different from-zero.

Anticipated and actual reactions to a strike

We now turn to the perceived behavioural control and satisfaction with the behavioural reactions to the strike. Overall, peoples' experience with the alternative they chose on the day of the strike wasn't so bad: 72% indicated that the chosen alternative led to minor problems or was easy to use (Figure 4.2) and 69% found it acceptable or good (Figure 4.3). Perceived behavioural control and satisfaction with the chosen alternative were moderately correlated (Spearman correlation = 0.58).

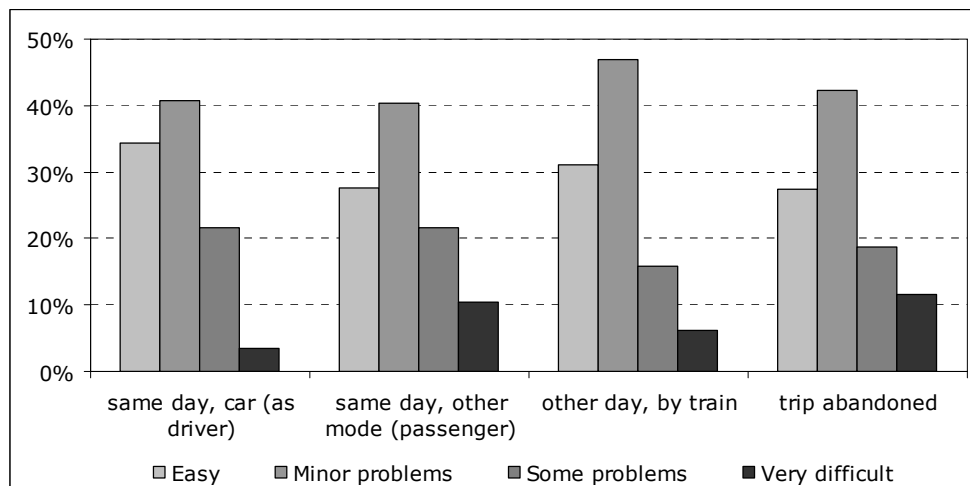


Figure 4.2 Perceived behavioural control with the chosen alternative

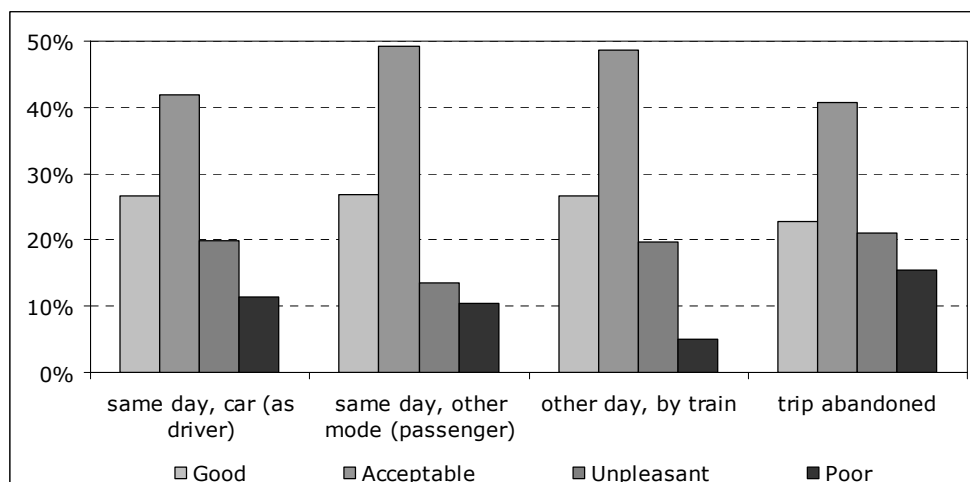


Figure 4.3 Satisfaction with the chosen alternative

Chapter 4

The majority of respondents (60%) scored the chosen alternative in the highest two categories on perceived behavioural control as well as on satisfaction and were categorised as being 'happy' with the chosen alternative (see Figure 4.4; the four dark bars). This was more often so for people in the middle age categories (30-59 years) and infrequent train users (once a month or less) ($p < .05$).

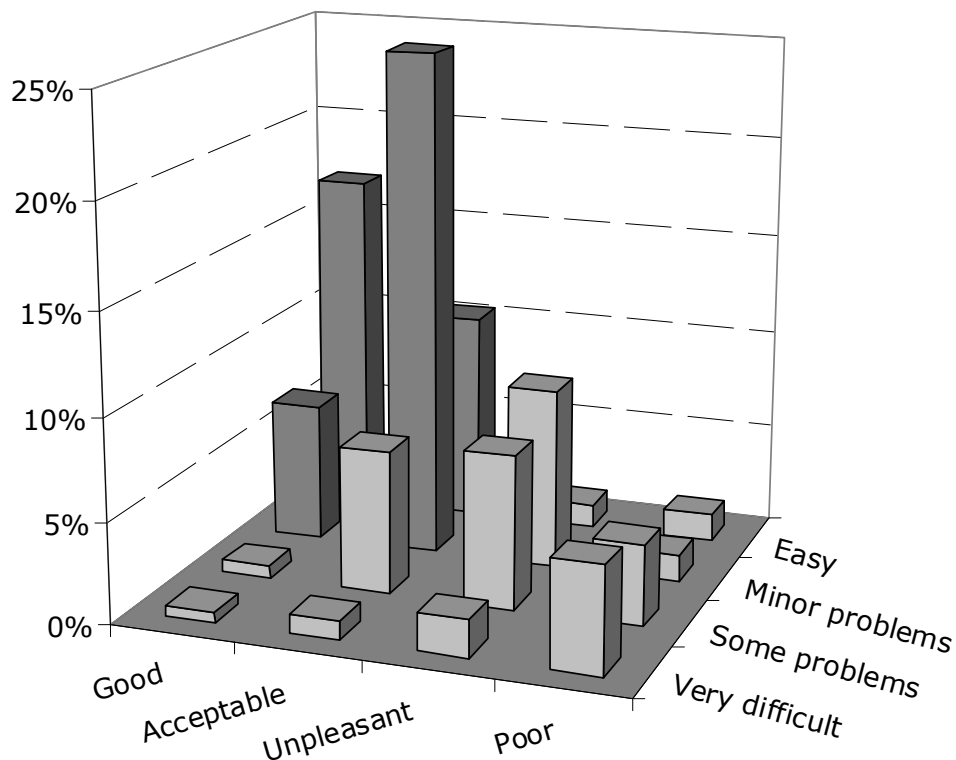


Figure 4.4 Happiness with the chosen alternative

Table 4.6 shows the associations of these indicators of perceived behavioural control and satisfaction with post-strike opinions. In both waves, respondents gave their opinion about the strike: 87% did not change their opinion about the strike, 10% were more positive afterwards than beforehand, and 3% were more negative. Changing opinion was positively associated with satisfaction and happiness with the chosen alternative ($p < .01$) and with the stated probability of choosing the same alternative on a next, similar occasion ($p < .05$).

Table 4.6 Perceived behavioural control, satisfaction and post-strike opinions

Variable	What is your opinion about the information provided by NS in the days before and on the day of the strike?				What is your opinion about the strike?				Would you choose the same alternative on a next, similar occasion?				Total
	Good	Sufficient	Insufficient or bad	χ^2	Approve	Neutral	Disapprove	χ^2	Yes	Only if no alternative	No	χ^2	
Perceived behavioural control													
Easy	60%	36%	4%		46%	5%	49%		61%	17%	22%		291
Minor problems	46%	49%	5%	***	29%	5%	66%	***	24%	38%	38%	***	414
Some problems	43%	50%	7%		14%	4%	82%		4%	51%	45%		188
Very difficult	36%	56%	8%		10%	5%	85%		10%	50%	40%		83
Satisfaction													
Good	56%	39%	5%		59%	3%	38%		73%	10%	17%		244
Acceptable	49%	47%	4%	**	27%	8%	65%	***	23%	37%	40%	***	426
Unpleasant	42%	54%	4%		13%	4%	83%		3%	54%	43%		190
Poor	44%	45%	11%		4%	2%	94%		6%	55%	39%		116
Happy ^a													
Yes	53%	43%	4%	**	42%	6%	52%	***	46%	25%	29%	***	581
No	43%	50%	7%		11%	4%	85%		5%	51%	44%		395
Total (%)	49%	46%	5%		29%	5%	65%		30%	35%	35%		976

Notes: n=976; row %; *** p<.001; ** p<.01. ^a the variable *happy* has value 'yes' if *perceived behavioural control* was scored either 'minor problems' or 'easy' AND *satisfaction* was scored either 'acceptable' or 'good'; otherwise, *happy* has value 'no' (see Figure 4.4).

4.4 Discussion and conclusion

The behavioural reactions observed in this sample were comparable to those observed in former studies of strikes (see Section 3.2), which showed that roughly between one out of every two or three travellers cancels her/his trip. It could be argued that 44% trips cancelled is a high number for a one-day strike. The multinomial logistic analysis showed that the choice to abandon the trip was more likely for trips that were made frequently and trips for commuting or education purpose. It is perhaps not surprising that scheduled activities like school were more difficult to shift in time and therefore more likely to be cancelled, either by students or by the schools themselves. For work trips it is, however, more complex. Some jobs come with the possibility to work from home or telework, which makes skipping a day at the office less burdensome and limits productivity losses. In other cases, however, cancelling the trip usually comes at the cost of taking a day off (see also Table 4.1).

The fact that the strike was pre-announced, gave people who intended to travel by train the opportunity to make other plans: many people travelling for commuting or business purposes switched to the car, either their own or a borrowed/rented one. Switching to car was considerably less likely for people aged under 20. For this variable it is pretty safe to state that this had less to do with willingness and more to do with ability: driving licence and car ownership will be low in this group. Ability may also play a role in the choice to pursue the activity travelling by another mode (as passenger) on short and middle distance trips. The number of private and public travel alternatives available, including the possibility to organise a carpool with a car owning colleague, is probably much higher.

Previous studies have shown that public transport strikes may have a lasting effect on ridership. Friman, Edvardsson and Gärling (2001) argued that satisfaction with the characteristics of the journey is an important

factor in the traveller's decision to persist in an established travel pattern or to change travel behaviour. It is mainly critical incidents with a transport alternative, i.e. experiences that were particularly (dis)satisfying, that may motivate people to search for alternatives and adapt or change their chosen course of action. Popular examples of critical incidents in public transport are (the consequences of) random effects on the supply side, such as vehicle breakdowns and signal failures (Friman & Gärling 2001; Bates et al. 2001; van Exel 2003). Strikes also provide a prominent example. People are forced to break with an established travel pattern, to reconsider their travel choice set, and to (re)acquaint themselves with alternative travel options. Whether this particular strike, as a single or cumulative event, will lead to a change in ridership is of course difficult to say with the data at hand. What we observed in this sample is that, despite the high level of agreement with the unions' underlying objectives for the strike, two out of three respondents disapproved of the strike, and about half indicated that the rail company's image was damaged, while perceived behavioural control and satisfaction with the chosen alternative on the day of the strike were rated fairly high. One could argue, therefore, that the dissatisfaction with rail and the satisfaction with the chosen alternative would make some level of permanent modal change likely. Yet, happiness with the chosen alternative was lowest among people who chose to pursue their activity travelling by car, even though the anticipated chaos on roads did not happen (see Textbox 5.1). In addition, as could be seen from the sizeable negative intercept value for 'same day, car (as driver)' (see Table 4.4), the preference for car was not particularly high in this sample, which is not uncommon among people with a preference for public transport (see Chapter 7). Therefore, at least the modal shift to car may be expected to be minimal.

Chapter 4

As highlighted in the introduction, this was a unique dataset in the sense that it contained pre- and post-strike information from the same respondents, making it possible to investigate and compare what people intended to do in reaction to the rail strike, what they eventually did, and how they perceived their chosen alternative. It made clear, for instance, the importance of experience for the coherence between stated and revealed preferences: frequent train travellers, season-ticket holders, and people travelling for commuting, business and education purposes most often stuck to their plan. Whether this inertia is the result of habituation or well-articulated preference is difficult to say. The main downside of this analysis is, of course, that it concerns a secondary analysis. The limited number of variables and the way some questions and response categories were formulated, as discussed, confines the analysis and the conclusions that can be drawn from it. If the data had been collected for the purpose of our research questions, at least the following variables would have been of interest: driving licence, car ownership and access, alternative private and public travel modes available for the specific trip, importance/urgency of the activity, and flexibility of the activity in time and space. This information would have provided better insight into the actual travel choice set people have, and therefore make it possible to distinguish more clearly between ability and willingness to change travel behaviour in relation to the (objective or subjective) travel choice set.

Could you also have made this trip by another mode?

Could you also have made this trip by another mode?



Chapter 5 is based on: 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: Policy and Practice* 43(4): 374-385 [http://dx.doi.org/10.1016/j.tra.2008.11.004]

5.1 Introduction

In most Western countries car ownership and use have increased dramatically since the 1960's. By now, each second person in the EU owns a car and between 80% and 90% of all passenger kilometres are made by car. Taking into consideration the large differences in car ownership and use between EU Member States and the even higher figures in the US, these levels are not yet saturated and this trend may be expected to persist. The increase in car ownership and use has generated traffic congestion. Particularly in the more densely urbanised areas congestion has become a common and persistent phenomenon. Peak hours have increased in duration and intensity, and at times, traffic comes to a complete standstill. This has made the accessibility of major cities and travel time reliability one of the most prominent issues among car drivers and transport policy makers. National, regional and urban transport authorities have considered many different policies to deal with increasing traffic demand, and, in the last decade, policy focus has increasingly shifted from 'predict and provide', which was aimed at accommodating demand and has been little effective, to 'demand management' and 'reducing the need for travel' (Lyons et al. 2000).

Chapter 5

This paradigm shift has only increased the need to understand individual travel behaviour. Goodwin (1995) already argued that there is one simple but important proposition for travel behaviour analysis that arises from past research: people differ. There is, therefore, little point in designing policies directed at the average car driver, and more to be expected from identifying distributions of differences among individuals and addressing significant subgroups in different ways. In other words, policy interventions need to be more responsive to the different motivations and constraints of different travel behaviour segments (Anable 2005; Raney et al. 2000). Many strategies were proposed for distinguishing between groups of travellers, for instance, based on clusters of travel attitudes, motivations or preferences (e.g. Lois & López-Sáez 2009; Rajé 2007; Johansson et al. 2006; Anable 2005; Ory & Mokhtarian 2005; Steg 2005; van Exel, de Graaf & Rietveld 2005; Götz et al. 2003; Bamberg & Schmidt 2001; Pas & Huber 1992), behavioural repertoires for different activities, locations, time frames, stages in family lifecycle or imperative social roles (e.g. Kitamura 2009; Diana & Mokhtarian 2009; Anable & Gatersleben 2005; Hailu et al. 2005; Mokhtarian & Salomon 1997; Orfeuil & Salomon 1993; Huff & Hanson 1990; Jones et al. 1983), and homogeneity in travel behaviour, car dependence or travel habits (e.g. Schlich 2003; Gärling et al. 1998; Rooijers & Welles 1996; Kropman & Katteler 1990; Hanson & Huff 1988). Arguably, these approaches are similar in distinguishing between people based on their (perceived) travel possibilities, but differ in their explanation of why and how these differ.

Mokhtarian and Salomon (1997) and Raney et al. (2000), among others, stated that people have a choice set of travel alternatives from which they make their travel decisions which is different from the total set of available alternatives. This restricted travel decision-making model, they argued, constitutes one of the main gaps between the rational travel behaviour assumption underlying much of transport economics and

Could you also have made this trip by another mode?

observed travel behaviour, making the predictions of transport models less accurate and the transport policies based on them less effective. For understanding travel behaviour, it is important to distinguish between people with different choice sets (Wardman & Tyler 2000; Fischer 1993). A person's objective choice set -or opportunity set (Burnett & Hanson 1982)- is determined by the location of activities, the theoretically available travel alternatives (i.e. the supply characteristics of the transport system in terms of road infrastructure, public transport provision, transport policy and fiscal regulations), and the person's capabilities to walk, cycle, use public transport or to drive a car. A person's subjective choice set -or consideration set (Punj & Brookes 2001)- concerns the set of choice alternatives the person is aware of and considers feasible and acceptable. This is the set that is actively considered in the choice process and is a subset of the objective choice set; the size of this set varies from all theoretically available alternatives to a single or even no alternative. The choice set of a captive or highly inert traveller, for instance, may consist of a single mode, perhaps even in combination with a mandatory route and departure time. In addition, Louvière and Street (2000) argued that it is useful to distinguish between choice set formation and objective choice given the choice set. Goodwin (1977) and Windervanck and Tertoolen (1998), for instance, claimed that commuters evaluate travel alternatives only occasionally, in response to some large change in situation like a change of home or work location. Subsequently, people thoughtlessly stick to the chosen alternative, until a next major change occurs in the transport system or in their personal lives. Meanwhile, people may persist in sub-optimal travel patterns, on the basis of misperceptions of features of non-chosen travel alternatives, in particular concerning travel time (Kingham et al. 2001).

The objective of this chapter is to investigate the perceived travel possibilities (or subjective choice set, consideration set) of car and train

travellers on the main travel corridors to the City of Amsterdam, The Netherlands, and associations of perceived travel possibilities with characteristics of the traveller and the trip.

5.2 Methods and data

We conducted secondary analysis on travel survey data from train and car travellers collected and processed on behalf of the Dutch Ministry of Transport for the MORA project (MobiliteitsOnderzoek Regio Amsterdam / Mobility Survey Region Amsterdam; MoT 2001). Objective of the MORA project was to gain more insight into the accessibility of the City of Amsterdam, as supporting information for regional transport policy development and monitoring. Focus of the data collection was on the composition of passenger car and rail traffic in the direction of the city, in terms of traveller and trip characteristics.

Study area

The study area covered the six main road and rail corridors connecting to Amsterdam (see Figure 5.1). All road corridors connect to the Amsterdam ring road, have high traffic intensity throughout the day, and are highly congested during peak hours. All rail corridors connect to Amsterdam Central Station.

Over 110 thousand survey questionnaires were distributed to people travelling in the direction of Amsterdam on one of the six corridors on any one of three survey days in September 2000. The study sample therefore consists of non-urban, longer-distance trips (≤ 10 kilometres). Because the questionnaires that were administered among public transport and car travellers were partly different, the samples will be presented as separate studies: 'study 1' concerns the train travellers and 'study 2' the car travellers.

Could you also have made this trip by another mode?

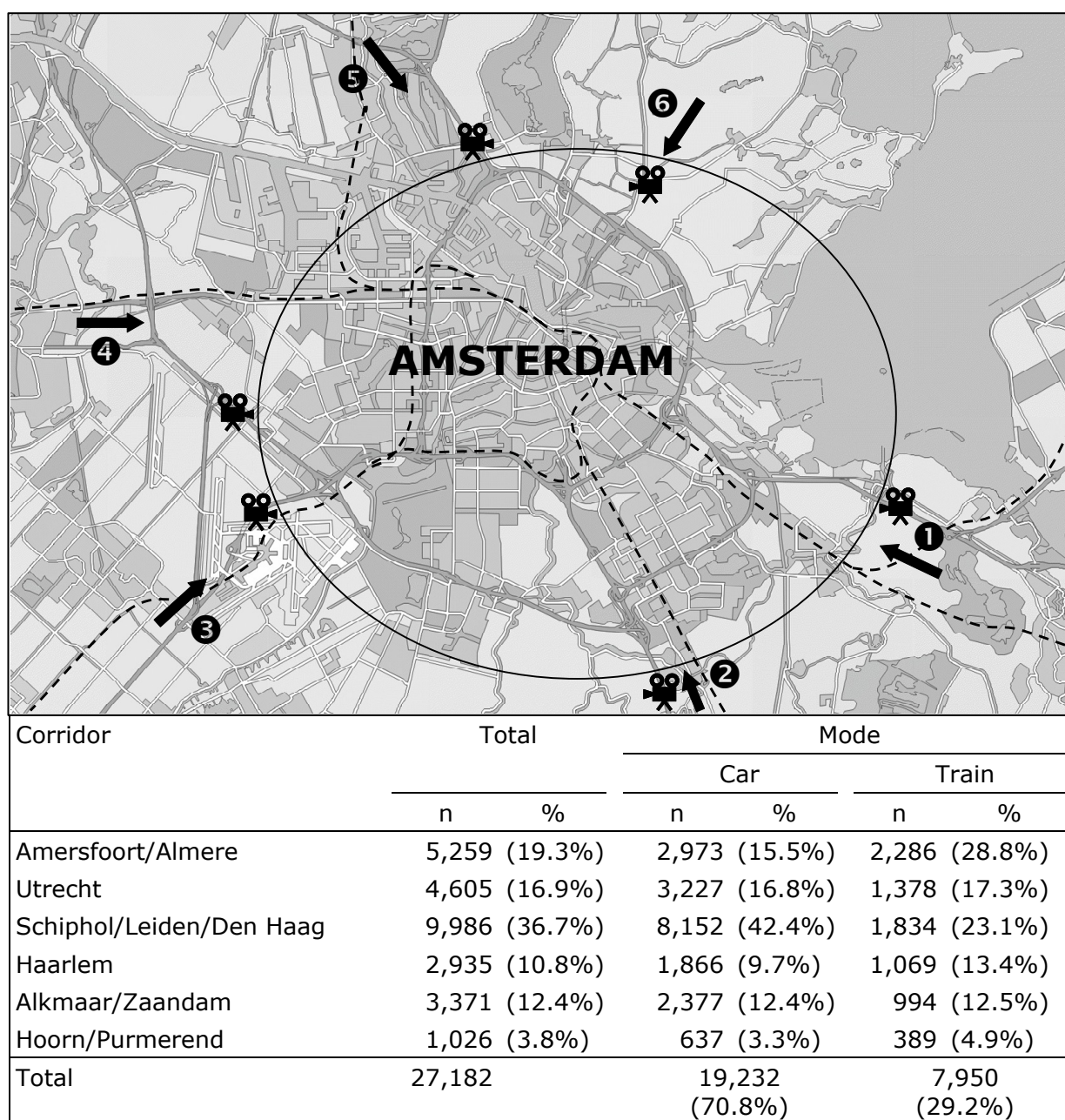


Figure 5.1 Study area and sample size ⁶¹

Study 1: train travellers

Public transport travellers were approached in trains and on bus platforms with a take-home questionnaire. The survey questionnaire included questions concerning trip origin and destination, trip purpose, trip

⁶¹ Source: based on MoT (2001) and www.amsterdam.nl.

Chapter 5

frequency, trip chain (access, main and egress modes, and travel time), ticket type, and payment of trip costs. In addition, the questionnaire included a question asking public transport users whether they had car as alternative mode of travel in their choice set for the trip they made on the day of the survey: "Could you also have made this trip by car?", with possible answers 'no', 'yes, sometimes do' and 'yes, mostly do'. Finally, public transport users were asked the main reasons why they chose public transport instead of car for that specific trip. A total of 41,225 questionnaires were distributed among train and bus travellers; 9,934 (24%) completed questionnaires were returned. Response was representative of travellers on the six corridors of study, at different times of day (MoT 2001). After data cleaning and removing observations with missing data on key variables for the current analysis, 8,303 useful questionnaires remained. Finally, because of the relatively small proportion in the total sample, 273 (3.3%) bus travellers were discarded from further analysis, as were 79 (1.0%) trips with unknown origin. Analysis was thus conducted using data of 7,950 train travellers (80.0% of total sample).

Study 2: car travellers

Car travellers were identified through video licence-registration and were sent a questionnaire to their home address. The survey questionnaire included general questions concerning trip origin and destination, trip purpose, travel time, trip frequency, vehicle type, vehicle ownership, payment of trip costs, number of passengers, parking facilities and costs at trip origin and destination, and whether the driver had shifted departure time of the trip because of anticipated congestion. This questionnaire also included a question asking car users: "Could you also have made this trip by public transport?" with possible answers 'no', 'yes, but rarely do' and 'yes, regularly do'. Finally, car users were asked to estimate total travel time by public transport for the same trip they had

Could you also have made this trip by another mode?

made on the day of the survey. A total of 69,616 questionnaires were sent out to car travellers; 22,771 (33%) completed questionnaires were returned. Response was representative of travellers on the six corridors of study, at different times of day (MoT 2001). After data cleaning and removing observations with missing data on key variables, 19,232 useful questionnaires remained for analysis (84.5% of total sample). The final sample included 1,590 (8.3%) observations with a missing value for estimated travel time by public transport. Because this largely (89.8%) concerned people who answered 'no' to the question "Could you also have made this trip by public transport?", it was hypothesised that a missing value may be informative for the analysis. A dummy variable was generated and included in the analysis to test this hypothesis.

Analysis

Associations of respondents' answers with the question "Could you also have made this trip by [public transport/car]?" with characteristics of the traveller and the trip were analysed using multinomial logistic regression, with the option 'no' as reference category. Given the possible answers categories one might think that ordered logit or probit analysis would be in place rather than multinomial logistic analysis. We have used ordered probit to analyse the data; interesting enough, it appears that the boundary parameters (or alternative-specific constants) that are estimated with the ordered probit model for the various response intervals include a negative value. This is a sign of a specification error (Maddala 1983). Because the coefficients of multinomial logistic models are generally difficult to interpret directly, marginal effects of each variable on each possible answer were computed. In the public transport sample, two models were estimated: Model 1 is the restricted model, including common traveller and trip characteristics as explanatory variables; Model 2 also included respondents opinions on five reasons for choosing public transport over car and two housing choice variables. Comparable

information was not available in the car travellers sample. Hereafter, we present the findings from these separate surveys consecutively, followed by joint discussion and conclusions.

5.3 Results

Study 1: public transport travellers

Table 5.1 presents the public transport travellers sample. About 73% of public transport trips had City of Amsterdam as destination. Mean travel time was 79 minutes (72 for Amsterdam, 99 for through-traffic; 71 for commute, 94 for business, 78 for education and 95 for social/recreational purpose). Figure 5.2 shows that less than half of the travellers had a car in their choice set for the trip they made on the day of the survey.

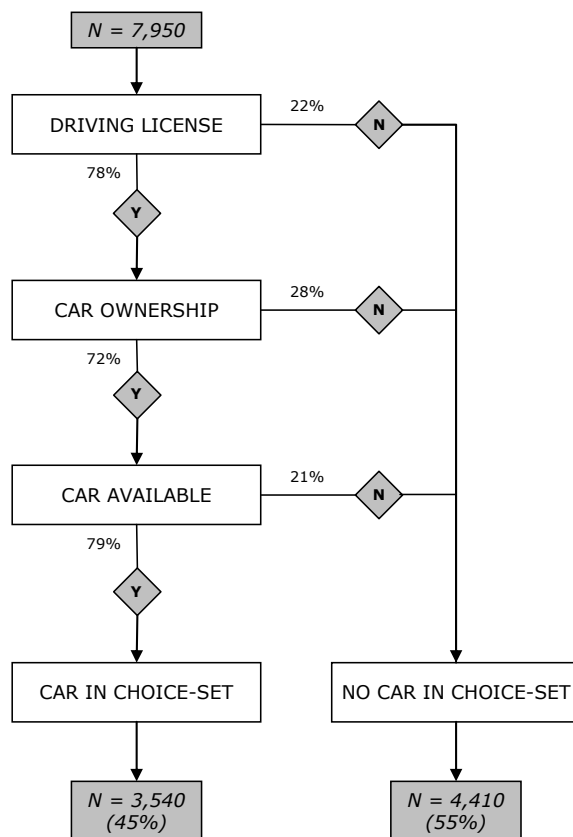


Figure 5.2 Car in choice set?

Could you also have made this trip by another mode?

Table 5.1 Characteristics of train users (n=7,950)

Variable		N (%)
Trip destination	Amsterdam city centre	3,022 (38.0%)
	Amsterdam periphery	2,794 (35.1%)
	Through-traffic	2,134 (26.8%)
Trip purpose	Commute	4,368 (54.9%)
	Business	616 (7.7%)
	Education	1,244 (15.6%)
	Social/recreational	1,722 (21.7%)
Trip frequency	Less than once a week	1,781 (22.4%)
	1 or 2 times a week	970 (12.2%)
	3 or 4 times a week	2,169 (27.3%)
	5 times a week or more	3,030 (38.1%)
Time of day	Morning peak (7:00-9:30)	2,933 (36.9%)
	Off-peak (9:30-16:00)	2,942 (37.0%)
	Afternoon peak (16:00-19:00)	2,075 (26.1%)
Total travel time by public transport ^a	up to 60 minutes	3,025 (38.1%)
	61 to 90 minutes	2,996 (37.7%)
	91 to 120 minutes	1,166 (14.7%)
	More than 120 minutes	763 (9.6%)
Access travel ^b	Walk or bicycle	5,378 (67.6%)
Egress travel ^b	Walk or bicycle	4,728 (59.5%)
Who is paying for this trip ^c	Me	2,344 (29.5%)
	Employer/Ministry of Education	3,854 (48.5%)
	Both	1,752 (22.0%)
Type of ticket	Single, (5-)return or day ticket	3,148 (39.6%)
	Student public transport card ^b	1,582 (19.9%)
	Season-ticket	3,220 (40.5%)
Driving licence	Yes	6,210 (78.1%)
Car ownership	Yes	6,225 (78.3%)
Car in choice set for this trip ^d	Yes	3,540 (44.5%)

Note: ^a mean = 79 minutes. ^b walk or bicycle (including multi-modal access/egress trip with walk or bicycle as main mode) versus all other modes except rail. ^c students of 18 years and older in the Netherlands receive a student public transport card from the Ministry of Education as part of their education grant; students can choose between a week and a weekend card, allowing for free use of all public transport in the part of the week of their choice and a 40% (rail) or 50% (other public transport) discount during the remainder of the week. ^d People that had a driving-licence and a car available for this trip (945 [15.2%] car owners could not avail of the car on that day, for that trip).

Chapter 5

Figure 5.3 shows the reasons for choosing public transport instead of car, among public transport travellers with car in their choice set. The accessibility of the City of Amsterdam in terms of congestion and parking were considerably more important reasons than the benefits of public transport. Furthermore, 684 (8.6%) of train travellers indicated to have chosen their housing location as close as possible to their work location, and 463 (5.8%) as close as possible to a rail station.

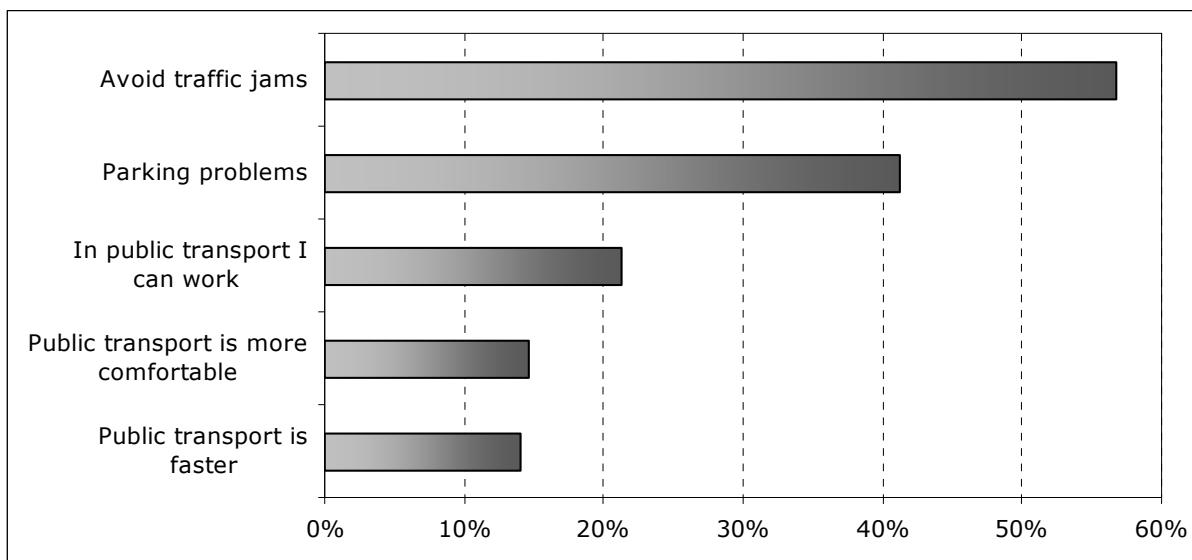


Figure 5.3 Main reasons for choosing public transport instead of car ⁶²

Multinomial logistic regression (see Table 5.2)⁶³ showed that about 27% of railway travellers who have access to a car nevertheless never would use the car for this trip. The category that mostly uses the car is 4%; the remaining 69% is in the middle category. In model 1, a 'no' to considering the car as an alternative was more likely in case of trips with destination Amsterdam city centre, trip purpose education, longer travel times (with a

⁶² Note: more than one response possible (n=3,540).

Could you also have made this trip by another mode?

peak at 89 minutes), access travel by foot or bike, and public transport commitment in the form of a season-ticket or a student public transport card (i.e. 'sunk costs'), while 'no' was less likely in case the trip was paid by traveller her-/himself. The answer 'yes, sometimes do' was more likely if the trip was paid by traveller her-/himself, and less likely for trips with destination Amsterdam city centre, trip purpose education, longer travel times (with a peak at 84 minutes), and in case of public transport commitment. Finally, 'yes, mostly do' was less likely for trips with destination Amsterdam, trip purpose commuting, frequent trips, access travel by foot or bike, trips paid for by the traveller and the employer (or Ministry of Education), and in case of public transport commitment. The result for the explanatory variable 'paying for the trip: me' is remarkable: those who pay for their trip avoid the extremes of never considering the car or mostly using it. This reveals a tendency in travel cost compensation schemes (usually provided by the supplier) that they lead to restricted views on choice options: people either ignore the car as an alternative (apparently when the travel cost compensation is for public transport only) or they try to stick to car use as much as possible (apparently when the travel cost compensation is for the car).⁶⁴

The results of Model 2 were highly similar for the variables discussed above (see Table 5.2). In addition, regarding the unattractive aspects of travelling by car, people who indicated that they choose public transport in order to avoid traffic jams less often answered 'no' and more often 'yes, sometimes do', while those who choose public transport because of anticipated parking problems more often answered 'no' and less often 'yes, sometimes do' or 'yes, mostly do'. The reason for this opposite effect of 'avoid traffic jams' and 'parking problems' could be that traffic

⁶³ The reference case for this model is a through-traffic rail trip for social or recreational purpose, made less than once a week, off-peak, on a single, (5-)return or day ticket, using car or urban public transport as access and egress travel.

⁶⁴ Note that a similar effect is found in Table 5.4 for those who travel by car.

Chapter 5

congestion is confined to certain directions and times of day, so that one can plan around it, while parking problems are more structural both in terms of availability and costs. In support, the 'Destination: A'dam city centre' dummy is the one most affected by the addition of the extra variables in Model 2; this variable is no longer statistically significant for the 'yes, mostly do' response category (i.e. trip destination A'dam city centre is no longer associated with a lower likelihood of mostly using car for this trip) and this effect seems to have been taken over by recognisable characteristics of A'dam city centre: parking problems and better accessibility by public transport. Regarding the benefits of public transport, people who find public transport faster and more comfortable were more likely to answer 'no' and less likely 'yes, sometimes do' or 'yes, mostly do', while those who appreciate the possibility to work during the trip more often answered 'yes, sometimes do' and less often 'no' or 'yes, mostly do'. Just like with the explanatory variable 'paying for the trip: me', those who appreciate the possibility to work en route appear to avoid the extremes of never considering the car or mostly using it. The interpretation of this effect is not straightforward, also because this variable does not distinguish clearly between people who just appreciate the possibility to work en route and those who actually desire to work en route.

The rationale behind this result could be that this feature of travelling by public transport is valued particularly by choice travellers, who switch between modes depending on the purpose of the trip and the characteristics of the available travel alternatives. Alternatively, it could be that working en route should be seen in interaction with the travel time variable, which gains in statistical significance in Model 2; this specific benefit of public transport would then specifically be of added value to people with intermediate travel times. Regarding the housing choice locations, people who chose to live close to a train station were more

Could you also have made this trip by another mode?

likely to answer 'no'. Though the set of five reasons for choosing public transport over car showed to have a statistically significant contribution to the model, the estimated average probabilities of the three possible answers were very similar and fairly similar to actual answers as well. Both models slightly overestimated the largest answer category 'yes, sometimes do', largely at the cost of 'yes, mostly do'.

Study 2: car travellers

Table 5.3 presents the car sample characteristics. About 56% of car trips had the City of Amsterdam as destination. Mean travel time was 61 minutes (49 for Amsterdam, 75 for through-traffic; 53 for commute, 70 for business, 65 for education and 65 for social/recreational purpose).

Multinomial logistic regression (see Table 5.4) showed that the share of car drivers who would not consider public transport as an alternative equals about 63%, which is much higher than the 26% found as a response to the mirror image question posed to public transport travellers. A 'no' was more likely in case of trips for business purpose, longer travel time, higher PT:car ratio or public transport travel time was not elicited, car trips by company or leased car, driver only, parking at a private parking place at origin or destination, car drivers who adjusted departure time to avoid congestion, and trips paid for by the employer. A 'no' answer was less likely for trips with destination Amsterdam, education purpose, parking at a paying public parking place at origin or destination, and trips paid for by the traveller. The answer 'yes, but rarely do' was more likely for trips with destination Amsterdam, education purpose, parking at a paying public parking place at origin or destination, and trips paid for by the traveller, while it was less likely for trips with business purpose, longer travel time, higher PT:car ratio or public transport travel time was not elicited, car trips by company or leased car, driver only, parking at a private parking place at origin or destination, and car drivers who adjusted departure time to avoid congestion.

Table 5.2 Possibility to use the car among train users with the car in their choice set; marginal effects

	MODEL 1: Could you also have made this trip by car?						MODEL 2: Could you also have made this trip by car?					
	Yes, mostly do ^a		Yes, sometimes do ^b		No ^c		Yes, mostly do ^a		Yes, sometimes do ^b		No ^c	
	dy/dx	S.E.	dy/dx	S.E.	Dy/dx	S.E.	dy/dx	S.E.	dy/dx	S.E.	dy/dx	S.E.
Destination: A´dam city centre	-0.018 **	0.007	-0.099 ***	0.021	0.117 ***	0.021	-0.010	0.007	-0.078 ***	0.022	0.088 ***	0.022
Destination: A´dam periphery	-0.023 **	0.007	0.005	0.022	0.017	0.022	-0.019 **	0.007	0.007	0.022	0.012	0.022
Trip purpose: commute	-0.027 *	0.010	0.041	0.028	-0.014	0.028	-0.026 **	0.010	0.020	0.028	0.006	0.028
Trip purpose: business	-0.003	0.009	0.017	0.033	-0.014	0.033	-0.001	0.009	-0.006	0.034	0.007	0.034
Trip purpose: education	-0.013	0.009	-0.087 *	0.039	0.100 *	0.039	-0.010	0.009	-0.104 **	0.040	0.114 **	0.040
Trip frequency: high ^d	-0.063 **	0.023	0.007	0.041	0.056	0.038	-0.057 **	0.021	0.003	0.040	0.053	0.038
Time of day: peak hours	0.009	0.006	-0.016	0.018	0.008	0.018	0.007	0.006	-0.019	0.018	0.012	0.018
Travel time by PT (hours) ^e	-0.004	0.020	-0.095	0.062	0.099	0.062	-0.006	0.018	-0.160 *	0.063	0.167 **	0.063
Travel time by PT (hours squared)	-0.001	0.005	0.034 *	0.018	-0.033 *	0.018	0.000	0.005	0.047 *	0.019	-0.048 *	0.019
Access: walk or bicycle	-0.026 **	0.008	-0.004	0.017	0.030 *	0.017	-0.021 **	0.007	-0.010	0.017	0.031 *	0.017
Egress: walk or bicycle	-0.010	0.007	0.015	0.017	-0.005	0.016	-0.008	0.006	0.014	0.017	-0.007	0.016
Paying for trip: employer	-0.059 **	0.019	0.030	0.028	0.030	0.025	-0.059 **	0.018	0.025	0.028	0.034	0.025
Paying for trip: me	-0.022 *	0.012	0.067 **	0.021	-0.046 *	0.020	-0.019 *	0.011	0.065 **	0.021	-0.046 *	0.020
Ticket: season-ticket	-0.044 ***	0.009	-0.052 *	0.021	0.096 ***	0.020	-0.039 ***	0.008	-0.057 **	0.021	0.096 ***	0.020
Ticket: student PT card	-0.033 ***	0.007	-0.091 *	0.039	0.124 **	0.039	-0.033 ***	0.006	-0.099 *	0.039	0.132 **	0.039
Reasons for choosing PT over car												
- Avoid traffic jams							0.008	0.006	0.050 **	0.017	-0.058 **	0.017
- Parking problems							-0.021 ***	0.006	-0.053 **	0.018	0.074 ***	0.017
- PT is faster							-0.019 **	0.007	-0.068 **	0.024	0.086 ***	0.024
- PT is more comfortable							-0.021 **	0.006	-0.029	0.024	0.049 *	0.024
- In PT I can work							-0.018 **	0.007	0.063 **	0.020	-0.045 *	0.019
Chose housing as close as possible												
- To work location							0.010	0.014	0.003	0.035	-0.013	0.034
- To train station							-0.005	0.013	-0.046	0.030	0.051 *	0.029
Estimated average probability	4.3%		68.6%		27.1%		3.9%		69.2%		26.9%	

Note: n=3,540; *** p<.001; ** p<.01; * p<.10. ^a N=239 (6.8%). ^b N=2,325 (65.7%). ^c N=976 (27.5%). ^d once a week or more. ^e PT = public transport.

Could you also have made this trip by another mode?

Table 5.3 Characteristics of car travellers (n=19,232)

Variable		N (%)
Trip destination	Amsterdam city centre	2,966 (15.4%)
	Amsterdam periphery	7,792 (40.5%)
	through-traffic	8,474 (44.1%)
Trip purpose	commute	8,830 (45.9%)
	business	3,531 (18.4%)
	education	364 (1.9%)
	social/recreational	6,507 (33.8%)
Trip frequency	less than once a week	8,157 (42.4%)
	1 or 2 times a week	2,757 (14.3%)
	3 or 4 times a week	3,045 (15.8%)
	5 times a week or more	5,273 (27.4%)
Time of day	morning peak (7:00-10:00)	4,229 (22.0%)
	off-peak (10:00-16:00)	10,132 (52.7%)
	afternoon peak (16:00-19:00)	4,871 (25.3%)
Total travel time by car ^a	up to 60 minutes	12,971 (67.4%)
	61 to 90 minutes	3,688 (19.2%)
	more than 90 minutes	2,573 (13.4%)
Car ownership	private	16,490 (85.7%)
	leased	1,240 (6.4%)
	company	1,502 (7.8%)
Car occupancy ^b	driver only	14,226 (74.0%)
	driver and passenger(s)	5,006 (26.0%)
Parking trip origin	private ground/facility	9,999 (52.0%)
	public parking place (free)	7,752 (40.3%)
	public parking place (paying)	1,481 (7.7%)
Parking trip destination	private ground/facility	8,980 (46.7%)
	public parking place (free)	6,285 (32.7%)
	public parking place (paying)	3,967 (20.6%)
Shifted departure time to avoid congestion?	no	12,205 (63.5%)
	yes, left later ^c	2,163 (11.2%)
	yes, left earlier ^d	4,864 (25.3%)
Who is paying for this trip	me	10,568 (55.0%)
	my employer	4,339 (22.6%)
	together	4,325 (22.5%)

Note: ^a mean = 61 minutes. ^b mean = 1.37. ^c mean = 60 minutes. ^d mean = 34 minutes.

Chapter 5

Table 5.4 Possibility to use public transport among car travellers; marginal effects

	Could you also have made this trip by public transport?					
	Yes, regularly do ^a		Yes, but rarely do ^b		No ^c	
	dy/dx	S.E.	dy/dx	S.E.	dy/dx	S.E.
Destination: A´dam city centre	0.013 ***	0.003	0.087 ***	0.012	-0.101 ***	0.012
Destination: A´dam periphery	0.010 ***	0.002	0.045 ***	0.009	-0.055 ***	0.009
Trip purpose: commute	0.012 ***	0.003	-0.024	0.013	0.012	0.013
Trip purpose: business	-0.003	0.003	-0.122 ***	0.012	0.125 ***	0.012
Trip purpose: education	0.039 **	0.012	0.082 **	0.029	-0.121 ***	0.030
Trip frequency: high ^d	-0.027 ***	0.003	0.006	0.011	0.021	0.011
Time of day: peak hours	-0.005 **	0.002	-0.010	0.008	0.015	0.008
Travel time by car	-0.033 ***	0.004	-0.258 ***	0.019	0.291 ***	0.019
Travel time by car (square)	0.004 ***	0.001	0.037 ***	0.004	-0.041 ***	0.005
Travel time ratio PT:car ^e	-0.039 ***	0.002	-0.174 ***	0.006	0.213 ***	0.006
Travel time PT not elicited ^f	-0.039 ***	0.002	-0.400 ***	0.005	0.439 ***	0.005
Car ownership: company	-0.014 ***	0.003	-0.118 ***	0.015	0.132 ***	0.015
Car ownership: leased	-0.015 ***	0.003	-0.062 ***	0.016	0.077 ***	0.016
Car occupancy: driver only	0.003	0.002	-0.051 ***	0.010	0.048 ***	0.010
Parking origin: private	-0.003	0.002	-0.030 ***	0.008	0.033 ***	0.008
Parking origin: public (paying)	-0.003	0.003	0.037 *	0.015	-0.034 *	0.015
Parking dest.: private	-0.003	0.002	-0.023 **	0.009	0.026 **	0.009
Parking dest.: public (paying)	0.000	0.002	0.023 *	0.011	-0.022 *	0.011
Shifted departure time: yes	-0.003	0.002	-0.023 **	0.008	0.026 **	0.008
Paying for trip: employer	-0.011 ***	0.002	-0.010	0.010	0.021 *	0.011
Paying for trip: me	-0.001	0.003	0.046 ***	0.013	-0.045 **	0.013
Estimated average probability	2.5%		35.0%		62.5%	

Note: n=19,232; *** p<.001; ** p<.01; * p<.10. ^a N=960 (5.0%). ^b N=7,097 (36.9%). ^c n=11,175 (58.1%). ^d Once a week or more. ^e Ratio travel time PT:car for respondents that elicited public transport travel time for the same trip (n=17,642); else 0. ^f Dummy variable with value 1 for respondents that did not elicit public transport travel time for the same trip (n=1,590); else 0. The reference case is a through-traffic car trip for social or recreational purpose, made less than once a week, off-peak, in a privately owned car, using a public parking place free of charge at origin and destination, without shifting departure time to avoid congestion.

Could you also have made this trip by another mode?

Finally, 'yes, regularly do' was a more likely answer for trips with destination Amsterdam, commuting and education purpose, while it was less likely for frequent trips, during peak hours, longer travel time, higher PT:car ratio or public transport travel time was not elicited, car trips by company or leased car, and trips paid for by the employer. The estimated average probabilities of the three possible answers were very fairly similar to actual answers, the largest answer category 'no' was overestimated, largely at the cost of 'yes, regularly do'.

5.4 Discussion and conclusion

Here we have presented the results of a secondary analysis of data from a large travel survey on the main rail and road corridors connecting to the City of Amsterdam. In the public transport sample we found that trip destination, who was paying for the trip and public transport commitment in terms of season-ticket ownership were particularly important determinants of people's consideration sets. In addition, education as trip purpose was an indication for not having a car in the choice set. To a large extent this effect can be attributed to a particular age group (students), in which driving licence and car ownership are expected to be lower. This effect comes in addition to the effect of the student public transport card this group receives. In the car sample we found quite a few statistically significant associations, all in plausible directions. What stood out most was the effect of relative PT:car travel time, both the ratio and the missing value dummy, but also the effect of replacing estimated with objective public transport travel time. Considerable effects were also found for the 'Destination: A'dam city centre', trip purposes business and education, and car ownership variables, in particular when one considers the interaction between trip purposes business and the car ownership

Chapter 5

variables. People driving company or leased cars tend to be more inert in their travel mode choice, particularly for business trips.

Some of the findings in both samples have clear policy implications. First and perhaps strongest is the effect of travel time perceptions. Our results indicate that there is ample space for improving the image of public transport among car users, in particular among those who use public transport infrequently, and so contribute to rationality in travel decision making. Second, parking charges for public parking places in the car sample and parking problems more in general in the public transport sample appear to work in favour of public transport; this effect is probably even stronger than the marginal effects for these variables suggest, considering that these are over and above the substantial effect of trip destination Amsterdam, where parking places are scarce and tariffs are substantial (i.e. €2.8 per hour for on-street parking [city centre, year 2001]). This supports earlier findings of the effect of parking fees on mode choice behaviour (e.g. Hess 2001; Wilson 1992). Finally, we found a considerable effect of who is paying for the trip; in both samples travellers who pay for their trip themselves appear to have a broader consideration set, while travellers who get their trip paid by their employer tend to be more inert (In the public transport sample this effect is also reflected in the season-ticket variable, which is the most common way to finance public transport for employees.). This suggests that employers could play an important role in promoting public transport use; policy makers could provide employers with incentives to do so.

Getting access to a large set of existing data in our field of interest was a great opportunity, and the analysis of these data, we believe, lead to interesting results. But it was also a bit of a blessing in disguise. Because the data were not collected for the purpose of our study, some variables of interest for answering our research questions were not included in the dataset. This especially concerns some personal characteristics of

Could you also have made this trip by another mode?

respondents that are usually included in similar analyses, like for instance, gender, age, education level, occupation, income, et cetera, but also more specific information about people's actual travel choice set and how it was formed. To some extent, this limits the comparability with similar research. Furthermore, there was a remarkable difference in choice spectrum between the samples. Public transport travellers were asked to classify themselves in a spectrum ranging from 'no' to 'mostly', while car travellers were offered a range from 'no' to 'regularly'. Looking at the observed distribution over the answer categories (see notes at bottom of Tables 2 and 4), it does not look like car users were hampered by a ceiling effect in their choice spectrum. Still, we suggest that future replications of this survey use the same spectrum for both groups, consisting of more categories so that differences in choice probabilities can be observed.

We found a substantial effect of deviant perceptions of public transport travel on car travellers' choice sets. This underlines the theoretical relevance of distinguishing between actual and perceived choice sets, especially in relation to modal shift policies. Changing distorted perceptions of travel alternatives directly affects the relative attractiveness of alternatives, and while this may not necessary lead to modal shift, it may at least promote inclusion of public transport in travel consideration sets. In the past, many travel demand management (TDM) experiments have been conducted with informing people about their travel alternatives by means of offering travel plans or trial periods with public transport. Though such programmes may not induce large effects (e.g. Hensher & Puckett 2007; Gärling & Schuitema 2007; Chorus et al. 2006; Loukopoulos et al. 2004), they may thus contribute to the rationality of travel choice.

The effect of experiencing alternatives on modal share is also apparent in the case of a public transport strike, as discussed in chapters 3 and 4. When the preferred alternative of public transport travellers is removed

Chapter 5

from their choice set, from a theoretical perspective, they are forced to (re)try the next best alternative in their preference ordering. In chapter 3 we discussed various studies showing that public transport strikes may lead to a permanent loss of ridership in the range of 0.3 to 2.5%, depending on the type of strike and the policy reaction to it. In the study presented in chapter 4 we found that people who switched to car during a public transport strike, on average, experienced high levels of perceived behavioural control and satisfaction with the chosen alternative. Nevertheless, the preference for car still proved to be fairly negative in this sample of public transport travellers, indeed making it more likely that the car was just added (or reconfirmed) to the consideration set following the positive experience, rather than inducing a sizeable, structural change in behaviour.

But then again, the objective of transport policy is not to abolish the car, but foremost to reduce (perceived) car dependency by increasing the relative attractiveness of alternatives to car, and promoting inclusion of these alternatives in car travellers' consideration sets. It is not car ownership that is the main problem, but instead the negative effects of our increasing use of the car. And luckily, these days, for many car users and policy makers this increasingly is far from an unbearable truth.

Travel time perceptions and travel choice



Chapter 6 is based on: N.J.A. van Exel, P. Rietveld. A note on perceptions of public transport travel time and their effect on choice sets among car drivers. *Journal of Transport and Land Use* 2010;2(3/4): 75–86.

6.1 Introduction

Reducing car use is a central topic in transport policy and research. Recent studies have shown that mode change requires making the car less attractive as well as increasing the awareness and knowledge of alternative modes of transport (e.g. Handy et al. 2005). One of the main barriers to the use of alternative modes are car drivers' distorted perceptions of their quality. Kenyon and Lyons (2003) for instance found that the majority of travellers rarely considered alternative modes for their journey. Travellers tended to disqualify alternatives in advance, particularly on familiar trips, based on perceptions of their viability and desirability. Kingham et al. (2001) observed that one of the main barriers for modal change among car drivers was the perception that alternatives were not viable in terms of travel time.

Car drivers' perceptions of alternative modes of transport are often not informed by experience or travel information (Kenyon & Lyons 2003). Handy et al. (2005) interviewed car drivers about possible reasons for excess car travel and reported that many people said they simply lacked information about alternative modes; only a part of these car drivers was willing to actually try whether public transport would work for them.

Chapter 6

Car drivers' perceptions are also often incorrect. Goodwin (1995) found that although 50% to 80% of people perceived themselves to be generally dependent on car use, only between 10% and 30% of trips could unambiguously be identified as both strictly necessary and provided with no alternative. In a corridor study, Kropman and Katteler (1990) found that although 83% of a sample of morning peak car drivers had the objective possibility to switch to public transport for the trip they were making, only one out of six of these car drivers perceived public transport as an alternative largely because of travel time and travel costs perceptions. Brög and Erl (1983) conducted in-depth analysis of car drivers' travel options and showed that half of their sample of car drivers had the objective opportunity to use public transport for the trip they were making, but that only 5% perceived to have a real choice between car and public transport.

Although distorted perceptions may have a considerable effect on mode choice, there is also evidence that perceptions can be changed and that this may lead to changes in attitudes, consideration of alternatives and mode choice behaviour. Kenyon and Lyons (2003) showed that presentation of information to habitual travellers about the cost, duration, comfort and convenience of alternatives for their trip could challenge existing perceptions and lead to consideration and use of these alternatives. Garvill et al. (2003) found that increasing the awareness of travel mode choice helped decrease car use among people with a strong car habit, because when forced to reconsider people in some cases realised that the car no longer was the best alternative. Rose and Ampt (2001) report similar results. Van Knippenberg and van Knippenberg (1988) observed that a temporary behavioural change, due to whatever circumstance, may lead to adjustment of perceptions and, consecutively, to attitudinal change and possibly to adoption of a new travel pattern. In the study presented in chapter 3 we also found indications that a positive

experience with an alternative mode of travel may influence consecutive travel choice. The present study investigated the accurateness of car drivers' perceptions of public transport travel time in a large sample of Dutch car drivers and the potential effect of changing any distorted perceptions on the travel choice set of these car drivers.

6.2 Methods and data

We conducted secondary analysis on travel survey data collected and processed on behalf of the Dutch Ministry of Transport for the MORA project (Mobility Survey Region Amsterdam; MoT 2001); see section 5.2 for more details about the sample. Here we focus on the car travellers' data. A total of 69,616 questionnaires were sent out to car drivers travelling in the direction of Amsterdam on one of the six corridors on any one of three survey days in September 2000. The study sample therefore consisted of non-urban, longer-distance trips (≥ 10 kilometres). A total of 21,335 (30.6%) questionnaires were returned, of which 17,642 (82.7%) were useful for analysis. The main source of drop-out was a missing value for perception of public transport travel time: 2,110 observations (57% of drop-out). This largely concerned car drivers who answered 'no' to the question "Could you also have made this trip by public transport?" (90.1% of missing travel time values). Apparently, parts of the people who do not consider public transport as an alternative also know little about it. Although these respondents were excluded from further analysis here, this is a first important observation.

To assess how accurate the perceptions of public transport travel time were, we estimated the 'objective' travel time by public transport using trip origin and destination information and web-based route planning software (www.ns.nl, www.9292ov.nl). The public transport trip was assumed to consist of a rail origin-to-destination link, and access and

Chapter 6

egress travel. In the MORA dataset, trip origin and destination were available as city or region name, while for trips to the City of Amsterdam destination was available at the level of nine city districts. Observations with a region name as origin or destination were excluded from further analysis because this made it impossible to approximate public transport travel time sufficiently accurately. For the remaining observations, rail travel time was calculated as intercity central to central station for through-traffic, and intercity central to the most appropriate of five rail stations in Amsterdam for trips to one of the nine city districts. Access and egress times were estimated at the level of all different points of origin and destination. Mean access and egress times varied between 10 and 30 minutes, depending on zone size and using a 'donut approach'.⁶⁵ In this way, we were able to determine a fair estimate of the 'objective' travel time by public transport for 6,318 car travellers (32.9% of the sample from chapter 5). This sub-sample consists of shorter trips as compared to the total sample (average car travel time 48 vs. 67 minutes; $p < .001$), because most long distance trips had a region name as origin and/or destination and, as explained above, were therefore excluded from this analysis.

To investigate the effect of car drivers' perceptions of public transport travel time on the inclusion of public transport in their choice set for the trip they made on the day of the survey, we looked at associations of answers to the question "Could you also have made this trip by public transport?" (response categories 'no', 'yes, but rarely do' and 'yes, regularly do') with characteristics of the traveller and the trip.

⁶⁵ We assumed that central station was in the centre of a zone, that people in the car sample were unlikely to live directly near the central station, and that population density of a zone decreased proportionally with travel distance from the central station. When estimating mean access and egress times we disregarded the parts of the zone that were either within approximately 5 minutes travel distance of central station (the hole of the "donut") or more than 30 minutes travel distance of central station (the outline of the "donut")

Define Y as the perceived possibility to use public transport for the trip that was actually made by car. Here, Y is a trichotomous variable, where $Y=0, 1$ and 2 stand for 'no', 'yes, but rarely do' and 'yes, regularly do', respectively. Let i denote individual i . The probability that $Y=j$ depends on features of the trip individual i made, in terms of trip destination, purpose, reported travel time by car, who pays for the trip, and other relevant features listed in Table 5.3; these variables are denoted as x_{i1}, \dots, x_{iN} . Then, in the multinomial model, the probability that individual i will choose alternative j is formulated as:

$$P_{Y=j} = \exp(\sum_n x_{in}\beta_j) / [1 + \exp(\sum_n x_{in}\beta_1) + \exp(\sum_n x_{in}\beta_2)] \quad \text{for } j=1,2$$

$$\text{where } P_{Y=0} = 1 - P_{Y=1} - P_{Y=2}$$

Unlike in ordered models, in a multinomial model like the one above the coefficients of explanatory variables are allowed to vary across alternatives, e.g. trip purpose can have a different effect on the different response categories. Multinomial logistic regression was conducted with the response category 'no' as reference value. Because the coefficients of these models are generally difficult to interpret, marginal effects were estimated (with the appealing characteristic that the sum over response categories is always zero). Next, the coefficients of the multinomial logit model (see Table 6.4) were used to estimate car drivers' likely answer to the question "Could you also have made this trip by public transport?" under the condition that they were better informed about the objective public transport travel time. For this, we substituted perceived public transport travel times reported by individual car drivers with OD-based public transport travel time obtained from web-based route planning software, all else equal, and compared predicted response frequencies.

6.3 Results

The mean travel time by car of the trip made on the day of the survey was 60 minutes. The mean perceived travel time by public transport for that same trip was almost double: 117 minutes. Table 6.1 shows that the mean ratio of perceived public transport and reported car travel time was 2.3 and that this ratio was inversely related to car travel time.

At first glance it appears car drivers add about an hour to their car travel time when asked to estimate public transport travel time for the same trip, independent of trip distance. To investigate this more closely, we conducted regression analysis of perceived public transport travel time, using travel time by car, OD-based travel time by public transport, trip frequency, experience with public transport, trip destination and time of day as explanatory variables. Table 6.2 shows that the perception of public transport travel time is positively associated with both reported car travel time and the objective public transport travel time. The perceived duration of the public transport trip decreases with familiarity with the trip (i.e. trip frequency) and the public transport system (i.e. experience with public transport on this trip). It is also lower for trips with destination Amsterdam as compared to through-traffic, supposedly because of the density of public transport services to and within the city as compared to smaller towns or rural areas, and additionally so for trips to City Centre. Finally, we found a traffic congestion effect: car drivers that made their trip during peak hours elicited lower public transport travel times. The ratio of perceived public transport travel time and reported car travel time was also inversely related to experience with public transport on the same trip (see Table 6.1). The 'chicken and egg' question then is whether people who use public transport less often have a less favourable view of public transport as an alternative for their trip, or that people who have a less favourable public transport connection on their trip use public transport less often.

Table 6.1 Reported travel time by car and perceived travel time by public transport

		N	%	Reported travel time by car (in minutes)		Perceived travel time by public transport for the same trip (in minutes)			
				Mean	SD	Mean	SD	Difference with car	Ratio to car
Reported travel time by car	0 to 30 minutes	3,546	(20.1%)	25.3	5.4	82.6	34.1	+57.3	3.5
	31 to 60 minutes	8,485	(48.1%)	48.1	8.4	104.6	37.1	+56.4	2.2
	61 to 90 minutes	3,371	(19.1%)	77.7	8.6	137.7	44.8	+60.0	1.8
	91 to 120 minutes	1,302	(7.4%)	110.0	8.2	172.8	58.9	+62.8	1.6
	More than 120 minutes	938	(5.3%)	162.2	43.6	206.2	70.6	+44.0	1.3
Could you also have made this trip by public transport?	No	9,747	(55.2%)	60.7	36.0	130.3	55.0	+69.6	2.5
	Yes, but rarely do	6,943	(39.4%)	58.3	35.1	101.9	46.5	+43.6	2.0
	Yes, regularly do	952	(5.4%)	62.1	35.6	89.2	44.1	+27.1	1.6
Total		17,642		59.8	35.6	116.9	53.4	+57.1	2.3

Note: n=17,642.

Chapter 6

Table 6.3 shows that both effects appear to play a role here. The first columns of the table contain the same information as Table 6.1, but for the smaller sub-sample of 6,318 car drivers for which OD-based public transport travel time could be estimated. The ratio of perceived public transport to car travel time and the association of this ratio with public transport experience was very similar to the one observed in the full sample (see Table 6.1). Mean OD-based public transport travel time was 67 minutes, about one third lower than perceived travel time and comparable for car drivers of the three levels of public transport experience. The last two columns of Table 6.3 show that the ratio between perceived and objective public transport travel time (1.5) and the ratio between objective public transport and reported car travel time (1.6) are of comparable magnitude, and are associated with public transport experience; the latter relation was statistically significantly ($p < .001$ [anova]). This coincides with earlier findings by Rooijers (1998), who observed that regular public transport users perceive reliability of public transport to be higher than non-regular users and non-users.

The relation between public transport experience and the ratio between objective public transport and reported car travel time (last column of Table 6.3) indicates that people with more favourable connections apparently use public transport more often. The effect of public transport experience on the ratio between perceived and objective public transport travel time is, however, much larger, indicating that car drivers' choice sets may be more affected by less favourable perceptions of public transport travel time than by actually less favourable travel times relative to car. In addition, the ratio of 1.1 between perceived and objective public transport travel time for car drivers who regularly use public transport indicates they have a fairly accurate perception of public transport travel time, considering that the objective times used here were based on public transport schedules (i.e. planned travel times) and that the punctuality of

rail services at the time was moderate: About 18% of trains had a delay of three minutes or more, and 10% of train to train connections was missed as a result of these delays (van Exel 2003).

If car drivers' perceptions of public transport travel time deviate substantially from objective travel times, what would be the potential gain from improving the accurateness of these perceptions? To investigate this, we analysed associations of car drivers' answers to the question "Could you also have made this trip by public transport?" ('no' = 51.4%; 'yes, but rarely do' = 42.4%; 'yes, regularly do' = 6.2%; see Table 6.3) with characteristics of the traveller and the trip. Table 6.4 shows that the possibility to use public transport on the trip made on the day of the survey was higher for trips to city centre, for commuting or education purpose, and for people paying for trip themselves (Table 6.5 presents the marginal effects). The possibility was lower for business and very frequent trips, decreased with trip distance and reported travel time by public transport relative to car, for people driving a leased or company car, driving alone, with a parking place available at destination on private grounds, who shifted their departure time in order to avoid congestion, and for trips paid by the employer. Taken together, particularly car drivers travelling alone for business purpose in a company or leased car, with a poor image of public transport in terms of travel time relative to car and their trip costs covered by the employer seem inert.

Some of the coefficients in the model were not statistically significant. Time of day and paying for parking at trip origin or destination showed no effect on the possibility to use public transport. That time of day had no effect is remarkable, but this effect may have been picked up by other variables in the model. For instance, the effect of congestion during peak hours is possibly reflected in the 'shifted departure time' variable, whereas some of the other time of day dynamics may be incorporated in the trip purpose variables. The lack of effect in the paid public parking variable

Chapter 6

must be considered against the comparator, i.e. free public parking, and the private parking variable.

Taken together, we speculate that there is no difference in resistance between the charge in paid parking and the anticipated time needed to find a parking place when public parking is free of charge (but often otherwise restricted and limited in capacity). In addition there are some variables that affect only one or two of the three response categories. Most of these (lack of) association(s), however, seem plausible and support the choice for a multinomial rather than an ordinal logit model.

Next, we compared the response predicted by this model with the likely response when we substituted perceived public transport travel time with objective OD-based travel time (in the 'travel time ratio PT:car' variable). This analysis showed that the response was the same for 63.6% of car drivers (see shaded cells in Table 6.6) but that a substantial number of car drivers would shift from the 'no' response category to the 'yes, but rarely do' response category. This indicates that improving the accurateness of car drivers' perceptions of public transport travel time will lead to a larger proportion of car drivers including public transport in their travel choice set, and perhaps using public transport instead of car from time to time.

6.4 Discussion and conclusion

This study investigated the accurateness of car users' perceptions of public transport travel time and the potential effect on their choice sets among a sample of car users intercepted on the main corridors to Amsterdam using a combination of reported data collected through a questionnaire and objective data obtained from web-based route planning software.

Table 6.2 Determinants of perceived public transport travel time

		Coef.	S.E.	t	95% C.I.	
Reported travel time by car		0.3	0.0	17.9	0.3	0.4
Objective travel time by public transport		0.5	0.0	21.5	0.5	0.5
Trip frequency: ^a	- 1 or 2 times a week	5.8	1.2	4.9	3.5	8.2
	- Less than once a week	10.7	1.0	11.2	8.8	12.6
Trip destination: ^b	- Amsterdam	-1.9	1.7	-1.1	-5.1	1.4
	- Amsterdam City Centre	-2.2	1.0	-2.3	-4.1	-0.4
Time of day: peak hours		-3.1	0.8	-3.7	-4.8	-1.5
Could you also have made this trip by public transport? ^c	- No	37.5	1.7	22.1	34.2	40.8
	- Yes, but rarely do	17.2	1.7	10.0	13.8	20.5
Constant		22.0	2.8	7.8	16.4	27.5

Note: n=6,318. Dependent variable: perceived public transport travel time. Reference values independent variables: ^a 3 times a week or more. ^b through-traffic; 'Amsterdam City Centre' is a subset of 'Amsterdam'. ^c 'yes, regularly do'. $R^2 = 0.28$.

Table 6.3 Travel time by car versus perceived and OD-based travel time by public transport

		N	%	Reported travel time by car (minutes)	Perceived travel time by public transport (minutes)		OD-based travel time by public transport (minutes)		
				Mean	Mean	Ratio to car	Mean	Ratio to perceived	Ratio to car
Could you also have made this trip by public transport?	No	3,246	(51.4%)	46.9	109.4	2.7	67.8	1.7	1.7
	Yes, but rarely do	2,680	(42.4%)	47.8	87.5	2.1	65.9	1.4	1.6
	Yes, regularly do	392	(6.2%)	52.2	75.4	1.7	68.4	1.1	1.5
Total		6,318		47.6	98.0	2.4	67.0	1.5	1.6

Table 6.4 Possibility to use public transport among car users; multinomial logit model

	Could you also have made this trip by public transport?									
	Yes, regularly do				Yes, but rarely do					
	B	S.E.	95% CI		B	S.E.	95% CI			
Destination: Amsterdam city centre	0.260	0.250	-0.230	0.750	0.417	**	0.125	0.171	0.663	
Destination: Amsterdam periphery	0.231	0.238	-0.236	0.697	0.197	*	0.118	-0.034	0.429	
Trip purpose: commute	0.846	***	0.202	0.450	1.241		0.024	0.094	-0.160	0.207
Trip purpose: business	-0.010		0.219	-0.438	0.419	-0.450	***	0.107	-0.660	-0.241
Trip purpose: education	1.367	***	0.340	0.700	2.034	0.111		0.222	-0.324	0.545
Trip frequency: high ^a	-1.275	***	0.171	-1.611	-0.939	-0.007		0.084	-0.172	0.158
Time of day: peak hours	-0.126		0.122	-0.366	0.114	-0.008		0.060	-0.125	0.110
Reported travel time by car	-0.024	***	0.003	-0.030	-0.018	-0.017	***	0.002	-0.020	-0.013
Travel time ratio PT:car	-1.883	***	0.110	-2.098	-1.668	-0.828	***	0.041	-0.908	-0.748
Car ownership: company	-1.063	**	0.389	-1.826	-0.300	-0.510	***	0.141	-0.786	-0.235
Car ownership: leased	-0.490	*	0.293	-1.065	0.084	-0.278	*	0.131	-0.535	-0.020
Car occupancy: driver only	0.077		0.162	-0.240	0.395	-0.195	*	0.077	-0.347	-0.044
Parking origin: private	-0.288	*	0.120	-0.523	-0.053	-0.173	**	0.058	-0.288	-0.059
Parking origin: public (paying)	-0.045		0.227	-0.490	0.400	0.056		0.118	-0.176	0.287
Parking dest.: private	-0.157		0.141	-0.434	0.119	-0.141	*	0.069	-0.275	-0.007
Parking dest.: public (paying)	-0.027		0.151	-0.322	0.268	0.023		0.074	-0.123	0.169
Shifted departure time: yes	-0.307	*	0.124	-0.549	-0.065	-0.135	*	0.061	-0.254	-0.016
Paying for trip: me	-0.116		0.209	-0.527	0.294	0.174	*	0.102	-0.026	0.375
Paying for trip: employer	-0.540	***	0.149	-0.831	-0.248	-0.104		0.072	-0.245	0.037
Constant	2.453	***	0.494	1.484	3.421	2.612	***	0.241	2.139	3.085

Note: n=6,318. *** p<.001; ** p<.01; * p<.10. R² = .11. Reference category: No. ^a Once a week or more.

Table 6.5 Possibility to use public transport among car users; marginal effects

	Could you also have made this trip by public transport?							
	Yes, regularly do ^a		Yes, but rarely do ^b		No ^c			
	dy/dx	S.E.	dy/dx	S.E.	dy/dx	S.E.		
Destination: Amsterdam city centre	0.002	0.008	0.099	**	0.030	-0.101	**	0.030
Destination: Amsterdam periphery	0.005	0.007	0.045		0.028	-0.049	*	0.028
Trip purpose: commute	0.026	***	0.006		0.022	-0.020		0.023
Trip purpose: business	0.006		0.008		0.024	0.101	***	0.024
Trip purpose: education	0.079	*	0.031		0.050	-0.068		0.053
Trip frequency: high ^d	-0.053	***	0.009		0.020	0.032		0.020
Time of day: peak hours	-0.004		0.004		0.014	0.004		0.015
Reported travel time by car	-0.001	***	0.000		0.000	0.004	***	0.000
Travel time ratio PT:car	-0.049	***	0.003		0.010	0.225	***	0.010
Car ownership: company	-0.020	**	0.006		0.031	0.130	***	0.031
Car ownership: leased	-0.010		0.007		0.030	0.071	*	0.031
Car occupancy: driver only	0.005		0.005		0.019	0.044	*	0.019
Parking origin: private	-0.007	*	0.004		0.014	0.045	**	0.014
Parking origin: public (paying)	-0.002		0.007		0.028	-0.012		0.029
Parking dest.: private	-0.003		0.004		0.016	0.035	*	0.017
Parking dest.: public (paying)	-0.001		0.005		0.018	-0.005		0.018
Shifted departure time: yes	-0.008	*	0.004		0.014	0.036	*	0.015
Paying for trip: me	-0.006		0.007		0.024	-0.037		0.025
Paying for trip: employer	-0.016	**	0.005		0.017	0.034	*	0.017

Note: n=6,318; *** p<.001; ** p<.01; * p<.10. Reference case: a through-traffic car trip for social or recreational purpose, made less than once a week, off-peak, in a privately owned car, using a public parking place free of charge at origin and destination, without shifting departure time to avoid congestion. See appendix A for coefficients from multinomial logit model. ^a N=392 (6.2%). ^b N=2,680 (42.4%). ^c N=3,246 (51.4%). ^d Once a week or more.

Chapter 6

Table 6.6 Could you also have made this trip by public transport?

		Predicted values based on OD-based public transport travel time			Total
		Yes, regularly do	Yes, but rarely do	No	
Predicted values based on public transport travel time perception	Yes, regularly do ^a	10	12	4	26 (0.4%)
	Yes, but rarely do ^b	8	2,608	270	2,886 (45.7%)
	No ^c	11	1,996	1,399	3,406 (53.9%)
Total		29 (0.5%)	4,616 (73.1%)	1,673 (26.5%)	

Note: n=6,318. ^a N=392 (6.2%). ^b N=2,680 (42.4%). ^c N=3,246 (51.4%).

Our results confirm what other studies found before using different methods of research: car drivers' perceptions of public transport travel time sometimes deviate substantially from objective travel times, and these deviations can be partly explained by familiarity with the trip and characteristics of the trip and the public transport system.⁶⁶ Our results also show that if public transport travel time perceptions of car users were more accurate – for instance if better information would be provided to car drivers about the objective travel time of the public transport alternative for their trip, which is the aim of many travel demand management (TDM) initiatives adopted internationally - almost two out of three people originally answering 'no' to considering public transport as an alternative would include public transport in their consideration set for this trip, and use it from time to time.

The size of this effect is, however, subject to some uncertainty. First, there are some limitations with respect to the way 'objective' travel time was calculated. We used mean access and egress times for people travelling to or from a specific zone, while considerable variations may

⁶⁶ It has been shown that subjective expectations may also deviate considerably from their objective counter facts for (other) central issues in peoples' lives, like their life expectancy (Hamermesh 1985; Mirowsky 1999; Brouwer & van Exel 2005).

exist especially in the larger zones. This may contribute to selection bias, as people on the upper ends of this variation may be more likely to have chosen car as their preferred option and may thus be overrepresented in the sample.

Second, our implicit hypothesis has been that deviant perceptions are the result of lack of knowledge, and that behavioural change would be stimulated by information policies. An alternative explanation could be that the distorted perceptions of public transport travel times among car users are the result of conscious or unconscious processes related to their mode choice. For instance, some car users may deliberately overestimate public transport travel time as a form of justification for their car use by emphasising the impossibility to use public transport. March (1997), for instance, argued that decision making in a social context ultimately is linked to making sense. People feel the need to justify their behaviours to themselves and others and therefore, either before (Dawes 1999) or after (Festinger 1957) choice, construct compelling, socially acceptable stories that make their behaviour consistent with their individual preferences as well as with the expectations from (relevant, important) others.⁶⁷ For our results this has two possible implications. First, this deliberate overestimation may lead to inflation of public transport travel time perceptions, indicating that what we find is an upper boundary of the effect. Second, this could mean that for some car users the sensitivity of the consideration set for information about objective public transport time is more limited than the results of our analysis suggest. In both cases, our estimation of the effect of deviant public transport travel time perceptions on car users' choice sets would be an overestimation. Summing up, both

⁶⁷ Providing better information may, in turn, affect such processes by confining the size of overestimation that is socially acceptable. For instance, whereas a few years ago in the Netherlands a train delay was a perfectly acceptable story for arriving late at an appointment (van Exel 2003), the combination of better performance in recent years and an information campaign from the national railways company have made it far less credible and accepted today.

Chapter 6

the uncertainty in estimating 'objective' public transport travel time and the possibility that some car users have consciously distorted 'subjective' public transport travel times point out that we should be reticent in drawing conclusions from our findings and that supporting evidence from additional research is warranted.

Both reasons, the gap between adding an alternative to one's choice set and actually choosing this alternative, and psychological processes related to justification processes imply that the change in proportion of car drivers that will actually travel by public transport regularly may be much smaller. This confirms findings of among others Hensher & Puckett (2007), Gärling & Schuitema (2007), Chorus et al. (2006) and Loukopoulos et al. (2004). Nonetheless, often only small changes in traffic are needed to decrease congestion considerably.

"I can do perfectly well without a car!"

"I can do perfectly well without a car!"



Chapter 7 is based on: Van Exel NJA, de Graaf G, Rietveld P (2011) "I can do perfectly well without a car!" Stated preferences for middle-distance travel. *Transportation* 38(3): 383-407 [<http://dx.doi.org/10.1007/s11116-010-9315-8>]

7.1 Introduction

In Western countries car ownership and use have increased dramatically over the last 50 years. For instance, every other person in the EU now owns a car and between 80% and 90% of all passenger kilometres are travelled by car. Large differences in car ownership and use among EU Member States indicate that these levels are not yet saturated and can be expected to increase. Current levels of car ownership and use, however, already cause considerable road congestion and have led to a substantial decline in the accessibility of certain vital economic areas.

One important reason for the automobile's increasing dominance in passenger transport is that (the recent past notwithstanding) the price of car travel relative to public transport has largely remained steady while the (system) quality of car travel has considerably increased relative to public transport. Other prominent reasons include increasing economic well-being, socio-cultural trends (more individualised and intensified lifestyles), and a history of 'predict and provide' policies chiefly concerned with compliance to the increased demand for road infrastructure (e.g. SCP 2003 1993; MoT 1997). Because these policies have not been very effective in accommodating the growing demand for car kilometres, the focus of transport policy in Western countries has recently shifted to travel

Chapter 7

demand management (TDM). The foremost aims of TDM policies are to reduce the need for travel and promote a modal shift from car to alternate modes of travel such as public transport and cycling.

Developing policies that will effectively persuade people to modify their travel behaviour requires a solid understanding of individual travel behaviour. Twenty-five years ago Burnett and Hanson (1982) stated that to do so, it is important to distinguish sizeable subgroups that display a particular behavioural response to specific circumstances or changes therein. There is little point in developing policies aimed at 'the average car driver'; it is more relevant to recognise distributions of differences among individuals and to address significant subgroups in different ways. As Goodwin (1995) said, there is one simple but important proposition for travel behaviour policy and research that arises from past research: people differ. To be effective, policy interventions need to be responsive to the different motivations and constraints of different travel behaviour segments (Anable 2005). Several methods of segmenting travellers into fairly homogenous subgroups have been pursued over time. For instance, some have distinguished travellers according to similarity in tastes, preferences, choice sets, and the nature and strength of travel habits (e.g. Anable 2005; Schlich 2003; Bamberg & Schmidt 2001; Wardman & Tyler 2000; Rooijers & Welles 1996; Pas & Huber 1992; Hanson & Huff 1988; Huff & Hanson 1986). Others argued that segmentation should be based on antecedents of behaviour such as attitudinal, motivational, and lifestyle dimensions (Diana & Mokhtarian 2009; Anable 2005; Götz et al. 2003); imperative social roles (Orfeuill & Salomon 1993); and stages in the family lifecycle stage (Jones et al. 1983). As an example, Anable (2005) identified six travel behaviour segments among car users⁶⁸ varying in predisposition to use alternative modes, which were associated with

⁶⁸ I.e. malcontented motorists, complacent car addicts, die-hard drivers, aspiring environmentalists, car-less crusaders, and reluctant riders (Anable 2005).

"I can do perfectly well without a car!"

more favourable attitudes to other modes, less psychological attachment to the car, stronger moral norms, and greater perceived control. Anable argued that segmentation according to predisposition toward alternative modes can contribute to our understanding of the modal choice process for reasons other than behaviour similarities. Is current travel behaviour, for example, the result of reasoned choice from a multimodal choice set (thus susceptible to changing circumstances)? Or is it the result of deep-seated habitual behaviour (thus inert within changing circumstances)? This study segments travellers according to their preferences in terms of (i) whether they are 'choice travellers' and (ii) their attitude toward car and public transport as alternative travel modes. The objective of this exploratory study is thus similar to that of some of the abovementioned studies, but contributes to the accumulating literature on heterogeneity in travel by combining the aspects of choice and attitude in a single experiment. It also adds to the literature by applying a research method that is fairly novel to transportation research: Q methodology. For focus and clarity the study was limited to middle-distance travel (30-100 kilometres or 20-60 miles) because they represent common trips and rule out private travel alternatives such as walking, cycling, roller skating. It was also limited to non-captive travellers, that is, people possessing a driving license,⁶⁹ because travel choice was part of the study objective.

7.2 Methods and data

What is Q methodology?

Q methodology combines aspects of qualitative and quantitative methods and provides a scientific foundation for the systematic study of human

⁶⁹ That is, non-captive in objective terms because everyone potentially can avail of car and public transport. Whether both modes in the objective choice set (or opportunity set) are also part of a person's subjective choice set (or consideration set) is subject of the current study.

Chapter 7

subjectivity, such as opinions, attitudes, preferences, and so on (Brown 1980; 1993; Cross 2005; Smith 2001; van Exel & de Graaf 2005; Watts & Stenner 2005). Q methodology is perhaps fairly novel in transportation research, but it has been around for about 70 years (Stephenson 1935) and is well-established in the political and social sciences (De Graaf 2005; 2001; De Graaf & van Exel 2009; Durning 1999; Ellis et al. 2007; Niemeyer et al. 2005; Steelman & Maguire 1999; van Eeten 2000) and health services research (Baker 2006; Boot et al. 2009; Bryant et al. 2006; Buljac et al. 2011; Cramm et al. 2010; Jedeloo et al. 2010; Risdon et al. 2003; Stenner et al. 2000; Tielen et al. 2008; van Exel et al. 2006; 2007; Vermaire et al. 2010; Wallenburg et al. 2010). The number of published Q studies in transportation research is limited. Cools et al. (2009) analysed discourses among travellers about reducing car use and shifting towards more environment-friendly transport modes. Rajé (2007) used Q methodology to explore people's perceptions of transport's role in their lives. Steg, Vlek and Slotegraaf (2001) investigated the relative importance of different motives for car use. Van Eeten (2000) explored public views on the expansion of Amsterdam Schiphol Airport, Kroesen and Broër (2009) peoples' way of thinking and feeling about aircraft noise and annoyance.

The aim of a Q methodological study is to reveal a topic's existing principal views. Typically, respondents are presented with a sample of statements about the topic (the Q set). Respondents (the P set) are asked to rank-order the statements from their individual points of view. By sorting the statements people give subjective meaning to the Q set and so reveal their subjective viewpoint (Smith 2001). The individual rankings (the Q sorts) are then correlated to reveal similarities in viewpoint. Stephenson⁷⁰ presented Q methodology as an inversion of conventional

⁷⁰ William Stephenson, the inventor of Q-methodology, served as the last assistant to Charles Spearman, the inventor of conventional factor analysis (Brown 1997).

"I can do perfectly well without a car!"

by-item factor analysis, in the sense that Q correlates persons instead of tests (i.e. by-person factor analysis). If each individual had his own specific likes and dislikes, their Q sorts would not correlate. If, however, significant clusters of correlations exist, they can be factorised and described as common viewpoints, and individuals can be mapped to a particular factor. Q methodology can thus be used to reveal and describe populations of viewpoints rather than populations of people, as in conventional factor analysis. For the purpose of a Q methodological study, a small sample of purposively selected respondents is sufficient (Smith 2001). The study thus does not reveal information about the distribution of the revealed viewpoints and the people that adhere to them (Brown 1980; Risdon et al. 2003).

The current study

The study was conducted in four steps. First, the Q sample was developed, the actual research instrument and the basis of any Q methodological study. Opinion statements were collected regarding (i) travel choice (reasoned, inert, and anything in between) and (ii) motivations for travel in general and for car and public transport as alternative modes. Statements were extracted from newspapers, periodicals, advertisements from public transport companies, a survey by the Dutch public transport travellers association (ROVER 2001), popular literature (van Kleef 1997), scientific literature (Rooijers. 1992; Desmet et al. 2000; Steg, Vlek & Slotegraaf 2001; Hiscock et al. 2002; Petit 2002; Hagman 2003; Staal 2003; Wall et al. 2004), and two of our previous studies. In the first study –a conjoint analysis of commuting behaviour– we asked respondents to elaborate on their responses during a follow-up interview (van Exel & Rietveld 2004). In the second study –a participant observational study on subjective reliability comprising 338 trips by public transport– we collected other travellers' and public transport employees' personal observations and statements (van Exel 2003).

Chapter 7

The raw material was edited and then categorised. Composite statements were split so that each addressed a single issue; similar statements were grouped and taken together. All statements were assigned to one of two categories: choice or motivation. The four statements in the choice category were selected to represent reasoned choice (Table 7.1, statement 25), inertia (16, 37), and the subjective choice set (33). The 38 statements in the motivation category were sub-divided into four sub-categories arising from our literature review: (1) instrumental-reasoned motives,⁷¹ (2) symbolic-affective motives,⁷² (3) personal and subjective norms, and (4) need/ desire for control. Finally, within each (sub)category we made a broadly representative selection leading to a final set of 42 statements for Q sorting. Each statement was randomly assigned a number and printed on a card (see Table 7.1).

The purposive sample was then constructed. The underlying idea of a purposive sample is to approach respondents on the basis of characteristics that ex-ante are expected to be associated with certain views on the study subject. Because choice and attitude may be related to the accessibility of travel modes, a two-dimensional structure for the P set was constructed based on car ownership (no car; private car; leased/company car) and living in a city with an intercity rail station (yes; no). Car ownership was expected to be an important determinant of travel behaviour as proxy for access, commitment, and habituation to a car.

⁷¹ Instrumental-reasoned motives play an important role in cognitive-reasoned models that assume travel behaviour is the result of a trade-off between the costs and benefits of travel alternatives. Central motives relate to individual preferences and attitudes, for instance, travel time, reliability, safety, and comfort (Steg, Vlek & Slotegraaf 2001).

⁷² Symbolic-affective motives stem from psychological analyses of travel behaviour and include, among other things, status, self-expression, self-esteem, and control (Lois & López-Sáez 2009; Steg, Vlek & Slotegraaf 2001; Diekstra & Kroon 2003; Sachs 1992). Wall (2006) studied car drivers' motivations for reducing or maintaining their car use for commuting and found a total of 67 psychological and contextual factors influencing travel mode choice.

"I can do perfectly well without a car!"

In addition, we distinguished between people with a private car and a leased or company car because the latter group generally drives better cars at negligible marginal costs, which may affect their travel decision making and view of public transport as an alternative mode of transport. Furthermore, living in a city with an intercity rail station was selected as proxy for availability of a (more) competitive public transport alternative for long distance trips. Travel time by intercity rail relative to car is often acceptable for trips whose origins and destinations close to rail stations. Easy access to an intercity rail also limits transfers, which are associated with waiting and travel time uncertainty. In addition, people of different age, gender, and education level were approached, but not systematically across cells of the 3x2 P set matrix; the aim was to recruit at least five respondents in each of the cells of this matrix. A first wave of respondents was recruited within the authors' circles of family, friends and colleagues based on their reputation of being car- or public transport-minded and their level of involvement with spatial and environmental aspects of travel. Subsequent respondents were recruited through snowballing, i.e. the first wave of respondents was asked to suggest one or two people with a different view from theirs on the subject, who were next approached to participate in the study.

Third, the Q sorts were administered. Potential respondents were approached by telephone or email to ascertain willingness to participate, possession of a driving licence, car ownership, and place of residence. Those who met the selection criteria and agreed to participate were sent the Q survey by mail to their home address with a request to return it in within ten days. The written instructions directed participants to read through the statements carefully and begin with a rough sorting of the statements into three buckets: statements with which they generally agreed, those with which they disagreed, and those about which they were neutral, doubtful, or undecided. After recording the number of

Chapter 7

statements in each pile, they were instructed to read through the 'agree' statements again, select the two statements they agreed with most, and place them in the rightmost boxes of the score sheet (Figure 7.1).

Table 7.1 Structured Q sample

Category	Statement	Nr
Motivation		
▪ <i>Instrumental / reasoned</i>	A big advantage of travelling by train is that you can do something useful en route: do some reading or take a nap	42
	A car is not a necessity, but it does make life a whole lot easier	22
	All things considered, to me the car is superior to public transport	7
	Door to door travel time plays an important role in my mode choice	40
	For an active social life I need a car. Without a car I would visit my family and friends less often and would make fewer leisure trips	30
	For me, travelling by public transport is more expensive than travelling by car	13
	For private use I do not need a car	1
	I am not really price- or time-sensitive, environmental aspects are most important to me	4
	I find the reliability of travel time important	18
	I know very well where in my neighbourhood I can get on public transport to the rail station and I have a fairly good notion of the timetable	14
	I often feel unsafe when using public transport and on stations, especially at night	21
	On a day when I do not have my car at my disposal for a day, I am greatly inconvenienced	20
	Public transport is much too dirty and unsafe to be an alternative for the car	39
	Things like comfort, privacy and safety are more important to me than travel costs and travel time	10
	Travel costs play an important role in my mode choice	34
	What really matters is reaching my destination and getting back, the mode of travel does not matter much	3
	▪ <i>Symbolic / affective</i>	A lovely view, a pleasant encounter, a surprising book, a brain wave. A train journey often is an experience
Driving a car is a great pleasure. The sound of the engine, accelerating sportily at traffic lights, cruising on the highway, listen to music		29
For me the car is more than a mode of transport, it is a part of my identity, a way to distinguish myself from others		23
I would rather look out of the compartment window to the passing Dutch landscape than to the bumper of the car before me		5
I recall the day I got my first car very well, I had been looking forward to that day for quite a while		24
In the train you sometimes meet nice people. I enjoy that. The car is much duller and more lonesome		31
Once you own a car, you'll use it for all your travel		27
Only the car takes me where I want, when I want it		36
You are what you drive		26

"I can do perfectly well without a car!"

Category	Statement	Nr
▪ <i>Norms</i>	A better environment starts with yourself. Therefore, everyone should use public transport more often	28
	For my work I need a representative mode of transport	12
	I am a dedicated follower of the four-wheel-credo. The car can maybe do without me for a day, but I can not do without my car	35
	My family and friends appreciate it when I travel by public transport	38
	Public transport is for people who can not afford a car	6
	The Netherlands is a car country. We could just as well pave all railroads and transform all stations into parking garages	41
▪ <i>Control</i>	As a result of all those different timetables and lines, travelling by public transport is too complicated	2
	I am well aware of the costs of a trip, by car as well as by public transport	17
	I find it pleasant to plan my trips in advance and to have everything well organised before I leave	19
	I would rather not drive in big cities... lots of traffic, lots of traffic lights, problems with parking	11
	I know the public transport system pretty well because I make use of it frequently	8
	It is important to me to have control over my journey	15
	The last time I travelled by public transport was a complete disaster	9
▪ <i>Choice</i>	As far as I am concerned, car and public transport both are good transport alternatives	33
	Before every trip, I draw a comparison between car and public transport regarding travel costs, time and so forth, and select the best alternative	25
	For the greater part my travel behaviour is routine, I do not really give it much thought	16
	I always travel in the same way and find it satisfactory	37

Note: Numbers assigned to statements at random for purpose of identification.

They were then asked to read through the remaining statements in the 'agree' bucket, select the three they now agreed with most, and place them in the designated boxes. This procedure was continued until all 'agree' statements had been ranked. The same procedure was followed for the cards in the 'disagree' bucket, beginning with the leftmost boxes. Statements from the 'neutral' bucket were ranked in the middle of the score sheet. Finally, participants were asked to explain why they were most emphatic about the four outermost statements (i.e. those they (dis)agreed with most). After finishing the Q sort, respondents completed a short questionnaire on individual characteristics, their travel choice set and the biggest (dis)advantage of car and public transport.

"I can do perfectly well without a car!"

interpreted and described using the characterising and distinguishing statements and the explanations of respondents loading on the factor. A statement is 'characterising' if its position is in the outer columns of the idealised Q sort of the factor (Figure 7.1; Table 7.3) and 'distinguishing' if the position is statistically significantly different from its position in the idealised Q sorts of all other factors. Some explanations of respondents describing a factor are cited in the results section to illustrate their way of thinking and to support the description of that particular viewpoint.

7.3 Results

A total of 39 people participated in the study: 9 without a car, 18 with a private car, and 12 with a leased or company car; 23 respondents lived with an intercity rail station, 16 without. As was our aim, 5 or more participants were recruited in each cell of the P set matrix. The overall balance in the Q sample was good: the mean number of statements pre-sorted under agree, neutral, and disagree was 15, 9, and 18, respectively. Analysis of the 39 Q sorts showed that the data supported a maximum of five factors. The factor diagram, which is a simple and visually appealing method for examining hierarchical factor structures (Goldberg 2006), presents correlations between consecutive factor solutions (Figure 7.2).⁷⁶ It shows that the accounts represented by the two-factor solution remain stable in subsequent solutions (e.g., correlation between factor 2/1 and 5/1 is .96; see also Table 7.2).

The added factors in the three- and four-factor solutions also constituted statistically independent and stable accounts, but the fifth factor (5/4) was considerably correlated with other factors and no significant accounts

⁷⁶ Only most important correlations shown (see Table 7.2) Width of the boxes represents percentage explained variance (see Table 7.2). Generated using Factor Diagrammer software (http://ego.psych.mcgill.ca/labs/levitin/software/factor_diagrammer).

Chapter 7

appear thereafter. Based on these statistics and inspection of the content of the factors in the different solutions, the four-factor solution was selected. Table 7.4 presents the factor loadings: 30 Q sorts loaded on a single factor and 8 were confounded. Factors one, two, three, and four were defined by 8, 6, 4, and 12 variables, respectively. The four factors individually explained between 8% and 20% of the variance in Q sorts, and collectively 57%. Table 7.3 presents the factor arrays.

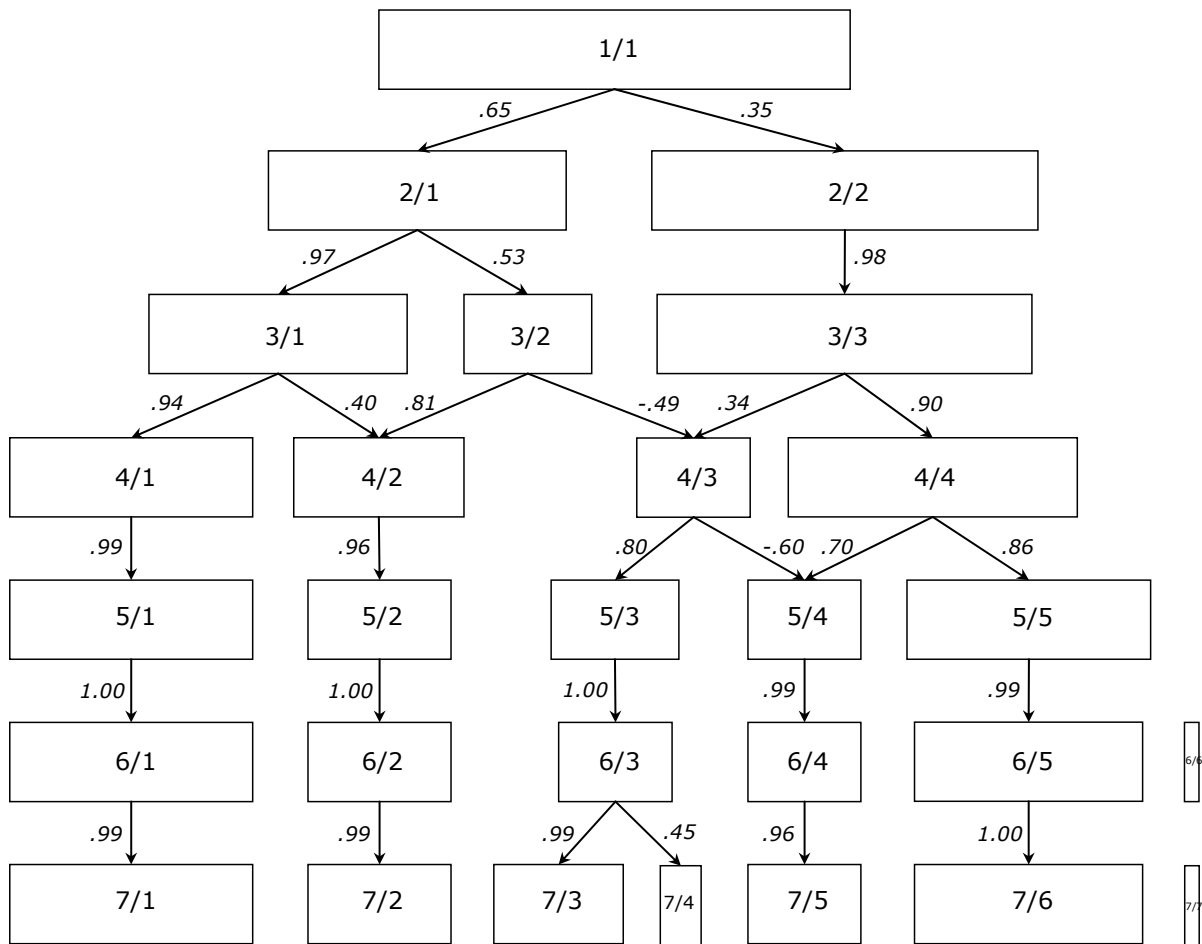


Figure 7.2 Factor diagram: Correlations between consecutive factor solutions

Table 7.2 Correlations between consecutive factor solutions

Factor	1/1	2/1	2/2	3/1	3/2	3/3	4/1	4/2	4/3	4/4	5/1	5/2	5/3	5/4	5/5	6/1	6/2	6/3	6/4	6/5	7/1	7/2	7/3	7/5	7/6
1/1		.65*	.35†	.61*	.52*	.28	.58*	.69*	.38†	.01	.57*	.71*	.26	-.20	.24	.56*	.73*	.24	-.20	.28	.53*	.71*	.35†	-.26	.30
2/1			-.48*	.97*	.53*	-.53*	.95*	.55*	.17	-.71*	.96*	.58*	-.02	-.61*	-.46*	.96*	.58*	-.02	-.64*	-.42*	.96*	.58*	.06	-.68*	-.40†
2/2				-.49*	-.06	.98*	-.51*	.12	.23	.90*	-.53*	.12	.33†	.52*	.85*	-.54*	.11	.31	.56*	.84*	-.57*	.11	.33†	.54*	.84*
3/1					.31	-.50*	.94*	.40†	.35†	-.73*	.93*	.46*	.10	-.75*	-.41*	.93*	.46*	.11	-.77*	-.37†	.94*	.46*	.17	-.80*	-.35†
3/2						-.23	.45*	.81*	-.49*	-.18	.52*	.70*	-.40†	.25	-.28	.51*	.69*	-.42*	.21	-.26	.47*	.70*	-.28	.16	-.25
3/3							-.55*	-.01	.34†	.90*	-.58*	.00	.40†	.44*	.88*	-.59*	.00	.39†	.48*	.87*	-.62*	-.00	.39†	.47*	.87*
4/1								.33†	.06	-.64*	.99*	.35†	-.15	-.58*	-.38†	.99*	.35†	-.15	-.62*	-.34†	.99*	.36†	-.05	-.66*	-.32†
4/2									.05	-.22	.39†	.96*	.09	.01	-.21	.39†	.96*	.07	.00	-.19	.37†	.95*	.16	-.02	-.17
4/3										-.08	.00	.19	.80*	-.60*	.24	.01	.21	.80*	-.56*	.25	.04	.19	.73*	-.52*	.26
4/4											-.66*	-.25	.07	.70*	.86*	-.67*	-.26	.05	.72*	.84*	-.71*	-.26	.07	.70*	.83*
5/1												.38†	-.15	-.52*	-.46*	1.00*	.38†	-.15	-.56*	-.42*	.99*	.39†	-.05	-.60*	-.40†
5/2													.05	-.19	-.10	.39†	1.00*	.03	-.19	-.08	.37†	1.00*	.09	-.21	-.06
5/3														-.13	.06	-.15	.07	1.00*	-.11	.06	-.14	.04	.96*	-.07	.07
5/4															.25	-.53*	-.20	-.15	.99*	.23	-.57*	-.19	-.09	.97*	.21
5/5																-.46*	-.10	.05	.28	.99*	-.48*	-.10	.06	.26	.99*
6/1																	.38†	-.14	-.56*	-.43*	.99*	.40†	-.04	-.62*	-.41*
6/2																		.05	-.20	-.08	.37†	.99*	.11	-.22	-.06
6/3																			-.13	.05	-.13	.02	.96*	-.09	.06
6/4																				.25	-.60*	-.19	-.07	.96*	.24
6/5																					-.45*	-.08	.05	.24	1.00*
EV	.33	.27	.21	.26	.9	.18	.20	.12	.08	.17	.17	.10	.09	.08	.17	.17	.10	.08	.08	.16	.17	.10	.09	.08	.16
CEV	.33	.48		.53			.57				.61					.59					.63				

Note: EV = explained variance; CEV = cumulative explained variance. * p<.01; † p<.05. Correlations between corresponding factors in consecutive factor solutions in bold. Factors 6/6, 7/4 and 7/7 not shown because they were not retained (Eigenvalue < 1).

Table 7.3 Factor arrays

Nr	Statement	Factors			
		1	2	3	4
1	For private use I do not need a car	+3	-3	+2	-3
2	As a result of all those different timetables and lines, travelling by public transport is too complicated	-1	0	-1	-1
3	What really matters is reaching my destination and getting back, the mode of travel does not matter much	+1	0	+1	0
4	I am not really price- or time-sensitive, environmental aspects are most important to me	+1*	-1*	-3	-4
5	I had rather look out of the compartment window to the passing Dutch landscape than to the bumper of the car before me	+3*	+1 [†]	-1	0
6	Public transport is for people who can not afford a car	-3	-3	-2	-3
7	All things considered, to me the car is superior to public transport	-3*	-1*	+2	+3
8	I know the public transport system pretty well because I make use of it frequently	+3	+2	0	0
9	The last time I travelled by public transport was a complete disaster	-2	-1	-1	-2
10	Things like comfort, privacy and safety are more important to me than travel costs and travel time	0	0	-1	-1
11	I had rather not drive in big cities... lots of traffic, lots of traffic lights, problems with parking	+2 [†]	0	+1	-3*
12	For my work I need a representative mode of transport	-1	-1	-3	+1 [†]
13	For me, travelling by public transport is more expensive than travelling by car	-1	0	+3*	+1*
14	I know very well where in my neighbourhood I can get on public transport to the rail station and I have a fairly good notion of the timetable	+2	+1	-2*	+1 [†]
15	It is important to me to have control over my journey	+1	+2	+2	+4 [†]
16	For the greater part my travel behaviour is routine, I do not really give it much thought	-1	-2 [†]	+1	+1*
17	I am well aware of the costs of a trip, by car as well as by public transport	+1	+1	0	0
18	I find the reliability of travel time important	+1	+3	+1	+2
19	I find it pleasant to plan my trips in advance and to have everything well organised before I leave	0*	+2	+3	-1*
20	On a day when I do not have my car at my disposal for a day, I am greatly inconvenienced	-1	-2	-4*	2*
21	I often feel unsafe when using public transport and on stations, especially at night	0	0	+1	-1
22	A car is not a necessity, but it does make life a whole lot easier	+2 [†]	+4	+4	+2
23	For me the car is more than a mode of transport, it is a part of my identity, a way to distinguish myself from others	-3	-3	-3	-2 [†]
24	I recall the day I got my first car very well, I had been looking forward to that day for quite a while	0	+1	0	0

Nr	Statement	Factors			
		1	2	3	4
25	Before every trip, I draw a comparison between car and public transport regarding travel costs, time and so forth, and select the best alternative	-1	+1*	-2	-2
26	You are what you drive	-2*	-2	0*	-2
27	Once you own a car, you'll use it for all your travel	+1	-2*	+4*	+2*
28	A better environment starts with yourself. Therefore, everyone should use public transport more often	+4	+3	0	0
29	Driving a car is a great pleasure. The sound of the engine, accelerating sportily at traffic lights, cruising on the highway, listen to music	-2 [†]	-1 [†]	+1 [†]	+1 [†]
30	For an active social life I need a car. Without a car I would visit my family and friends less often and would make fewer leisure trips	-2*	+4	+1*	+3
31	In the train you sometimes meet nice people. I enjoy that. The car is much duller and more lonesome	+2*	-1	-1	-1
32	A lovely view, a pleasant encounter, a surprising book, a brain wave. A train journey often is an experience	+2*	+1	0	0
33	As far as I am concerned, car and public transport both are good transport alternatives	+1	+2	+2	+1 [†]
34	Travel costs play an important role in my mode choice	0	0	+3*	0 [†]
35	I am a dedicated follower of the four-wheel-credo. The car can maybe do without me for a day, but I can not do without my car	-4	-4	-4	-1*
36	Only the car takes me where I want, when I want it	-2*	+1	0	+3*
37	I always travel in the same way and find it satisfactory	0	-1	-1	+2*
38	My family and friends appreciate it when I travel by public transport	0	0	-2	-2
39	Public transport is much too dirty and unsafe to be an alternative for the car	-1	-2	-1	-1
40	Door to door travel time plays an important role in my mode choice	0*	+2	+2	+4*
41	The Netherlands is a car country. We could just as well pave all railroads and transform all stations into parking garages	-4	-4	-2	-4
42	A big advantage of travelling by train is that you can do something useful en route: do some reading or take a nap	+4 [†]	+3	0*	+1

Note: Statements with a factor score of -4, -3, +3 or +4 (i.e. those ranked in two outer columns on either side of the score sheet; see Figure 7.1) are called *characterising* for that factor. Statements with a factor score that is statistically significantly different from the score in the other factors are called *distinguishing* for that factor. * p<.01; † p<.05.

Chapter 7

Table 7.4 Factor loadings

Respondent	Factor 1	Factor 2	Factor 3	Factor 4
Johan	0.81	0.06	0.20	0.02
Klaas	0.64	0.14	0.13	0.02
Marije	0.79	0.09	0.08	0.03
Mike	0.63	-0.01	0.25	0.08
Pai	0.70	0.55	0.06	-0.06
Petra	0.76	0.21	-0.01	-0.19
Rik	0.70	0.42	-0.06	0.11
Ruurd	0.73	0.35	0.10	0.00
Anna	0.50	0.59	0.05	0.18
Arjan	0.14	0.50	0.11	0.23
Elly	0.26	0.72	0.23	0.17
Irene	0.16	0.59	0.41	0.24
Johanna	0.28	0.65	0.01	0.39
Marc K	0.52	0.62	0.29	0.10
Anita	0.16	0.06	0.59	0.20
Anke	0.27	0.22	0.55	0.40
Henri	0.18	0.31	0.56	0.13
Huib	-0.37	-0.14	0.44	0.00
Benedikte	0.28	0.08	0.22	0.67
Dani	-0.25	0.20	-0.23	0.59
Dirk-Jan K	0.02	0.37	-0.08	0.64
Dirk-Jan M	0.23	0.22	0.11	0.75
Geert	-0.09	0.22	0.09	0.82
Ines	0.05	0.24	0.25	0.40
Kees	0.22	-0.01	0.31	0.74
KJ	-0.21	0.01	0.03	0.75
Marlene	-0.38	-0.28	0.05	0.51
Michiel	0.03	0.19	0.24	0.64
Wag	-0.10	0.25	0.16	0.66
Ytzen	0.13	0.07	0.15	0.73
Bob	0.42	0.48	0.27	0.48
Elsbeth	0.16	0.29	0.42	0.48
Esther	0.34	0.19	0.51	0.47
Maria	-0.08	0.46	0.41	0.56
Nientje	0.45	0.29	0.35	0.38
Oever	0.24	0.38	-0.13	0.30
Rob	0.20	0.33	0.42	0.56
Teun	0.44	0.43	0.32	0.05
Ulf	-0.27	-0.12	-0.42	0.48

"I can do perfectly well without a car!"

Factor 1

Travellers in this preference segment expressed a general preference for public transport. Most emphasised the possibility of accomplishing something during the trip (Table 7.3, statement 42): *—For me the possibility to spend my travel time on something useful is an important reason to prefer travelling by public transport. —I often have a lot of reading to do. And I can catch up with some sleep as well. —It is relaxing. A cup of coffee, do some reading, rest a bit.* Public transport apparently has for them a process utility over the outcome utility of reaching their destination (31, 32): *—The train usually is more practical, more enjoyable, and more relaxing than the car.* Perhaps that is why they, of all the travellers, are least concerned with door-to-door travel time (40). In addition, they refer strongly to environmental aspects of public transport, both in normative (28) and affective (4, 5) terms: *—The environment is a great concern in our small and densely populated country. Everyone should think about this and use public transport more often. —Public transport contributes to a better society: less pollution, higher safety, less stress. —Environmental aspects are an important motivation for me to choose travelling by public transport.*

These travellers regard the car as an alternative (33), but least of all see the car as a necessity for their personal travel (1, 22, 30, 36): *—Public transport and bicycle are fine alternatives. —If you want you can get almost everywhere by public transport; you are only a bit less independent. My social life is not worse without a car. —Generally I do not need a car. On the occasions I do need one, there is always someone that can help me out.* Moreover, they do not seem to particularly like the car as a travel mode (7, 11, 29): *—It's brainwashing to think you could not do without a car. —The car is not superior. It's a fallacy that you would have more privacy and less delay with your car. —A car is just an object I don't attach much value to, definitely not a status symbol. —The*

Chapter 7

car as such is irrelevant to me, only the functional aspects count. It definitely is not more than a mode of transport (23, 35): —For me, identity is purely associated with immaterial things.

Although these travellers do not exclude the car as an alternative (33), the preference for public transport and dislike of the car appear to result in a fairly stable travel behaviour pattern (16, 25, 37). As a consequence, they are familiar with the public transport system (8, 14): *—I use public transport almost daily and can find my way very well.*

This preference segment for middle-distance travel was labelled 'choice travellers with a preference for public transport'.

Factor 2

Travellers in this preference segment share some of the above travellers' appreciation for public transport, but attach more weight to some advantages of the car. Public transport is favoured for the possibility of doing something during the trip (42) and its environmental benefits (28): *—The environment is very important. If we can contribute by decreasing car use we should, but costs of public transport should go down.* The car is liked because it makes life easier (22) *—For some destinations and especially when travelling with children it is easier to travel by car. —You're not dependent on time schedules and station locations. —You can get where you want, when you want and, if there are no traffic jams, within a reasonable time.* It is perceived as necessary to maintain an active social life (1, 30): *—In the evenings connectivity between train and urban public transport is virtually non-existent. —At night, the safety of the car is better than that of an abandoned platform. By car the barrier to get up and go is much lower. —Some family and friends live in places difficult to reach other than by car. if I didn't have a car I think I wouldn't visit them that often. —I definitely need a car. You can't go everywhere with public transport, at least not within a reasonable time.* They clearly

"I can do perfectly well without a car!"

are not, however, 'car addicts' (23, 27, 29, 35): *—Maybe for yuppies, not for an old lady. —All that noise, definitely not a pleasure! —The mere thought of deriving your identity from a vehicle is very strange. —I can do perfectly well without a car!*

Their travel behaviour is not habitual (16, 37) and they like to plan their travel in advance (15, 19). More than others they regard car and public transport as good alternatives for personal travel (33): *—Depends on trip destination and purpose. —If there's a good train connection I prefer the train, if not I prefer the car.* They are well informed (8, 14, 17) and take travel alternatives into consideration when making their plans (25): *—I always compare my options for a trip on the basis of cost, travel time, and comfort. I usually choose the train when travel time is not much longer than the car because of comfort.* They emphasise travel time as an important argument for their mode choice (18, 40): *—Reliability is important when you have an appointment, for instance, or have to catch a flight.*

This preference segment for middle-distance travel was labelled 'deliberate choice travellers'.

Factor 3

Travellers in this preference segment express a general like for travel by car. Of all travellers in our study, they most enjoy driving a car (29) and attach a value to the car they drive (26). The car, however, remains primarily a mode of transport (23, 35): *—For me a car is a means to get from A to B and back. A nice car makes it pleasant, but reliability is more important.* They do not feel inconvenienced on a day they do not have their car at their disposal (20): *—If by chance I don't have the car at my disposal I travel by another mode, no problem.* They do not really need a car (1, 12) but travelling by car makes life easier (22): *—You can*

Chapter 7

probably get anywhere with public transport, but by car you are much less dependent on time schedules, connections, and departure frequencies.

In travel decision making they are most concerned about costs (4, 13, 34): *—I could take the train more often, but I find train fares too high when compared with the convenience of just taking the car. —Driving a car is becoming increasingly unaffordable for private car owners.* They are also concerned about travel time (18, 40). Of all travellers they most like to organise their trips well in advance (15, 19). They regard car and public transport as alternatives for personal travel (33), but attach the least value to the benefits of public transport (42) and least disagree with the negative aspects of public transport (6, 21): *—Nowadays public transport is no longer a necessity and it's generally unsafe and filthy.* They are least familiar with the public transport system (8, 14). For the most part they consider the car the better alternative for all their personal travel (7, 27): *—If I have the car at my disposal, I use it for all my trips; if not, I have to look for an alternative.* Consequently they do not deliberate much about their choice of travel mode (16, 25).

This preference segment for middle-distance travel was labelled as 'choice travellers with car as dominant alternative'.

Factor 4

Travellers in this preference segment are clearly car-oriented. They find the car superior to other modes (7, 27, 36): *—Comfort, convenience and pleasure. —Dense network, no transfers! —For most of my trips public transport is too complicated and travel time is unacceptable. —I would say, by definition [the car is superior]. —When you live in a small town, public transport is fairly inaccessible. You always have transfers and miss connections, leading to long travel times. —Available 24/7, no scheduling problems. Travel-plan dependence, time schedules, and strikes weigh heavily for me [against public transport].* They feel they really need a car

"I can do perfectly well without a car!"

for their personal and work-related travel (1, 12, 30, 35): *—I make a lot of chained trips, for instance, taking the kids to kindergarten and to school before work. A car then becomes a necessity. The car generally makes their life easier (22): —It is much easier to take the car unthinkingly than to undertake a trip by public transport. They feel inconvenienced when they do not have a car at their disposal (20). They are happy driving a car (11, 29), but still regard it primarily as a means of transport (23, 26): —The car as part of your identity is nonsensical. The most important thing is that it's a reliable mode of transport. —A car is not a status symbol for me, just a practical and necessary resource in daily life.*

These travellers attach high value to travel time (4, 18, 40): *—Travel time is crucial; convenience comes second. But they attach much less to travel costs (34): —I don't look at the costs; convenience is paramount. The ease of having a car at hand and the fact that costs are 'sunk' mean that you no longer make a financial trade-off, and to environmental aspects (4, 28): —Environmental aspects play no role in my personal choices. In addition, they find it important to have control over their journey (15): —Go where I want when I want, optimal mobility, but not in terms of planning ahead (19): —That's just the point of having a car; no planning, no trouble.*

Of all travellers they least regard public transport as an alternative to the car (33): *—Public transport is unreliable, expensive, and crowded. They do not deliberate about their travel much (25): —I don't feel like thinking about it. —I'm a creature of habit and often delude myself into believing that travel by leased car is free. —Ninety-five per cent of the time I just take the car. In some cases, like going to big events or cities, I consider public transport. Like the travellers in factor three, they are not 'car addicts' but simply strongly prefer the car for pragmatic reasons: comfort and travel time (perceptions). Because they are satisfied, they behave fairly routinely (16, 37).*

Chapter 7

This preference segment for middle-distance travel was labelled as 'car dependent travellers'.

Preference segments and characteristics of respondents

Some associations of the four preference segments with characteristics and contexts of middle-distance travel collected from the post-Q sort survey were noteworthy. First, car ownership as a sampling criterion was statistically significantly associated with preference for middle-distance travel; living in a city with an intercity rail station was not. 'Choice travellers with a preference for public transport' were characterised largely by being older-than-average, higher-educated males not owning a car. More than 80% had a public transport season pass and used the train once or more per month. 60% walked or cycled to work; about 40% regarded carpooling an acceptable alternative to get to work, and more than 80% would consider both train and car for a middle-distance trip. They mentioned flexibility, independence, and convenience as primary advantages of the car; environment, stress and congestion were disadvantages. Advantages of public transport were relaxation, absence of parking concerns, and environmental benefits; disadvantages were transfers, delays, and inaccessibility. 'Deliberate choice travellers' were characterised largely by being older-than-average females owning a private car. More than 80% had a public transport season pass and used the train once or more per month; about 80% regarded carpooling an acceptable alternative to get to work. 80% would consider train for a middle-distance trip, 100% a car. They mentioned control, door-to-door destination, and travel time as advantages of a car; disadvantages were congestion, parking, and long-distance inefficiency. Advantages of public transport were doing something en route and convenience; disadvantages were transfers, delays and inflexibility. 'Choice travellers with car as dominant alternative' were younger than average and less educated. 25% had a public transport season pass and used train once or more per

"I can do perfectly well without a car!"

month, over 80% regarded carpooling an acceptable alternative to get to work; 100% would consider the train for middle-distance travel, 75% by car. They mentioned freedom and privacy as the primary advantages of the car; costs, maintenance, and parking were disadvantages. The only advantage of public transport was cost; disadvantages were travel time and crowds. 'Car dependent travellers' were largely younger-than-average, higher-educated males All had a leased or company car; none had a public transport season pass. Fewer than 10% used the train once or more per month; 90% always went to work by car. They had the highest frequency of business trips. About 40% regarded carpooling an acceptable alternative to get to work; 50% would consider the train for a middle-distance travel, 100% the car. They mentioned practicality, availability, and flexibility as advantages of the car; disadvantages were congestion, parking, and not being able to do anything other than driving the car. Advantages of public transport were doing something en route and relaxing; disadvantages were travel time, waiting, and dependency. Opinions about car and public transport differed significantly (in level) between preferences (Figure 7.3 and Figure 7.4).

7.4 Discussion and conclusion

Researchers and policymakers in the field of transportation increasingly recognise that traveller homogeneity is rare and consideration of traveller heterogeneity is necessary to develop effective TDM policies. Our study revealed four preference segments for middle-distance travel: (1) choice travellers with a preference for public transport, (2) deliberate-choice travellers, (3) choice travellers with a car as the dominant alternative, and (4) car-dependent travellers. These preference segments differ in travellers' level of involvement and cognitive effort in travel decision making, travel consideration set, and underlying motivations.

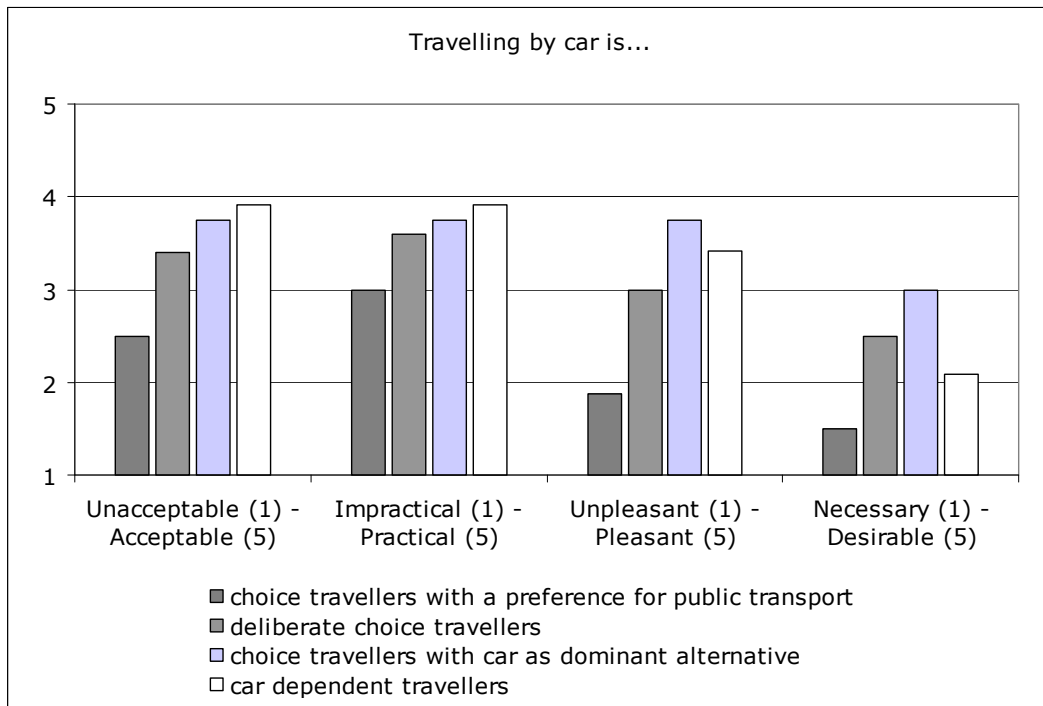


Figure 7.3 Opinions about car per preference segment

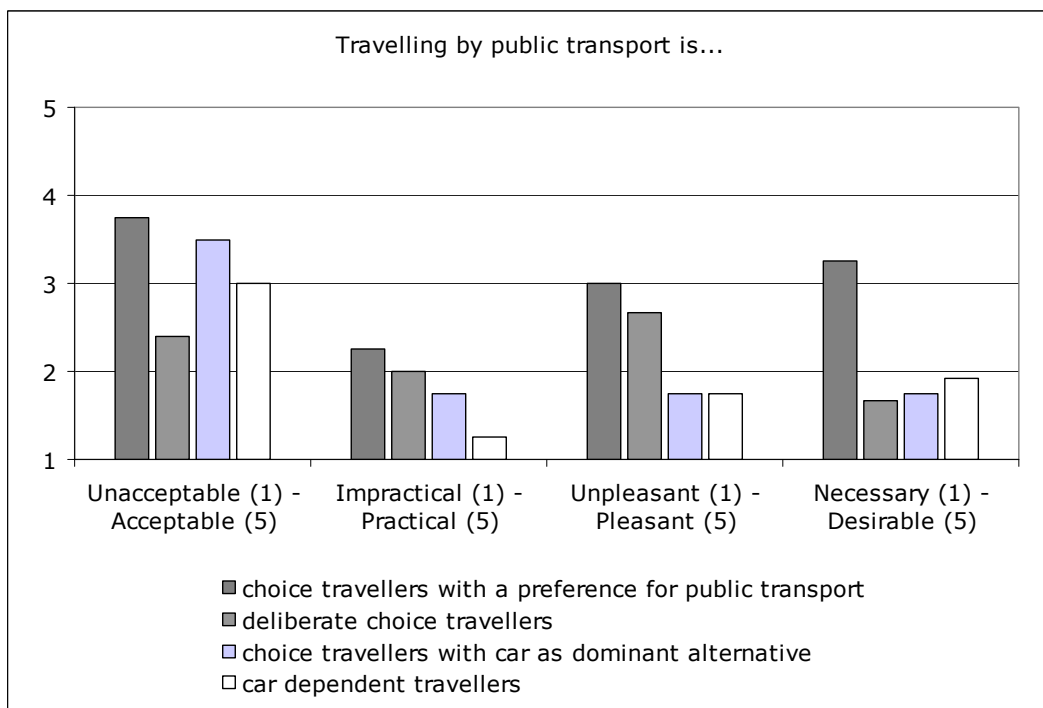


Figure 7.4 Opinions about public transport per preference segment

"I can do perfectly well without a car!"

This study thus underlines the findings of previous studies: choice of travel mode is not a matter of black and white, but of shades of gray. It appears uncommon for travellers to be addicted to or totally abstain from any particular mode, but travellers explicitly differ in the extent to which they consider different modes to be alternatives for their personal travel in different circumstances.

Considering the travel opportunity set and traffic intensity in a small and densely-populated country like the Netherlands, the four preference segments for middle-distance travel observed in this exploratory study may be considered fairly realistic. It is impractical to have a single mode choice set, in particular a car. Nonetheless, obvious groups missing from this study are people who drive cars as a form of status consumption and people who strictly object to driving a car for environmental reasons. Statements relating to these aspects did not come out as important in any of the four preferences for middle-distance travel (nor could they support a factor on their own). We cannot rule out the possibility that people gave what they considered to be socially-desirable answers. People may shy from admitting that the car is a status symbol or part of their identity. But, because responses were anonymous⁷⁷ and respondents were requested to make complex trade-offs between multiple aspects of travel, we see this complication as limited with respect to the veracity of the study results.

That environmental aspects (4, 28, 38) seem to be of limited influence on peoples' travel preferences is a notable finding, especially among 'choice travellers with a preference for public transport' and 'deliberate choice travellers'. Environmental aspects receive only marginally higher rank scores, largely due to the rather casual and normative statement (28) that

⁷⁷ The names in Table 7.4 were provided by respondents for identification so that results could be communicated back to them. An alias could be used if complete anonymity was desired.

Chapter 7

everyone should use public transport more often. Another notable finding is that the statement, 'What really matters is reaching my destination and getting back, the mode of travel does not matter much' is ranked in the middle range throughout. Apparently for most people there is much more to travel than just the transfer between two locations. What also stands out is that all statements portraying negative aspects of public transport (2, 6, 9, 21 and 39) received neutral or negative rank-scores almost throughout. That is, most travellers do not have a bad image of public transport, regardless of their like or dislike of the mode. Along the same lines, the statement 'The Netherlands is a car country. We could just as well pave all railroads and transform all stations into parking garages' elicited emotion: *—Ridiculous idea; this country needs exactly the opposite. —A disaster for landscape and environment, a despicable statement. —Nonsense. The Netherlands cannot do without trains. Not everyone can drive. —It is public transport that should be invested in; both options must remain available. There must be choice.*

If the purpose of TDM policies is to reduce the need for (car) travel and to stimulate modal switch away from automobiles, the results from this study have definite policy implications. 'Choice travellers with a preference for public transport' are clearly not the primary target group for TDM policies: these travellers will tend to choose public transport when possible. They consider the car occasionally, but this urge can be further discouraged by promoting the attractiveness of public transport. 'Deliberate choice travellers' are expected to be sensitive to changes in the relative quality of both modes, particularly improvements in accessibility, reliability, connectivity in non-urban areas, and safety at night. 'Choice travellers with car as dominant alternative' are less likely to switch to public transport because they are fairly negative about it and also unfamiliar with it. They are, however, concerned with the costs and affordability of travel and thus increasing car-travel costs are likely to influence their use

"I can do perfectly well without a car!"

of it. Whether this means reducing car travel or switching to another mode of travel is difficult to ascertain. 'Car dependent travellers' are least likely to dispense with its use. They appear most sensitive to travel time and seem to use public transport circumstantially, for instance, in cases of inaccessible areas, dense traffic, crowded events. Although not fond of public transport, they are practical about their travel. Therefore, these travellers most likely can be persuaded to reduce their car use by offering accessible and high-quality 'park & ride' facilities strategically located near economic (and social) centres and by encouraging technological alternatives to travel – telework and teleconference facilities, for example. In sum, 'deliberate choice travellers' and 'choice travellers with car as dominant alternative' should be the primary focus groups for TDM policies.

A few issues regarding this study merit further discussion. First, this was a novel application of Q methodology and little can be said about the reliability and validity of the results. We are confident that the survey instrument was representative for the variety of issues relevant to peoples' preferences for middle-distance travel and that the respondents recruited for conducting the Q sort covered the relevant range of characteristics. But like any other methodology, the study needs to be replicated so that over time we can develop an idea of the strength of the results. We encourage this with the understanding that the current Q set is not necessarily directly applicable in other countries. The research instrument needs to be carefully reviewed for missing and superfluous stimuli because, after all, the Q set consists of context-dependent opinion statements.

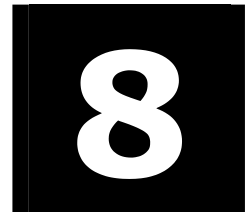
Second, based on this study little can be said about the distribution of the four preference segments among travellers in general, or their association with characteristics of travellers and the context of travel. This conventional form of representativeness is not relevant to Q methodology. The associations presented here are tentative and serve as hypotheses to

Chapter 7

be tested in follow-up research. We can, however, say that these preferences are representative for those that can be observed among travellers in the Netherlands for middle-distance travel. To investigate distribution and associations it is necessary to conduct a regular survey among a sizeable, representative sample of the population, using a questionnaire and analytical techniques that make it possible to match travellers to preference segments (Kroesen, Molin & van Wee 2011; Baker et al. 2010).

Third, the preference segments of this study should not be interpreted as 'stable types'. Although the test-retest reliability of Q sorts generally is in the neighbourhood of .80 (Brown 1980), a person's preference may vary over time with changes in the travel context and individual circumstances. The associations between preferences and characteristics of travellers and the context of travel may, however, be far more stable.

Discussion and conclusion



Transportation research has a longstanding tradition with roots in engineering, geography, economics and psychology. Over the past decades there has been considerable development in methods for travel behaviour analysis. This development has generally been in the direction of more sophisticated modelling techniques and using more data, facilitated by the increased availability and power of computer hard- and software. Nevertheless, critique persists about the accuracy of the predictions of these improved models and the relevance and effectiveness of the policy recommendations based on them. A focal point of this critique has always been the underlying rational behaviour assumption. Although the assumption that people behave *as if* they maximize their individual utility making use of all available information is appealing and convenient for analytical purposes, this assumption allegedly lacks descriptive accuracy. People do not always choose the alternative that appears to be utility maximising for them, and regularly tend to stick to travel patterns they are accustomed to.

This lacking descriptive accuracy of the rational behaviour assumption is obviously relevant for transportation research and policy in a number of ways. Without being exhaustive I list three. First of all, for understanding travel behaviour in any specific context it means that it is important to consider potential heterogeneity in travel decision making and possible reasons why subgroups of travellers may display other than rational behaviour. Studies of travel behaviour should aim to recognize distributions of preferences among travellers and understand the opportunities and constraints they face in their travel decision making.

Chapter 8

More insight into how people make their travel choices is thus warranted in order to better comprehend observed travel behaviour. Second, for predicting travel behaviour and the impact of policy measures more accurately, it means that it is important to take heterogeneous approaches to travel decision making into account more explicitly in transportation studies and models. Acknowledging that not all travellers will react to policy measures according to classical assumptions of rational behaviour and designing studies which are able to identify sizeable subgroups of travellers displaying similar behaviour in response to specific circumstances or changes therein will contribute to more accurate predictions. Third, once the reasons why subgroups of travellers display rational or inert behaviour are sufficiently understood and methods to identify these subgroups have been developed, they may be targeted in new policy measures. For instance, policies can be aimed at breaking habits that are undesirable or at the formation and perpetuation of habits that are desirable; or at altering inaccurate subjective expectations of the travel time with alternative modes and so attempt to change people's consideration set.

These considerations illustrate the relevance of studying travel behaviour in relation to diverse behavioural assumptions. This thesis therefore aimed to advance our understanding of individual travel behaviour by exploring possible causes for inertia from a behavioural economic perspective, where inertia was defined as exhibiting invariant behaviour while from a mainstream economic perspective change of behaviour appears to be rational. In addition, a number of the ideas emerging from behavioural economics were investigated further in the context of travel behaviour. In this final chapter, I will first briefly summarize important conclusions stemming from the previous chapters in relation to the aim of this thesis and highlight some noteworthy limitations. I will end with some

implications for transport policy and a number of promising areas of future research.

Main findings and limitations

Chapter 2 explored possible causes for inert travel behaviour from a behavioural economic perspective. The chapter first discussed how individual behaviour is generally treated in transportation research, indicating that (i) *travel is a derived demand* (section 2.1.1) from the desire to participate in activities spread over space and time; (ii) *travel choice is hierarchical* (section 2.1.2), subordinated to prior mobility related choices, so that day-to-day travel choices more likely are made from a limited consideration set than from the full set of objectively available travel alternatives; (iii) over the past decades transportation research has generally worked under the assumption that *observed travel behaviour is the result of rational choice* (section 2.1.3) and in spite of persistent criticism there has been limited interest in exploring alternative behavioural assumptions; finally, (iv) recent years show an increasing interest in the way *people differ in preferences, strength of habit and choice set* (section 2.1.4), but so far without coming to a new analytical framework integrating diverse forms of behaviour. Hence, while rational behaviour is still generally considered central to the analysis of travel behaviour, accumulating evidence indicates that people may differ in the way they make their travel decisions and that the extent to which these decisions are reasoned or inert may differ between people as well as between choices or choice contexts for the same person.

Following the discussion of how transportation research generally approaches travel decision making and the dominance of the rationality assumption therein, section 2.2 described the corresponding mainstream economic approach to behaviour depicting humans as individual utility maximising individuals, and highlighted the main arguments in the ongoing debate within economics regarding the appropriateness of this

Chapter 8

assumption. In this debate, advocates uphold that *homo economicus*, if nothing else, can be seen as a useful benchmark of how, from an economic perspective, people should react in response to specific circumstances or changes therein. Critics persist that its lacking descriptive accuracy legitimates, at least, the investigation of alternative behavioural assumptions, and several have been proposed within the growing field of behavioural economics: bounded rationality (section 2.3.1), prospect theory (2.3.2), judgement of probabilities (2.3.3), interdependence (2.3.4), adaptive and relative preferences (2.3.5) and intertemporal choice (2.3.6). These approaches relax some of the assumptions underlying *homo economicus* and depart from procedural rationality, where decision makers for instance strive for an optimal solution under a simplified representation of the choice problem or for a satisfactory solution considering the complexity and uncertainty surrounding real world decisions (Simon 1976; Hodgson 1997; Shefrin 1996; Heiner 1983; Vlek 1990; Wolfson 1998). These approaches each have been shown to describe individual behaviour better than mainstream economic theory in particular circumstances, by explaining some of the anomalies economists have observed (with *homo economicus* as benchmark). Heinrich et al. (2001) therefore wondered under what circumstances behaviour may still be consistent with expected utility maximization and to what extent mainstream theory can be preserved. Ben-Akiva et al. (1999) argued that conformation to the rational behaviour model may vary across people (e.g. cognitive capacity, information, motivation), decision problems (e.g. simple or complex, well- or ill-defined, risky or risk-free, reversible or irreversible, degree of time pressure), and social situations (e.g. degree of accountability, peer pressure).

The insights these alternative ideas provide in how actual behaviour may deviate from utility maximization can also be valuable in the context of

travel. As highlighted in sections 2.3.1 to 2.3.6, the application of these alternative approaches is, however, still fairly limited in transportation research. A selected number of these alternative ideas emerging from behavioural economics was therefore further investigated in chapters 3 to 7, which all discussed the results of empirical studies focussing on the subjective choice set; how it affects travel decisions, how it is affected by perceptions, and how it relates to preference segments.

Chapters 3 and 4 addressed the effect of a strike on the travel behaviour of public transport users. Since these travellers' preferred alternative is removed from their travel choice set, it is interesting to observe how they subsequently reconsider their travel opportunities. We showed in chapter 3 that while most travellers find an alternative mode of transport for their trip, by themselves or with help from others, between 10 and 20 percent of the intended trips is cancelled or postponed because travellers perceive to be captive to public transport; the large majority of them actually has no alternative, others consider the available alternatives in their opportunity set to be unreasonable. A striking finding in chapter 3 was that among the respondents who knew about the strike, about half did not adjust their normal behaviour and, what's more, 10 percent left for the station at the usual time in spite of expecting to have no chance to reach their destination. Clearly, it is hard to consider such behaviour as rational in the traditional sense. Finally, 15% stated that the strike would affect future use of public transport, largely infrequent users -mostly choice travellers, making it a more credible threat- and young travellers -mostly captive in the short-term, potentially developing a habit (or taste) for public transport. These obviously are target groups for policy makers and operators that want to increase the use of public transport. A strike apparently works in the opposite direction and, in that sense, should thus be prevented or its effects mitigated as much as possible, for instance by choosing modes of protesting that are more friendly to system users.

Chapter 8

Although this 15% concerned stated preferences, previous studies have shown that up to 2.5% of affected travellers indeed will abandon public transport after a strike. Chapter 4 followed on this topic and investigated what rail users intended to do in reaction to a strike, again removing the preferred alternative from their travel choice set, what they eventually did, and how they perceived this alternative. Frequent rail users showed the highest congruence between anticipated and actual behavioural reaction, which may reflect either experience or habituation; nothing more conclusive can be said based on this dataset. Almost half of rail users cancelled their trip, probably by lack of alternatives in their choice set. About 25% switched to the car (as driver). Although perceived behavioural control and satisfaction were generally positive, we found that preference for travelling by car was not particularly high among rail users. This may help explain the limited effect of strikes on ridership and indicate that stickiness to rail may simply express rational choice in this subgroup, at the least in the short term. Infrequent travellers were most happy with the chosen alternative. Young travellers and commuters frequently had no alternative to rail in their choice set and were least happy. For these latter groups, strikes will not be helpful to develop or sustain a taste for public transport and may affect their consideration set in the short term as well as -through mobility related choices- in the longer run. This aligns with the findings from chapter 3 and reaffirms the policy relevance of considering effects in different subgroups and the importance of careful selection of the type of strike action, also for workers in the sector.

Chapters 5 and 6 focused on the consideration sets of car and train travellers and how these relate to characteristics of the traveller and the trip and to perceptions of alternative modes of transport. In chapter 5 we showed that almost half of the train travellers had the car in their opportunity set, but that one out of four would not consider it for the trip they were making. Associated characteristics included preference for or

habituation to public transport and unattractive features of the car system, like congestion and parking. In terms of policy this underlines that popular measures aimed at reducing congestion and moderating parking, if successful, may motivate these travellers to add the car to their consideration set, potentially generating more demand. While public transport is omnipresent and could be seen as an opportunity for every trip in the study area, only two out of five car travellers had public transportation in their consideration set. When considering why some excluded public transport from their consideration set the ratio between perceived public transport and objective car travel time stood out as an important determinant. Therefore, the finding in chapter 6 that car users on average perceive travel time by public transport to be 2.3 times longer than their travel time by car has clear relevance. We showed that about half of this ratio was due to disturbed perceptions of public transport travel time, depending strongly on experience with the public transport system, and we estimated that if travel time by public transport perceptions would actually be accurate, up to two out of three car drivers would include public transport in their consideration set (but may still not change their travel behaviour). On the one hand this shows how imperfect information may impact travel choice and that improving the quality of decision making may lead to socially more desirable outcomes. This is supported by the finding that both among car and rail travellers, those paying for the trip themselves are more likely to consider alternative options. On the other hand, it indicates that even with more accurate perceptions of travel time, public transport will not be considered as an alternative by about one out of three car users. It may of course be that this relates to the fact that public transport remains too unattractive in particular circumstances, but may also relate to particular preference structures that exclude alternatives to car.

Chapter 8

Chapter 7 explored heterogeneity in travel preferences among car and public transport users and showed that preferences may differ considerably in terms of the cognitive effort to involve in decision making, the travel alternatives considered and the underlying motivations for travel. Using an innovative method for transportation research, Q methodology, four distinct preference segments for middle-distance travel were identified: choice travellers with a preference for public transport, deliberate-choice travellers, choice travellers with car as dominant alternative, and car-dependent travellers. These segments differed clearly in terms of the deliberation involved and the extent to which alternative modes of travel were perceived as viable and considered for use. Preference heterogeneity obviously has policy implications. First, some travellers will be more sensitive than others to policies aimed at influencing their travel behaviour. Choice travellers may be encouraged to adapt their behaviour, structurally or occasionally, while this is unlikely with travellers who perceive to be car dependent. Second, the different preference segments will be sensitive to different types of policies aimed at influencing their behaviour. Whereas choice travellers may be susceptible to a wide array of policies encouraging public transport use or discouraging car use, those that have car as dominant alternative appeared most concerned with travel costs and to lack information about alternatives, while those who perceive to be car dependent seemed most sensitive to issues of accessibility and travel time. All preference segments can perhaps be induced to consider and use public transport more often and car less often, but policy effort will be most effective and efficient when aimed at specific groups and tailored to their preference structure.

There are a number of limitations to the research presented in this thesis that should be mentioned, foremost its scope (or focus) and the data used. Despite our early decision to restrict the discussion in chapter 2 to one dominant stream in behavioural economics (and thus disregard

experimental economics), the number of potentially relevant ideas for transportation research still turned out to be much too large to attend to in this thesis. We focused our investigation on the subjective choice set, following the argument that travel is a derived demand and that distinguishing between choice set formation and actual choice given the prevailing choice set was indicated as an important gap between observed travel behaviour and the rational travel behaviour assumption underlying much of transportation research. More in particular, we focused on how the subjective choice set affects travel decisions, how it is affected by perceptions, and how it relates to preference segments. In this sense, it is relevant to emphasize that this thesis highlights only a few examples of the possible causes of inert travel behaviour. Second, the data used for analysis in chapters 3 to 7 calls for comment. The data used in chapter 3 had to be collected short-term because the idea that a strike would form an interesting context for analysis of inertia only emerged on the day of the concerning strike. The time for review of the literature, questionnaire development and timely data collection therefore was short, and we found out late that we were not permitted to collect data in station areas or on trains. While, with hindsight, the literature review and questionnaire were considered satisfactory, the sample potentially was selective. Nonetheless, we generated some interesting insights, which eventually led to the opportunity to gain access to the data used in chapter 4. This dataset was truly unique in the sense that it contained pre- and post-strike information from the same rail users, which was unprecedented. This advantage, however, came with the disadvantage that it was secondary data, not collected for the purpose of our research question and therefore omitted information that could have been of interest, in particular related to peoples' travel choice sets. Chapters 5 and 6 relied on secondary data as well, with specific limitations highlighted in the respective discussion sections. All these chapters would benefit from replication using original, dedicated datasets. Chapter 7 could be criticized for the sample size,

Chapter 8

which is relatively small for transportation research standards. However, as also argued in the chapter, the sample is appropriate for the research method used.

This research contributes to our understanding of travel behaviour by showing why considering choice sets explicitly in transportation research and policy is relevant. Irrespective of whether a travel decision is reasoned or inert, it is often not made from the full set of available opportunities. The choice set may be restricted in different -reasoned and inert- ways. Travel may be inert as a result of deliberate, superordinate mobility related decisions or clear preferences for a particular way of travel ('passion'), which could be considered rational. But it may also result from incomplete information ('ignorance') or limited cognitive capacity devoted to the decision ('stupidity'), which is harder to interpret as rational. And then again, travel decisions from this restricted choice set may be rational or inert as well, and approaches to consider for the analysis of such decisions may include bounded rationality, prospect theory, judgement of probabilities, interdependence, adaptive and relative preferences, and intertemporal choice. The question may then be raised what approach would be appropriate to adopt in any specific study of observed behaviour. According to Ben-Akiva et al. (1999), this depends on characteristics of the concerning decision makers, the object of choice and the situational context. But perhaps at least as important, it is contingent on the goal of the study. If, for instance, the aim is to predict the effects of any policy as accurately as possible, using models that account for heterogeneity in travel behaviour (even if deemed 'irrational') seems appropriate. If, on the other hand, the aim is to show what would be optimal travel choices following a policy, using rational models of behaviour may be considered preferable.

It is also important to stress that not all invariant travel behaviour needs to be inert and that repetition does not necessarily imply habit. Such

behaviour may also be consistent with informed preferences and reasoned behaviour. Repeating the same behaviour breeds familiarity and induces learning and experience. Travellers gather information about the relation between context and outcome and develop decision making strategies about how to behave under different circumstances. When outcome expectations are fulfilled, strategies are reinforced and may develop into routines, which allow travellers to manage choice situations efficiently and can be seen as an expertise model of behaviour. However, travel routines may lead to habit formation and, although perhaps once rationally formed, may eventually lead to inertia. For instance, habits may moderate travellers' involvement with decision making and lead to selective alertness to information about changes in alternatives or the wider choice context, inaccurate perceptions of travel choice options and restriction of consideration sets. As McFadden (2001) phrased it: "Even for routinised, 'rational' decisions such as work trip mode choice which may be consistent with the economists' standard model, psychological elements are likely to be important in the construction and reinforcement of preferences". Such habits and associated behaviour may be undesirable from an individual and societal perspective and transport policy may strive to break them, or they may be desirable and policies can be aimed at sustaining such types of invariant travel behaviour.

Implications for transport policy

Chapters 3 to 7 and the discussion above have highlighted a number of implications of inertia for transport policy in relation to travel choice sets. These can be summarized into more general focus points for policies aimed at influencing travel behaviour: influencing the travel choice set and influencing travel decisions from the prevailing choice set.

As discussed, a traveller's consideration set may consist of a (very) restricted selection of his travel opportunities as a result of mobility-related choices. While travel decisions may be made on a daily basis,

Chapter 8

mobility-related choices are made much less frequently. Changing house or work location, starting a family, having kids who go to school and retiring from work are some examples of major life events that may lead people to reconsider their travel alternatives and to evaluate and 'open' their consideration set. On such opportunities for influencing travel choice sets it is important that people have complete, undistorted information about the travel options they have. For example, when people (consider to) move house, a policy to stimulate people to consider their opportunities could be to provide access to individualized multi-modal information for the principal trips of the household. Ideally, such information would include the full opportunity set, the travel time and reliability of all alternatives at different times of day and the travel costs according to different arrangements of car and season-ticket ownership. But also information about other aspects of travel which subgroups of travellers may find important, as for instance the ecological footprint of alternatives or possibilities to switch to other modes of travel in particular occasions. A mobility advisor, in-person or on-line, could provide such information. Currently, the travel information that is available is fragmented and most of the times comes from different sources, for individual modes and for single trips, sometimes for combinations of modes (e.g., public transport alternatives for a trip or multi-modal information to a specific location). If optimizing travel decision making is viewed as primarily a social problem such a mobility advisor could be financed by government (RVW 2010), but public transport suppliers obviously also have a lot to gain from stimulating people to consider and use their services more often. The provision of company (or leased) cars is another example. When people change jobs and get a company car for their commuting and business travel this may have a substantial impact on their willingness to consider public transport as an alternative for these trips (see chapter 5). Alternatively, company relocation (or urban planning more in general) also provides opportunities to influence the choice of

office location, the provision of (parking and public transport) services at that location, the mobility arrangements offered to employees, or to inform employees of their travel possibilities. Solof (2010) argued that companies can nudge employees by changing the choice infrastructure of business and commuting travel; by making particular alternatives the default option (e.g., monthly mobility budget rather than company car, business travel refunded at train tariff, flexible working hours/meetings between 10 and 4) the point of reference for travel decisions is changed. As an example, the Academic Hospital Amsterdam (AMC) offers new employees a comprehensive mobility advice for their new commuting trip and a 'destination work pass' that gives them two months free access to public transport; first experiences are that eight out of ten new employees owning a car accepts the offer to try out public transport and half of them sticks to public transport after the trial period (Kusiak 2009). Because commuting tends to be the backbone of peoples' travel behaviour, the effect of policies that aim to influence commuting and business travel may well extend to other travel. The major life events mentioned before may also be the occasions when people take their experience with alternative modes into consideration, and the effects of public transport strikes or recurrent congestion and parking problems potentially arise (as seen in chapters 3 to 7). Therefore, if the policy concern is to persuade car drivers to consider and use public transport more often, it could be effective to prevent negative experiences with public transport as much as possible and to not attempt to solve congestion and parking problems more than necessary for other purposes. Furthermore, it is important that public transport services are available before new housing or office locations are delivered. More in general, RVW (2010) recently formulated a range of recommendations to make trends in demography and differences in lifestyle more central to policy makers, urban planners and transport service providers. For instance, more attention for specific mobility preferences, means of communication and lifestyles among in subgroups

Chapter 8

of travellers -like for instance the elderly, the young and the autochthonous population- should provide opportunities for decreasing car dependence and promoting easy and effective decision making between alternatives.

Second, for influencing travel decisions from the prevailing choice set, it is important to consider the heterogeneity in travel decision making and to account for differences among travellers in preferences, opportunities and constraints. Segments of travellers will differ in their sensitivity to attempts at influencing their behaviour, as well as to the type of policy that may be most effective. It is thus relevant to identify sizeable subgroups of travellers displaying similar behaviour in response to changes in circumstances, and to understand their choice sets and motivations for travel. Next, policies targeted at specific subgroups could be developed, bearing in mind their travel preferences. As an example, for a policy targeting car users (on a specific route, time of day) who are willing to consider alternative modes of travel, one could explore what their travel opportunities are, their perceptions of the costs and benefits of these opportunities, and how this information could be used to persuade this subgroup to use the car less often (on that specific route, time of day). Recently, experiments have been conducted in the Netherlands, offering car users on highly congested routes and train travellers on connections with high capacity utilisation a premium to travel off-peak (e.g., Spitsmijden Group 2007; 2009; Samenwerkingsverband Spitsmijden 2009). Although first experiences seem to be mixed and longer-term effects are yet unclear, this is a good example of such a policy. More in general, however, chapters 3 to 5 showed that the majority of public transport travellers has the car in their consideration set, while only a minority of car users has public transport in theirs. Moreover, chapter 7 indicated that public transport travellers tend to be choice travellers, whereas mode dependent travellers tend to be car

users. All in all this suggests a continuous potential shift towards the car, away from public transport, and a need for more forceful policies to persuade car drivers to consider and use public transport more often. Examples include restricting or pricing access to areas or routes by car (at specific times of day, for specific groups) and investing in experience and the relative attractiveness of public transport (e.g., high volume connections, urbanized areas, particular subgroups). Notable examples include congestion pricing (e.g., London, Stockholm, Singapore, Trondheim, California) and free use of public transport, either structurally (e.g., Hasselt, Hawaii, Stanford), temporarily (e.g., student public transport pass in the Netherlands) or occasionally (e.g., weekends, shopping nights, special events). Public transport suppliers could develop more policies to attract and retain ridership, for instance through free trials for specific subgroups (e.g., car users changing house or work location or living close to new connections), loyalty programmes (e.g., saving for free trips or upgrades) and cooperation with suppliers of related services (e.g., diverse forms of access and egress transport, business services on board). As discussed in chapters 3 and 4, such policies are particularly important following service disruptions, like a strike or any other major incident, in order to mitigate longer-term effects of negative experiences on ridership.

The road ahead

For transportation research there are quite a few interesting directions to venture on. As became clear from section 2.3, many of the ideas emerging from behavioural economics have not yet been studied extensively in the context of travel behaviour. Following the research presented in chapters 3 to 7, many interesting questions remain concerning subjective choice sets, for example: What are peoples' choice sets? How are they formed and sustained? How are travel decisions made from this choice set? What is the influence of individual preferences and

Chapter 8

perceptions, and how can these be targeted by policy? Such questions are relevant in the context of middle-distance travel, but also in other areas of individual decision making. An integrated study of preference segments, choice sets and travel behaviour would certainly also be of interest. In addition, more research could be done into the effects of policies to stimulate companies to offer their employees a mobility package rather than a single mode option, which is usually the case with company cars, or public transport suppliers to offer multi-modal options to their season-ticket holders. This may of course primarily attract the choice traveller segments, but they obviously form the primary target group for such policies. In this context, it would also be interesting to consider how people adjust their (total) travel behaviour when they lose their company car, for instance after they change or lose employment. Recently, KiM (2011) formulated nine building-blocks for more effective transport policies based on insights from psychology and behavioural economics. Among them, many of the concepts and ideas discussed here above: distinguish between different decision-making approaches, account for differences in attitude and lifestyle, target policies to specific subgroups and around discontinuities in people's lives, and sustain good habits.

Thus, the road ahead in transportation is far from empty, not for research and certainly not for policy. The best direction to take for understanding and influencing travel behaviour is uncertain and probably there is no single best direction (ESB 2011). The assumption of the rational actor basing travel decisions on utility maximization probably will remain a strong and fruitful starting point in transportation research and policy, but there may also be a lot to gain from pursuing alternative approaches to improve the analysis and possibility to influence travel decision making. In which direction the field will move is difficult to foresee, because as Dietz and Wolfson (2011) highlight, inertia is not bounded to travellers only.

List of tables

Table 3.1	Overview of observed effects in 13 studies of public transport strikes	84
Table 3.2	Characteristics of strikes	85
Table 3.3	Reaction to strike according to travel motive	90
Table 3.4	Mode choice of travellers who left home on the day of the strike.....	90
Table 3.5	Reaction to the strike according to expectations of strike severity	91
Table 4.1	Media reports on the day of the 2004 strike and the day after	97
Table 4.2	Sample characteristics	102
Table 4.3	Actual versus anticipated behavioural reaction to the strike	103
Table 4.4	Behavioural reaction to the strike; multinomial logit model	105
Table 4.5	Behavioural reaction to the strike; marginal effects.....	106
Table 4.6	Perceived behavioural control, satisfaction and post-strike opinions	109
Table 5.1	Characteristics of train users (n=7,950)	121
Table 5.2	Possibility to use the car among train users with the car in their choice set; marginal effects	126
Table 5.3	Characteristics of car travellers (n=19,232)	127
Table 5.4	Possibility to use public transport among car travellers; marginal effects	128
Table 6.1	Reported travel time by car and perceived travel time by public transport.....	139

Table 6.2	Determinants of perceived public transport travel time	143
Table 6.3	Travel time by car versus perceived and OD-based travel time by public transport	143
Table 6.4	Possibility to use public transport among car users; multinomial logit model	144
Table 6.5	Possibility to use public transport among car users; marginal effects	145
Table 6.6	Could you also have made this trip by public transport?.....	146
Table 7.1	Structured Q sample	156
Table 7.2	Correlations between consecutive factor solutions	161
Table 7.3	Factor arrays	162
Table 7.4	Factor loadings	164

List of figures

Figure 1.1	Income and car ownership	2
Figure 2.1	Hierarchical identification of car drivers with opportunity to use public transport	17
Figure 2.2	Relation between emotional arousal and cognitive performance	48
Figure 2.3	Interdependence and information value	61
Figure 4.1	Data collection in two waves	99
Figure 4.2	Perceived behavioural control with the chosen alternative	107
Figure 4.3	Satisfaction with the chosen alternative.....	107
Figure 4.4	Happiness with the chosen alternative.....	108
Figure 5.1	Study area and sample size	117
Figure 5.2	Car in choice set?	120
Figure 5.3	Main reasons for choosing public transport instead of car	122
Figure 7.1	Score sheet	158
Figure 7.2	Factor diagram: Correlations between consecutive factor solutions	160
Figure 7.3	Opinions about car per preference segment	172
Figure 7.4	Opinions about public transport per preference segment.....	172

List of references

- Ajzen I (1977) Intuitive theories of events and the effects of base-rate information on prediction. *Journal of Personality and Social Psychology* 35(5): 303-314.
- Akerlof GA (1970) The market for 'lemons': quality uncertainty and the market mechanism. *Quarterly Journal of Economics* 84(3): 488-500.
- Akerlof GA (1984) *An economic theorist's book of tales*. Cambridge University Press.
- Alessie R, Kapteyn A (1991) Habit formation and preference interdependence in the Almost Ideal Demand System. *The Economic Journal* 101: 404-419.
- Alexander B, Dijst M, Ettema D (2010) Working from 9 to 6? An analysis of in-home and out-of-home working schedules. *Transportation* 37(3): 505-523.
- Allais AM (1953) Le comportement de l'homme rationel devant le risque, critique des postulats et axiomes de l'école américaine. *Econometrica* 1: 503-546.
- Allingham M (1999) *Rational choice*. London: MacMillan.
- Anable J (2005) 'Complacent car addicts' or 'Aspiring environmentalists'? Identifying travel behaviour segments using attitude theory. *Transport Policy* 12: 65-78.
- Anable J, Gatersleben B (2005) All work and no play? The role of instrumental and affective factors in work and leisure journeys by different travel modes. *Transportation Research A* 39(2/3): 97-123.
- Anderson E (2000) Beyond homo economicus: New developments in theories of social norms. *Philosophy & Public Affairs* 29(2): 170-200.
- Ansoff HI (1987) *Corporate strategy*. London: Penguin Business.
- Anten J, Manders P, Mors BWC, Schmidt T, Knegtmans JJ (1984) Car-free: an investigation into the experiences of former car-owners [in Dutch: Autoloos: een onderzoek naar de ervaringen van ex-autobezitters]. University of Leiden, Vakgroep Sociale en Organisationspsychologie.
- Antonides G (1998) Psychological explanations for some economic anomalies [in Dutch: Psychologische verklaringen van enkele economische anomalieën]. *Nederlands Tijdschrift voor de Psychologie* 53: 12-22.

- Armoogum J, Krakutovski Z, Madre J-L (2003) Long term trend of travel time budgets related to demographic factors: A comparative case study between 3 French large conurbations, Paris, Lyon & Lille. Lucerne: Proceedings of the 10th International Conference on Travel Behaviour Research.
- Arrow KJ (1994) Methodological individualism and social knowledge. *American Economic Review* 84: 1-9.
- Arrow KJ (1996) Preface. In: Arrow KJ, Colomatto E, Pearlman M, Schmidt C (Eds.) *The rational foundations of economic behaviour*. London: MacMillan press.
- Arrow KJ (1997) The functions of social choice theory. In: Arrow KJ, Sen A, Suzumura K (Eds.) *Social choice re-examined: Proceedings of the International Economic Association conference 1994 1*. London: MacMillan Press.
- Asensio J, Matas A (2008) Commuters' valuation of travel time variability. *Transportation Research E* 44(6): 1074-1085.
- Assael H (1992) *Consumer behavior and marketing action*. New York University Press.
- Avineri E, Prashker J (2004) Violations of Expected Utility Theory in Route-Choice Stated Preferences: Certainty Effect and Inflation of Small Probabilities. *Washington: TRB Transportation Research Record* 1894: 222-229.
- Axelrod R (1984) *The evolution of cooperation*. New York: Basic Books.
- Axhausen KW, Zimmermann A, Schönfelder S, Rindsfuser G, Haupt T (2001) Observing the rhythms of daily life: A six-week travel diary. *Transportation* 29(2): 95-124.
- Bagozzi RP (1992) The self-regulation of attitudes, intentions and behavior. *Social Psychology Quarterly* 55(2): 178-204.
- Baker R, van Exel J, Mason H, Stricklin M (2010) Connecting Q & surveys: a test of three methods to explore factor membership in a large sample. *Operant Subjectivity* 34(1): 38-58.
- Baker RM (2006) Economic rationality and health and lifestyle choices for people with diabetes. *Social Science & Medicine* 63(9): 2341-53.
- Bamberg S, Ajzen I, Schmidt P (2003) Choice of travel mode in the Theory of Planned Behaviour: the roles of past behaviour, habit and reasoned action. *Basic and Applied Social Psychology* 25(3): 175-187.
- Bamberg S, Rölle D, Weber C (2003) Does habitual car use not lead to more resistance to change of travel mode. *Transportation* 30(1): 97-108.

List of references

- Bamberg S, Schmidt P (2001) Theory-Driven Subgroup-Specific Evaluation of an Intervention to Reduce Private Car Use. *Journal of Applied Social Psychology* 31(6): 1300-1329.
- Bamberg S, Schmidt P (2003) Intentions, morality or habit? Predicting students' car use for university routes with the models of Ajzen, Schwartz and Triandis. *Environment and Behavior* 35(2): 264-285.
- Banerjee AV (1992) A simple model of herd behavior. *Quarterly Journal of Economics* 107(3): 797-817.
- Banister D (1978) The influence of habit formation on modal choice: a heuristic model. *Transportation* 7(1): 19-33.
- Banister D (2002) *Transport planning*. Revised and enlarged 2nd edition. London: Routledge.
- Banister D, Marshall S (2000) *Encouraging travel alternatives*. London: The Stationary Office.
- Basmajian C (2010) "Turn on the radio, bust out a song": the experience of driving to work. *Transportation* 37(1): 59-84.
- Bates J (2001) Reliability: The missing model variable. In: Hensher D (Ed.) *Travel behaviour research: The leading edge*. Amsterdam: Elsevier.
- Bates J, Polak J, Jones P, Cook A (2001) The valuation of reliability for personal travel. *Transportation Research E* 37: 191-229.
- Baumol WJ, Blinder AS (1999) *Economics: principles and policy*. Fort Worth, TX: The Dryden Press.
- Becker GS (1976) Altruism, egoism and genetic fitness: economics and sociobiology. *Journal of Economic Literature* 14: 817-826.
- Becker GS (1978) *The economic approach to human behavior*. University of Chicago Press.
- Becker GS (1992) Habits, addictions, and traditions. *Kyklos* 45(3): 327-346.
- Becker GS (1993a) *A treatise on the family*. Harvard University Press.
- Becker GS (1993b) Nobel lecture: The economic way of looking at behavior. *Journal of Political Economy* 101(3): 385-409.
- Becker GS, Mulligan CB (1997) The endogenous determination of time preference. *Quarterly Journal of Economics* 112(3): 729-758.

- Becker GS, Murphy KM (1988) A theory of rational addiction. *Journal of Political Economy* 96(4): 675-700.
- Beilock R (2000) The impact of caring on exchange choices and efficiencies: a modification of Boulding's three social organizers. *The Journal of Socio-Economics* 29: 263-279.
- Bell DE (1982) Regret in decision making under uncertainty. *Operations Research* 30(5): 961-981.
- Bell DE (1985) Disappointment in decision making under uncertainty. *Operations Research* 33(1): 1-27.
- Belsky G (1999) To understand your customers, you have to know how they think. *America's Community Banker*: 23-26.
- Ben-Akiva M, Lerman S (1985) *Discrete choice analysis: Theory and application to travel demand*. Cambridge: The MIT Press.
- Ben-Akiva M, McFadden D, Gärling T, Gopinath D, Walker J, Bolduc D, Börsch-Supan A, Delquié P, Larichev O, Morikawa T, Polidoropoulou A, Rao V (1999) Extended framework for modelling choice behaviour. *Marketing Letters* 10(3): 187-203.
- Bentham J (1879) *An introduction into the principles of morals and legislation*. Oxford University Press.
- Bilton T, Bonnett K, Jones P, Sheard K, Stanworth M, Webster A (1989) *Introductory sociology*. London: MacMillan.
- Bjørnskau T (1999) *Bothered by the bus strike? Report 423*. Oslo: Transportøkonomisk institutt.
- Blaas EW, Vleugel JM, Louw E, Rooijers T (1992) *Car ownership, car use and driving behaviour; determinants of energy consumption in passenger car mobility [in Dutch: Autobezit, autogebruik en rijgedrag; determinanten van het energiegebruik bij personen-automobiliteit]*. Technical University Delft, Infrastructuur, Transport & Logistiek.
- Blanchflower DG, Oswald AJ (2001) *Well-being over time in Britain and the USA*. University of Warwick, Economic Research Paper 616.
- Blauwens G, de Baere P, van de Voorde E (2010) *Transport Economics*. Berchem: De Boeck.
- Blumstein A, Miller HD (1983) Making do: the effects of a mass transit strike on travel behavior. *Transportation* 11(4): 361-382.

List of references

- Bogers EAI, van Lint HWC, van Zuylen HJ (2008) Reliability of travel time: effective measures from a behavioral point of view. *Transportation Research Record* 2008: 27-34.
- Bogers EAI, Viti F, Hoogendoorn SP, van Zuylen HJ (2006) Valuation of different types of travel time reliability in route choice: large-scale laboratory experiment. *Transportation Research Record* 1985: 162-170.
- Bohnet I, Frey BS (1999) Social distance and other-regarding behaviour in dictator games: comment. *American Economic Review* 89(1): 335-339.
- Bolduc D, McFadden D. Methodological developments in travel behaviour modelling. In: Hensher D (Ed.) *Travel behaviour research: The leading edge*. Amsterdam: Elsevier. 2001.
- Bonsall P, Dunkerley C (1997) Use of concessionary travel permits in London: results of a diary survey. *Proceedings of 25th annual AET European Transport Conference (Seminar G: Public transport planning and operations)* P416: 99-116.
- Boot CRL, NJA van Exel, JWJ van der Gulden. "My Lung Disease Won't Go Away, it's There to Stay": Profiles of Adaptation to Functional Limitations in Workers with Asthma and COPD. *Journal of Occupational Rehabilitation* 2009;19(3): 284-292.
- Boulding KE (1981) *A preface to grants economics: the economy of love and fear*. New York: Praeger.
- Bovenberg AL, van de Klundert ThCMJ (1999) Christian tradition and neo-classical economics in conversation [in Dutch: Christelijke traditie en neo-klassieke economie in gesprek]. *Economische Statistische Berichten* 84(4230): 848-852.
- Bovy P, Stern E (1990) *Route choice: wayfinding in transport networks*. Dordrecht: Kluwer Academic Publishers.
- Brindle R (2003a) Kicking the habit (Part 1): some musings on the meaning of 'car dependence'. *Road & Transport Research* 2003;12(3): 61-73.
- Brindle R (2003b) Kicking the habit (Part 2): what are the real options for reducing 'car dependence'? *Road & Transport Research* 2003;12(4): 34-40.
- Brög W, Erl E (1983) Application of a model of individual behaviour (situational approach) to explain household activity patterns in an urban area and to forecast behavioural changes. In: Carpenter SM, Jones PM (Eds.) *Recent advances in travel demand analysis*. Gower: Aldershot.
- Brög W, Heuwinkel D, Neuman K-H (1977) Psychological determinants of user behaviour. Paris: European Conference of Ministers of Transport, Round Table 34.

- Brouwer WBF, Culyer AJ, NJA van Exel, FFH Rutten (2008) Welfarism vs. extra-welfarism. *Journal of Health Economics* 27(2): 325-338.
- Brouwer WBF, van Dijk JJ, van Exel NJA (1998) Reputation-effects in the second-hand car market [in Dutch: De markt voor gebruikte auto's; reputatie-effetcten]. *Tijdschrift Vervoerwetenschap* 2: 137-144.
- Brouwer WBF, van Exel NJA (2005) Expectations regarding length and quality of life: some empirical findings. *Social Science & Medicine* 14: 169-183.
- Brouwer WBF, van Exel NJA, van den Berg B, van den Bos GAM, Koopmanschap MA (2005) Process utility from providing informal care: the benefit of caring. *Health Policy* 74 (1): 85-99.
- Brown SR (1980) *Political subjectivity: Applications of Q methodology in political science.* Yale University Press.
- Brown SR (1986) Q technique and method: principles and procedures. In: Berry WD, Lewis-Beck MS. *New tools for social scientists: advances and applications in research methods.* Beverly Hills: Sage Publications.
- Brown SR (1993) A primer on Q methodology. *Operant Subjectivity* 16(3/4): 91-138.
- Browning M, Crossley TF (2000) Luxuries are easier to postpone: A proof. *Journal of Political Economy* 108(5): 1022-1026.
- Bryant WK (1990) *The economic organization of the household.* Cambridge University Press.
- Buchanan J (1987) Nobel lecture: The constitution of economic policy. *American Economic Review* 77: 243-250.
- Buljac M, JDH van Wijngaarden, KP van Wijk, NJA van Exel. Perceptions of team workers in youth care of what makes teamwork effective. *Health & Social Care in the Community* 2011;19(3): 307-316.
- Burnett P, Hanson S (1982) The analysis of travel as an example of complex human behavior in spatially constrained situations: Definition and measurement issues. *Transportation Research A* 16(2): 87-102.
- Calvert T, Avineri E (2011) Who wants to commute more and why? Exploring the positive utility of the commute. *PROJECT: Journal of the Department of Planning and Architecture* 3: 68-69.

List of references

- Camerer C (1999) Behavioral economics: reunifying psychology and economics. *Proceedings of the National Academy of Sciences of the United States of America* 96(19): 10575–10577.
- Camerer C, Babcock L, Loewenstein G, Thaler R (1997) Labor supply of New York City cabdrivers: one day at a time. *Quarterly Journal of Economics* 112(2): 407-441.
- Cameron S, Lyons TJ, Kenworthy JR (2004) Trends in vehicle kilometres of travel in world cities, 1960-1990: underlying drivers and policy responses. *Transport Policy* 11(3): 287-298.
- Cantillo V, de Dios Ortúzar J, Williams HCWL (2007) Modelling discrete choices in the presence of inertia and serial correlation. *Transportation Science* 41(2): 195–205.
- Cao X, Mokhtari PL (2005a) How do individuals adapt their personal travel? A conceptual exploration of the consideration of travel-related strategies. *Transport Policy* 2005;12: 199-206.
- Cao X, Mokhtari PL (2005b) How do individuals adapt their personal travel? Objective and subjective influences on the consideration of travel-related strategies for San Francisco Bay Area commuters. *Transport Policy* 2005;12: 291-302.
- Caplice C, Mahmassani HS (1992) Aspects of commuting behaviour. *Transportation Research A* 26(5): 409-418.
- CBS (1999) Mobility of the Dutch population in 1998 [in Dutch: De mobiliteit van de Nederlandse bevolking in 1998]. Voorburg/Heerlen: Central Bureau of Statistics.
- CBS (2006). Statline. Voorburg/Heerlen: Central Bureau of Statistics.
- Chaloupka FJ, Warner KE (2000) The economics of smoking. In: Culyer AJ, Newhouse JP (Eds.) *Handbook of health economics*. North-Holland: Elsevier Science.
- Chandrasekharan R, McCarthy PS, Wright GP (1997) Models of brand loyalty in the automobile market. In: Stopher P, Lee-Gosselin M. *Understanding travel behaviour in an era of change*. Oxford: Pergamon.
- Chapman GB, Johnson EJ (1999) Anchoring, activation, and the construction of values. *Organizational Behavior and Human Decision Processes* 79(2): 115-153.
- Chen Y-H (2010) Exploring passenger anxiety associated with train travel. *Transportation* 37(6) :875–896.
- Cherchi E, Manca F (2011) Accounting for inertia in modal choices: some new evidence using a RP/SP dataset. *Transportation* 38(4):679–695.

- Choo S, Mokhtarian PL (2004) What type of vehicle do people drive? The role of attitude and lifestyle in influencing vehicle type choice. *Transportation Research A* 38: 201-222.
- Chorus CG, Arentze TA, Timmermans HJP (2008) A Random Regret-Minimization model of travel choice. *Transportation Research B* 42(1): 1-18.
- Chorus CG, Molin EJE, van Wee B (2006) Travel information as an instrument to change car-drivers' travel choices: a literature review. *European Journal of Transport and Infrastructure Research* 6(4): 335-364.
- Chorus CG, Molin EJE, van Wee B, Arentze TA, Timmermans HJP (2006) Responses to transit information among car-drivers: Regret-based models and simulations. *Transportation Planning and Technology* 29(4): 249-271.
- Cipriani GP, Lubian D, Zago A (2009) "Natural born economists?" *Journal of Economic Psychology* 30(3): 455-468.
- Clark AE (1999) Are wages habit-forming? Evidence from micro data. *Journal of Economic Behavior & Organization* 39: 179-200.
- Clark JM (1918) Economics and Modern Psychology, I and II. *Journal of Political Economy* 26(1/2): 1-30; 136-166.
- Clarke M, Dix M (1983) Stages in lifecycle: a classificatory variable with dynamic properties. In: Carpenter S, Jones P. *Recent advances in travel demand analysis*. Aldershot: Gower Publishing.
- Clifton KJ, Handy SL (2003) Qualitative methods in travel behaviour research. In: Stopher P, Jones P. *Transport Survey Quality and Innovation*. Amsterdam: Pergamon.
- Cohen GA (1993) Equality of what? On welfare, goods and capabilities. In: Nussbaum MC, Sen AK (Eds.) *The Quality of Life*. Oxford: Clarendon Press.
- Coindet J (1998) Home-to-work trips during the transportation strikes in Ile-de-France at the end of 1995. *Journal of Transportation and Statistics* 1(3): 43-51.
- Commons JR (1931) Institutional Economics. *American Economic Review* 21(4): 648-657.
- Commons JR (1934) *Institutional economics: Its place in political economy*. London: MacMillan.
- Cookson R (2000) Incorporating psycho-social considerations into health-valuation: an experimental study. *Journal of Health Economics* 19: 369-401.

List of references

- Cools M, Moons E, Janssens B, Wets G (2009) Shifting towards environment-friendly modes: profiling travelers using Q-methodology. *Transportation* 36(4): 437–453.
- Crain JL, Flynn SD (1975) Southern California Rapid Transit District 1974 strike impact study. Sacramento, CA: California Department of Transportation, Division of Mass Transportation.
- Cramm J-M, H Finkenflügel, V Møller, NJA van Exel. Patient views on determinants of adherence with tuberculosis treatment in the Eastern Cape, South Africa: An application of Q-methodology. *The Patient: Patient-Centered Outcomes Research* 2010;3(3): 159-172.
- Cross JG (1983) A theory of adaptive economic behavior. Cambridge University Press.
- Cyert RM, March JG (1963) A behavioral theory of the firm. Endlewood Cliffs, NJ: Prentice-Hall.
- Damasio AR (1994) Descartes' error: Emotion, reason and the human brain. New York: GP Putnam's Sons.
- Dargay J, Gately D, Sommer M (2007) Vehicle ownership and income growth, worldwide: 1960-2030. *Energy Journal* 28(4): 143-171.
- Dargay JM (2001) The effect of income on car ownership: evidence of asymmetry. *Transportation Research* 35(9): 807-821.
- Dargay JM (2004) The effect of prices and income on car travel in the UK. Istanbul: Proceedings of the World Conference on Transport Research.
- Dawes RM (1999) A message from psychologists to economists: mere predictability doesn't matter like it should (without a good story to append to it). *Journal of Economic Behavior & Organization* 39(1): 29-40.
- De Blaeij AT, van Vuuren D (2003) Risk perception of traffic participants. *Accident Analysis & Prevention* 35(2): 167-175.
- De Borger B, Fosgerau M (2008): Discrete choices and the trade-off between money and time: A test of the theory of reference-dependent preferences. *Journal of Urban Economics* 64(1): 101-115.
- De Craen S, Twisk DAM, Hagenzieker MP, Elffers H, Brookhuis KA (2008) The development of a method to measure speed adaptation to traffic complexity: identifying novice, unsafe, and overconfident drivers. *Accident Analysis and Prevention* 40(4): 1524-1530.

- De Dios Ortúzar J, Willumsen LG (2001) *Modelling transport*. Chichester: John Wiley & Sons.
- De Graaf G, J van Exel. Using Q-methodology in Administrative Ethics. *Public Integrity* 2009;11(1): 63-78.
- De Graaf G. (2001) Business Ethics and Discourse Theory, the Case of Bankers' Conceptualizations of Customers. *Journal of Business Ethics* 31(4): 299-319.
- De Graaf G. (2005) Veterinarians' discourses on animals and clients. *Journal of Agricultural and Environmental Ethics* 18(6): 447-578.
- De Jong G, Kouwenhoven M, Geurs K, Bucci P, Tuinenga JG (2009) The impact of fixed and variable costs on household car ownership. *Journal of Choice Modelling* 2(2): 173-199.
- De Palma A, Myers GM, Papageorgiou YY (1994) Rational choice under an imperfect ability to choose. *American Economic Review* 84(3): 419-437.
- Denzau AT, North DC (1994) Shared mental models: ideologies and institutions. *Kyklos* 47(1): 3-31.
- Desmet PMA, Hekkert P, Jacobs JJ (2000) When a car makes you smile: development and application of an instrument to measure product emotions. *Advances in Consumer Research* 27: 111-117.
- Diana M, Mokhtarian PL (2009) Grouping travellers on the basis of their different car and transit levels of use. *Transportation* 36(4): 455-467.
- Diekstra R, Kroon M (2003) Cars and behaviour: psychological barriers to car restraint and sustainable urban transport. In: Tolley (Ed.) *Sustainable Transport: Planning for Walking and Cycling in Urban Environments*. Cambridge: Woodland Publishing.
- Dietz F, Wolfson D (2011). What is our value of nature, environment and space? [in Dutch: Wat zijn natuur, milieu en ruimte ons waard?] *TPEdigitaal* 2011 jaargang 5(1) 1-14.
- Diwan R (2000) Relational wealth and the quality of life. *Journal of Socio-Economics* 29(4): 305-340.
- Dolfsma W (2002) The mountain of experience: how people learn in a complex, evolving environment. *International Journal of Social Economics* 29(8): 675-684.
- Domencich TA, McFadden D (1975) *Urban travel demand: a behavioral analysis*. Amsterdam: North-Holland Publishing Company.

List of references

- Douma S, Schreuder H (1991) Economic approaches to organizations. London: Prentice-Hall.
- Duesenberry JS (1959) Income, saving and the theory of consumer behavior. Harvard University Press.
- Dupuy G. (1999). La dépendance automobile. Paris : Collection Villes, Editions Anthropos-Economica.
- Durning D (1999) The Transition from Traditional to Postpositivist Policy Analysis: A Role for Q-Methodology. *Journal of Policy Analysis and Management* 18(3): 389-410.
- Easterlin RA (1974) Does economic growth improve the human lot? Some experimental evidence. In: David PA, Reder MW (Eds.) *Nations and households in economic growth: essays in honor of Moses Abramovitz*. New York: Academic Press.
- Easterlin RA (1995) Will raising the incomes of all increase the happiness of all?. *Journal of Economic Behavior & Organization* 27(1): 35-47.
- Eckel CC, Grossman PJ (1996) Altruism in anonymous dictator games. *Games and Economic Behavior* 16(2): 181-191.
- Effinger MR, Polborn MK (2001) Herding and anti-herding: A model of reputational differentiation. *European Economic Review* 45(3): 385-403.
- Einhorn HJ, Hogarth RM (1986) Decision making under ambiguity. In: Hogarth RM, Reder MW (Eds.) *Rational choice: the contrast between economics and psychology*. University of Chicago Press.
- Ellis G, Barry J, Robinson C (2007) Many ways to say 'no', different ways to say 'yes': Applying Q-Methodology to understand public acceptance of wind farm proposals. *Journal of Environmental Planning and Management* 50(4): 517-551.
- ESB (2011) Nudge for policy: Erik Verhoef / Kees Verhoeven on suppression of queuing [in Dutch: Nudge voor beleid: Erik Verhoef / Kees Verhoeven over filebestrijding. *Economische Statistische Berichten* 96(4607): 212-213.
- Etzioni A (1988) *The moral dimension: toward a New Economics*. New York: Free Press.
- Etzioni A (1991) A socio-economic perspective on time. In: Antonides G, Arts W, van Raaij WF (Eds.) *The consumption of time and the timing of consumption: Toward a new behavioral and socio-economics*. Amsterdam: North-Holland Publishing Company.
- Etzioni A (2003) Toward a new socio-economic paradigm. *Socio-Economic Review* 1(1): 105-134.
- Etzioni A (2008) The moral dimension revisited. *Socio-Economic Review* 6(1): 168-173.

- Eurostat (2009) *Panorama of Transport, 1990-2006*. Luxembourg: Office for Official Publications of the European Communities.
- Farag S, Lyons G (2008) What affects use of pretrip public transport information? Empirical results of a qualitative study. *Transportation Research Record* 2069: 85-92.
- Farag S, Lyons G (2010) Explaining public transport information use when a car is available: attitude theory empirically investigated. *Transportation* 37(6): 897-913.
- Fehr E, Gächter S (1998) Reciprocity and economics: the economic implications of Homo Reciprocans. *European Economic Review* 42(3-5): 845-859.
- Fehr E, Zych PK (1998) Do addicts behave rationally? *Scandinavian Journal of Economics* 100(3): 643-662.
- Fennema H, Wakker P (1997) Original and cumulative prospect theory: a discussion of empirical differences. *Journal of Behavioral Decision Making* 10(1): 53-64.
- Ferguson E (1991) Aggregate transit ridership forecasting with disaggregate temporal disturbances. Quebec: Proceedings of the 6th International Conference on Travel Behaviour: 586-602.
- Ferguson E (1992) Transit ridership, incident effects and public policy. *Transportation Research A* 26(5): 393-407.
- Ferrer-i-Carbonell A, Frijters P (2004) How important is methodology for the estimates of the determinants of happiness? *The Economic Journal* 114(497): 641-659.
- Festinger L (1957) *A theory of cognitive dissonance*. Stanford University Press.
- Field AJ (1998) Sunk costs, water over the dam and other liquid parables. In: Dennis K (Ed.) *Rationality in economics: alternative perspectives*. Boston: Kluwer Academic Publishers.
- Fischer MM (1993) Travel demand. In: Polak J, Heertje A (Eds.) *European transport economics*. Oxford: Blackwell.
- Fischhoff B (1975) Hindsight \neq foresight: the effect of outcome knowledge on judgement under uncertainty. *Journal of Experimental Psychology: Human perception and Performance* 1(3): 288-299.
- Fischhoff B (1982) For those condemned to study the past: heuristics and biases in hindsight. In: Kahneman D, Slovic P, Tversky A (Eds.) *Judgement under uncertainty: heuristics and biases*. Cambridge University Press.
- Fisher I (1930) *The theory of interest*. New York: MacMillan.

List of references

- Folmer H (2007) Why economists often slip up badly [in Dutch: Waarom economen vaak miskleunen]. Inaugural address, University of Groningen.
- Folmer H (2009) Why Sociology is Better Conditioned to Explain Economic Behaviour than Economics. *Kyklos* 62(2): 258–274.
- Folmer H, Oud H, Saris W (2010) Economie gebaat bij meer empirie en minder wiskunde. *Economische Statistische Berichten* 95(4592): 534-536.
- Fotheringham AS, O'Kelly ME (1989) Spatial interaction models: Formulations and applications. Dordrecht: Kluwer Academic Publishers.
- Frank RH (1988) Passions within reason: the strategic role of emotions. New York: WW Norton & Company.
- Frey BS, Stutzer A (2002) What can economists learn from happiness research? *Journal of Economic Literature* 40(2): 402-435.
- Frey BS, Stutzer A (2005) Beyond outcomes: measuring procedural utility. *Oxford Economic Papers* 57(1): 90–111.
- Friedman M (1962) Price theory. New York: Aldine Publishing Company.
- Friman M, Edvardsson B, Gärling T (2001) Frequency of negative incidents and satisfaction with public transport services: I. *Journal of Retailing and Consumer Services* 2001;8(2): 95-104.
- Friman M, Gärling T (2001) Frequency of negative incidents and satisfaction with public transport services: II. *Journal of Retailing and Consumer Services* 2001;8(2): 105-114.
- Frusti T, Bhat CR, Axhausen KW (2003) An exploratory analysis of fixed commitments in individual activity-travel patterns. *Transportation Research Record* 1807: 101-108.
- Fujii S, Gärling T (2003) Application of attitude theory for improved predictive accuracy of stated preference methods in travel demand analysis. *Transportation Research A* 37(4): 389-402.
- Fujii S, Kitamura R (2003) What does a one-month free bus ticket do to habitual drivers? *Transportation* 30(1): 81-95.
- Gallagher MP (1975) A temporary carpool lane. *Traffic Engineering* 45(11): 36-38.
- Gardner B, Abraham C (2008) Psychological correlates of car use: a meta-analysis. *Transportation Research F* 11(4): 300-311.

- Gärling T, Gillholm R, Gärling A (1998) Reintroducing attitude theory in travel behavior research. *Transportation* 25(2): 129-146.
- Gärling T, Schuitema G (2007) Travel Demand Management Targeting Reduced Private Car Use: Effectiveness, Public Acceptability and Political Feasibility. *Journal of Social Issues* 63(1): 139-153.
- Gärling T, Young W (2001) Perspectives on travel behaviour: decision paradigms. In: Hensher D (Ed.) *Travel behaviour research: The leading edge*. Amsterdam: Elsevier.
- Garvill J, Marell A, Nordlund A (2003) Effects of increased awareness on choice of travel mode. *Transportation* 30(1): 63-79.
- Gatersleben B (2011) The car as material possession: exploring the link between materialism and car ownership and use. In: Lucas K, Blumenberg E & Weinberger R (Eds.) *Auto Motives: understanding car use behaviours*. Bradford: Emerald Books.
- Gatersleben B, Haddad H (2010) Who is the typical bicyclist? *Transportation Research F* 13(1): 41-48.
- Gattig ALW (2002) Intertemporal decision making: Studies on the working of myopia. PhD Thesis, University of Groningen.
- Goldberg LR (2006) Doing it all Bass-Ackwards: The development of hierarchical factor structures from the top down. *Journal of Research in Personality* 40(4): 347-358.
- Goodwin PB (1977) Habit and hysteresis in mode choice. *Urban Studies* 14(1): 85-98.
- Goodwin PB (1983) Some problems in activity approaches to travel demand. In: Carpenter S, Jones P. *Recent advances in travel demand analysis*. Aldershot: Gower Publishing.
- Goodwin PB (1992) A review of new demand elasticities with special reference to short and long run effects of price changes. *Journal of Transport Economics and Policy* 36(2): 155-169.
- Goodwin PB (1995) Car dependence. *Transportation* 2(3): 151-152.
- Gorter C (1991) The dynamics of unemployment and vacancies on regional labour markets. PhD thesis, Free University of Amsterdam.
- Gosselin D, Gagnon S, Stinchcombe A, Joanisse M (2010) Comparative optimism among drivers: an intergenerational portrait. *Accident Analysis and Prevention* 42(2): 734-740.
- Götz K, Loose W, Schmied M, Schubert S (2003) Mobility styles in leisure time. Lucerne: Proceedings of the 10th International Conference on Travel Behaviour Research.

List of references

- Goulias KG (2003) On the role of qualitative methods in travel surveys. In: Stopher P, Jones P (Eds.) *Transport Survey Quality and Innovation*. Amsterdam: Pergamon.
- Grant S, Kajii A, Polak B (2001) Different notions of disappointment aversion. *Economic Letters* 70(2): 203-208.
- Hägerstrand T (1970) What about people in regional science? *Papers of the Regional Science Association* 24(1): 7-21.
- Hagman O (2003) Mobilizing meanings of mobility: car users' constructions of the goods and bads of car use. *Transportation Research D* 8(1): 1-9.
- Hailu G, Boxall PC, McFarlane BL (2005) The influence of place attachment on recreation demand. *Journal of Economic Psychology* 26(4): 581-598.
- Hamermesh DS (1985) Expectations, life expectancy, and economic behavior. *The Quarterly Journal of Economics* 100(2): 389-408.
- Handgraaf MJJ, van Raaij WF (2005) Fear and loathing no more: the emergence of collaboration between economists and psychologists. *Journal of Economic Psychology* 26(3): 387-391.
- Handy S, Weston L, Mokhtarian PL (2005) Driving by choice or necessity? *Transportation Research A* 39(2/3): 183-204.
- Hanson S, Huff JO (1982) Assessing day-to-day variability in complex travel patterns. Washington: TRB *Transportation Research Record* 891: 18-24.
- Hanson S, Huff JO (1988) Systematic variability in repetitious travel. *Transportation* 15(1/2): 111-135.
- Harré N, Sibley CG (2007) Explicit and implicit self-enhancement biases in drivers and their relationship to driving violations and crash-risk optimism. *Accident Analysis and Prevention* 39(6): 1155-1161.
- Heggie IG, Jones PM (1978) Defining domains for models of travel demand. *Transportation* 7(2): 119-125.
- Heijs W (1999) Domestic energy consumption: habitual behaviour and possibilities for intervention [in Dutch: Huishoudelijk energieverbruik: Gewoontegedrag en interventiemogelijkheden]. Technische Universiteit Eindhoven, Faculteit Technologie Management.
- Heinen E, Maat K, van Wee B (2011) The role of attitudes toward characteristics of bicycle commuting on the choice to cycle to work over various distances. *Transportation Research D* 16(2): 102-109.

- Heiner RA (1983) The origin of predictable behavior. *American Economic Review* 73(4): 561-589.
- Heinrich J, Boyd R, Bowles S, Camerer C, Fehr E, Gintis H, McElreath R (2001) In search of Homo Economicus: Behavioural experiments in 15 small-scale societies. *American Economic Review* 91(2): 73-78.
- Hennipman P (1945) Economic motive and economic principle [in Dutch: Economisch motief en economisch principe]. Amsterdam: Noord-Hollandse Uitgevers Maatschappij.
- Hensher DA, King J (2001) The leading edge of travel behaviour research. In: Hensher D (Ed.) *Travel behaviour research: The leading edge*. Amsterdam: Elsevier.
- Hensher DA, Puckett SM (2007) Congestion and variable user charging as an effective travel demand management instrument. *Transportation Research A* 41(7): 615-626.
- Hess DB (2001) Effect of free parking on commuter mode choice evidence from travel diary data. *Transportation Research Record* 1753: 35-42.
- Hiscock R, Macintyre S, Kearns A, Ellaway A (2002) Means of transport and ontological security: Do cars provide psycho-social benefits to their users? *Transportation Research D* 7(2): 119-135.
- Hodgson GM (1997) The ubiquity of habits and rules. *Cambridge Journal of Economics* 21(6): 663-684.
- Hodgson GM (1998) The approach of Institutional Economics. *Journal of Economic Literature* 36(1): 166-192.
- Hoffman E, McCabe K, Smith VL (1996) Social distance and other-regarding behavior in dictator games. *American Economic Review* 86(3): 653-660.
- Hofstede G (1991) *Cultures and organisations: software of the mind*. New York: McGraw-Hill.
- Hofstede G (2010) The nationality of theories [in Dutch: De nationaliteit van theorieën]. *Economische Statistische Berichten* 95(4597): 692-693.
- Hogarth RM (1987) *Judgement and choice: the psychology of decision*. Chichester: John Wiley & Sons.
- Hogarth RM, Reder MW (1986) Perspectives from economics and psychology. In: Hogarth RM, Reder MW (Eds.) *Rational choice: the contrast between economics and psychology*. Chicago: University of Chicago Press.
- Huff JO, Hanson S (1986) Repetition and variability in urban travel. *Geographic Analysis* 18(2): 97-114.

List of references

- Huff JO, Hanson S (1990) Measurement of habitual behaviour: examining systematic variability in repetitive travel. In: Jones P (Ed.) *New approaches in dynamic and activity-based approaches to travel analysis*. Brookfield, VT: Gower.
- Hupkes G (1982) The law of constant travel time and trip-rates. *Futures* 14(1): 38-46.
- Inman JJ, Zeelenberg M (2002) Regret in repeat purchase versus switching decisions: the attenuating role of decision justifiability. *Journal of Consumer Research* 29(1): 116-128.
- Jager W, Vlek CAJ (1991) Car drivers about car-restriction scenarios [in Dutch: *Automobilisten over autoreducerende scenario's*]. *Milieu* 1(1): 20-24.
- Jakobsson C, Fujii S, Gärling T (2002) Effects of economic disincentives on private car use. *Transportation* 29(4): 349-370.
- Janis IL, Mann L (1977) *Decision making: A psychological analysis of conflict, choice and commitment*. New York: The Free Press.
- Jedeloo S, A van Staa, JM Latour, NJA van Exel. Preferences for Health Care and Self-Management among Dutch Adolescents with Chronic Conditions: A Q-Methodological Investigation. *International Journal of Nursing Studies* 2010;47(5): 593-603.
- Jekel H (2011) *De autoafhankelijke samenleving*. PhD thesis, Erasmus University Rotterdam.
- Johannesson M, Persson B (2000) Non-reciprocal altruism in dictator games. *Economic Letters* 69(2): 137-142.
- Johansson MV, Heldt T, Johansson P (2006) The effects of attitudes and personality traits on mode choice. *Transportation Research A* 40(6): 507-525.
- Jones PM (1978) Destination choice and travel attributes. In: Hensher D, Dalvi Q (Eds.) *Determinants of travel choice*. New York: Praeger.
- Jones PM, Dix MC, Clarke MI, Heggie IG (1983) *Understanding travel behaviour: Oxford studies in transport*. Aldershot: Gower.
- Kahneman D, Knetsch JL, Thaler RH (1986) Fairness and the assumptions of economics. *Journal of Business* 59(4): 285-300.
- Kahneman D, Knetsch JL, Thaler RH (1990) Experimental tests of the endowment effect and the Coase theorem. *Journal of Political Economy* 98(6): 1325-1340.
- Kahneman D, Knetsch JL, Thaler RH (1991) The endowment effect, loss aversion, and status quo bias. *Journal of Economic Perspectives* 5(1): 193-206.

- Kahneman D, Thaler RH (1991) Economic analysis and the psychology of utility: applications to compensation policy. *American Economic Review* 81(2): 341-346.
- Kahneman D, Tversky A (1979) Prospect theory: an analysis of decision under risk. *Econometrica* 47(2): 263-291.
- Kahneman D, Tversky A (1982) The psychology of preferences. *Scientific American* 46(1): 136-142.
- Kapteyn A (1977) A theory of preference formation. PhD thesis, Leiden University.
- Katona G (1975) *Psychological economics*. New York: Elsevier.
- Kaufman BE (1990) A new theory of satisficing. *Journal of Behavioral Economics* 19(1): 35-51.
- Kaufman BE (1999) Emotional arousal as source of bounded rationality. *Journal of Economic Behavior & Organization* 38(2): 135-144.
- Kenworthy J (1995) Automobile dependence in Bangkok: an international comparison with implications for planning policies. *World Transport Policy & Practice* 1(3): 31-41.
- Kenyon S, Lyons G (2003) The value of integrated multimodal information and its potential contribution to modal change. *Transportation Research Part F* 6(1): 1-21.
- Keuzekamp HA (1999) Absolutie voor de 'homo economicus'. In: van de Klundert T (Ed.) *Economisering van de samenleving*. Tilburg: Centrum voor Wetenschap en Levensbeschouwing.
- Khattak AJ, De Palma A (1997) The impact of weather conditions on the propensity to change travel decisions: a survey of Brussels commuters. *Transportation Research A* 31(3): 181-203.
- KiM (2007) *Mobiliteitsbalans 2007*. Den Haag: Kennisinstituut voor Mobiliteitsbeleid.
- KiM (2010) *Mobiliteitsbalans 2010*. Den Haag: Kennisinstituut voor Mobiliteitsbeleid.
- KiM (2011) *Behaviour in policy: using psychology and behavioural economics to strengthen transport policy [Gedrag in beleid: Met psychologie en gedragseconomie het mobiliteitsbeleid versterken]*. Den Haag: Kennisinstituut voor Mobiliteitsbeleid.
- Kingham S, Dickinson J, Copsey S (2001) Travelling to work: will people move out of their cars. *Transport Policy* 8(2): 151-160.
- Kitamura R (2000) Longitudinal methods. In: Hensher DA, Button KJ (Eds.) *Handbook of Transport Modelling*. Amsterdam: Elsevier / Pergamon.
- Kitamura R (2009) Lifestyle and travel demand. *Transportation* 36(6): 679-710.

List of references

- Kitamura R, Mokhtarian PL, Laidet L (1997) A micro-analysis of land use and travel in five neighbourhoods in the San Francisco Bay area. *Transportation* 24(2): 125-159.
- Klamer A (1987) As if economists and their subject were rational. In: Nelson J, Megill A, McCloskey DN (Eds.) *The Rhetoric of the Human Sciences*. Wisconsin University Press.
- Koning P, van den Berg GJ, Ridder G (1997) A structural analysis of job search methods and subsequent wages. Amsterdam: Tinbergen Institute Research Paper TI97-082/3.
- Kroesen M, Broër C (2009) Policy discourse, people's internal frames, and declared aircraft noise annoyance: an application of Q-methodology. *Journal of the Acoustical Society of America* 126(1): 195-207.
- Kroesen M, Molin EJE, van Wee B (2011) Policy, personal dispositions and the evaluation of aircraft noise. *Journal of Environmental Psychology* 31(2): 147-157.
- Kropman J, Katteler H (1990) Traffic jams in the Randstad, solutions on rails? An investigation of possibilities for substitution of car use on the Dordrecht-Rotterdam corridor [in Dutch: Files in de Randstad, oplossingen op het spoor? Onderzoek naar substitutiemogelijkheden voor het autogebruik op de corridor Dordrecht-Rotterdam]. Nijmegen: ITS Instituut voor Toegepaste Sociale Wetenschappen.
- Kusiak L (2009) Successes in suppression of queuing [in Dutch: Successen in de filebestrijding]. *SER Bulletin* 2(februari): 14-17.
- Laibson D, Zeckhauser R (1998) Amos Tversky and the ascent of behavioral economics. *Journal of Risk and Uncertainty* 16(1): 7-47.
- Lam TC, Small KA (2001) The value of time and reliability: measurement from a value pricing experiment. *Transportation Research E* 37(2/3): 231-251.
- Lamkin J, Saunders J, Hearne-Locke L (1984) Effect of labor disputes on transit ridership. Washington: Urban Mass Transportation Administration.
- Langlois RN (1998) Rule-following, expertise and rationality: a new behavioral economics?. In: Dennis K (Ed.) *Rationality in economics: alternative perspectives*. Dordrecht: Kluwer Academic Publishers.
- Lanzendorf M (2003) *Mobility Biographies: A new perspective for understanding travel behaviour*. Lucerne: Proceedings of the 10th International Conference on Travel Behaviour Research.
- Lapierre E (1998) What is the best car sharing organisation for Ile de France? Proceedings of 26th annual AET European Transport Conference (Seminar C: Policy planning and sustainability) P422: 189-199.

- Larsen OI, Rekdal J (2009) Treatment of seasonal tickets for public transport in estimation and application of mode/destination choice models. *Transportation* 36(5): 469-482.
- Lea SEG, Tarpay RM, Webley P (1987) *The individual in the economy: A survey of economic psychology*. Cambridge University Press.
- Lee-Gosselin MEH, Pas EI (1997) The implications of emerging contexts for travel behaviour research. In: Stopher P, Lee-Gosselin M. *Understanding travel behaviour in an era of change*. Oxford: Pergamon.
- Leenheer J, Pieters R (2010) Rational emotions of consumers [in Dutch: Rationele emoties van consumenten]. *Economische Statistische Berichten* 95(4591): 505-507.
- Lester D, Yang b (2009) Two sources of human irrationality: cognitive dissonance and brain dysfunction. *Journal of Socio-Economics* 38(4): 658-662.
- Levin IP, Schneider SL, Gaeth GJ (1998) All frames are not created equal: a typology and critical analysis of framing effects. *Organizational behavior and human decision processes* 76(2): 149-188.
- Levinson DM (1998) Accessibility and the journey to work. *Journal of Transport Geography* 6(1): 11-21.
- Li Z, Hensher D (2011) Prospect theoretic contributions in understanding traveller behaviour: a review and some comments. *Transport reviews* 31(1): 97-115.
- Lichtenstein S, Slovic P, Fischhoff B Layman M, Combs B (1978) Judged frequency of lethal events. *Journal of Experimental Psychology: Human Learning and Memory* 4(6): 551-578.
- Lieberman W, Schumacher D, Hoffman A, Wornum C (2001) Creating a new century of transit opportunity: strategic planning for transit. *Transportation Research Record* 1747: 60-67.
- Lindbladh E, Lyttkens CH (2000) Habit versus choice: the process of decision-making in health-related behaviour. *Social Science & Medicine* 55(3): 451-465.
- Lindenberg S (2001) Social rationality as a unified model of man (including bounded rationality). *Journal of Management and Governance* 5(3/4): 239-251.
- Litman T (2003) *The costs of automobile dependency and the benefits of balanced transportation*. Victoria: Transport Policy Institute.
- Litman T (2007) *Mobility as a positional good: implications for transport policy and planning*. Victoria Transport Policy Institute.

List of references

- Lo S, Hall RW (2006) Effects of the Los Angeles transit strike on highway congestion. *Transportation Research A* 40(10): 903-917.
- Loewenstein G (1992) The fall and rise of psychological explanations in the economics of intertemporal choice. In: Loewenstein G, Elster J (Eds.) *Choice over time*. New York: Russell Sage Foundation.
- Loewenstein G (1999) Experimental economics from the vantage-point of behavioural economics. *The Economic Journal* 109(453):25-34.
- Lois D, López-Sáez M (2009) The relationship between instrumental, symbolic and affective factors as predictors of car use: a structural equation modeling approach. *Transportation Research A* 43(9/10): 790-799.
- Loomes G, Sugden R (1982) Regret theory: an alternative theory of rational choice under uncertainty. *The Economic Journal* 92(368): 805-824.
- Loukopoulos P, Jakobsson C, Gärling T, Schneider CM, Fujii S (2004) Car-user responses to travel demand management measures: goal setting and choice of adaptation alternatives. *Transportation Research D* 9(4): 263-280.
- Louviere J, Street D (2000) Stated preference methods. In: Hensher DA, Button KJ (Eds.) *Handbook of Transport Modelling*. Amsterdam: Elsevier / Pergamon.
- Lucas RE (1986) Adaptive behavior and economic theory. In: Hogarth RM, Reder MW (Eds.) *Rational choice: The contrast between economics and psychology*. University of Chicago Press.
- Luce MF (1998) Choosing to avoid: coping with negatively-laden consumer decisions. *Journal of Consumer Research* 24(4): 409-433.
- Lyons G, Chatterjee K, Marsden G, Beecroft M (2000) *Transport visions: Society and lifestyles*. London: Landor Publishing.
- Maat K, Timmermans H (2009) Influence of the residential work environment on car use in dual-earner households. *Transportation Research A* 43(7): 654-664.
- Maat K, van Wee B, Stead D (2005) Land use and travel behaviour: expected effects from the perspective of utility theory and activity-based theories. *Environment and Planning B: Planning and Design* 32(1): 33-46.
- Machina MJ (1987) Choice under uncertainty: Problems solved and unsolved. *Economic Perspectives* 1(1): 121-154.
- Mackellar J (2006) Fanatics, fans or just good fun? Travel behaviours and motivations of the fanatic. *Journal of Vacation Marketing* 12(3): 195-217.

- Mackett RL (1983) The inter-relationships between travel and locational decisions. In: Carpenter S, Jones P. Recent advances in travel demand analysis. Aldershot: Gower Publishing.
- MacLeod WB, Pingle M (2000) An experiment on the relative effects of ability, temperament and luck on search with uncertainty. University of Southern California Law School, Olin Research paper 00-12.
- Maddala GS (1983) Limited dependent and qualitative variables in econometrics. Cambridge University Press.
- Manning F, Winston C (1985) A dynamic empirical analysis of household automobile ownership and utilization. *Rand Journal of Economics* 16(2): 215-236.
- Manski CF, Sherman L (1980) An empirical analysis of household choice among motor vehicles. *Transportation Research A* 14(5/6): 349-366.
- March JG (1997) Understanding how decisions happen in organizations. In: Shapira Z (Ed.) *Organizational decision making*. Cambridge University Press.
- Marmo M (1990) *More profile than courage: the New York City transit strike of 1966*. New York: State University of New York Press.
- Martin S (1978) *Industrial economics*. New York: MacMillan.
- Martin S (1993) *Advanced industrial economics*. Oxford: Blackwell.
- Masiero L, Hensher DA (2011) Shift of reference point and implications on behavioral reaction to gains and losses. *Transportation* 38(2): 249-271.
- Mazursky D (1998) The effects on invalidating information on consumers subsequent search patterns. *Journal of Economic Psychology* 19(2): 261-277.
- McCloskey DN, Murray JF (1996) *The vices of economists; the virtues of the bourgeoisie*. Inaugural address, Erasmus University Rotterdam.
- McFadden D (1981) Econometric models of probabilistic choice. In: Manski CF, McFadden D (Eds.) *Structural analysis of discrete data with econometric applications*. London: The MIT Press.
- McFadden D (1999) Rationality for economists? *Journal of Risk and Uncertainty* 19(10): 73-105.
- McFadden D (2001) Disaggregate behavioural travel demand's RUM side: a 30-year retrospective. In: Hensher D (Ed.) *Travel behaviour research: The leading edge*. Amsterdam: Elsevier.

List of references

- Mehndiratta SR, Picado R, Venter C (2003) A qualitative survey technique to explore decision making behaviour in new contexts. In: Stopher P, Jones P. *Transport Survey Quality and Innovation*. Amsterdam: Pergamon.
- Metz D (2000) Mobility of older people and their quality of life. *Transport Policy* 7(2): 149-152.
- Metz D (2005) Journey quality as the focus of future transport policy. *Transport Policy* 12(4): 353-359.
- Metz D (2008) The Myth of Travel Time Saving. *Transport Reviews* 28(3): 321-336.
- Metz D (2010) Saturation of Demand for Daily Travel. *Transport Reviews* 30(5): 659-674.
- Michalos AC (1985) Multiple discrepancies theory (MDT). *Social Indicators Research* 16(4): 347-413.
- Miller LK (1999) The savant syndrome: intellectual impairment and exceptional skill. *Psychological Bulletin* 125(1): 31-46.
- Mirowsky J (1999) Subjective life expectancy in the US: Correspondence to actual estimates by age, sex and race. *Social Science & Medicine* 49(7): 967-979.
- Mokhtarian PL, Chen C (2004) TTB or not TTB, that is the question: a review and analysis of the empirical literature on travel time (and money) budgets. *Transportation Research A* 38(9/10): 643-675.
- Mokhtarian PL, Salomon I (1997) Modelling the desire to telecommute: The importance of attitudinal factors in behavioral models. *Transportation Research A* 31(1): 35-50.
- Mokhtarian PL, Salomon I (2001) Redmond LS. Understanding the demand for travel: it's not purely 'derived'. *Innovation* 14(4): 355-380.
- Mondschein A, Blumberg E, Taylor BD (2006) Cognitive mapping, travel behavior, and access to opportunity. *Transportation Research Record* 1985: 266-272.
- Morgan MS (2006) Economic man as model man: ideal types, idealization and caricatures. *Journal of the History of Economic Thought* 28(1): 1-27.
- MoT (1984) Effects on traffic and transportation of a strike at HTM [in Dutch: Effekten op verkeer en vervoer van een staking bij de HTM]. Den Haag: Ministry of Transport, Projectbureau Integrale Verkeers- en Vervoerstudies.
- MoT (1991) A comparison of the costs of car and public transport: 1962-1990 [in Dutch: De kosten van de auto en het openbaar vervoer vergeleken: 1962-1990]. Den Haag: Ministry of Transport, Projectbureau Integrale Verkeers- en Vervoerstudies.

- MoT (1997) 7 trends: mobility in the changing Netherlands [in Dutch: 7 trends: mobiliteit in vernaderend Nederland]. Rotterdam: Ministry of Transport, Adviesdienst Verkeer en Vervoer.
- MoT (1998) Instructions concerning the valuation of passenger travel time [in Dutch: Advies inzake reistijdwaarderingen van personen]. Rotterdam: Ministry of Transport, Adviesdienst Verkeer en Vervoer.
- MoT (2001) Mobiliteitsonderzoek Regio Amsterdam. Haarlem: Ministry of Transport, DG Rijkswaterstaat, Directoraat Noord-Holland.
- MoT (2004a) Congestion review: The development of delays on the Dutch motorway network [in Dutch: Fileverkenning: De ontwikkeling van de vertragingen op het Nederlandse autosnelwegennet]. Rotterdam: Ministry of Transport, Adviesdienst Verkeer en Vervoer.
- MoT (2004b) Reliability of travel times [in Dutch: Betrouwbaarheid van reistijden]. Rotterdam: Ministry of Transport, Adviesdienst Verkeer en Vervoer. 2004.
- Murray SJ, Walton D, Thomas JA (2010) Attitudes towards public transport in New Zealand. *Transportation* 37(6):915-929.
- New York City Transit Authority (1967) The effect of the 1966 New York City transit strike on the travel behavior of regular transit users. New York: US Department of Housing and Urban Development.
- Niemeyer S, Petts J, Hobson K (2005) Rapid climate change and society: Assessing responses and thresholds. *Risk Analysis* 25(6): 1443-1456.
- Noland RB, Polak JW (2002) Travel time variability: a review of theoretical and empirical issues. *Transport Reviews* 22(1): 39-54.
- Noland RB, Small KA (1995) Travel-time uncertainty, departure time choice, and the cost of morning commutes. Washington: TRB Transportation Research Record 1493: 150-158.
- O'Donoghue T, Rabin M (1999) Doing it now or later. *American Economic Review* 89(1): 103-124.
- OECD (2010) OECD Economic Surveys: Netherlands, June 2010. Paris: Organisation for Economic Co-operation and Development.
- Orfeuil J-P, Salomon I (1993) Travel patterns of the Europeans in everyday life. In: Salomon I, Bovy P, Orfeuil J-P (Eds.) *A billion trips a day: Tradition and transition in European travel patterns*. Dordrecht: Kluwer Academic Publishers.

List of references

- Ory DT, Mokhtarian PL (2005) When is getting there half the fun? Modeling the liking for travel. *Transportation Research A* 39(2/3): 97-123.
- Outwater ML, Spitz G, Lobb J, Campbell M, Sana B, Pendyala R, Woodford W. Characteristics of premium transit services that affect mode choice: TCRP H-37 summary of phase 1. *Transportation* (2011) 38(4):605–623.
- Paleti R, Copperman RB, Bhat CR (2011) An empirical analysis of children's after school out-of-home activity-location engagement patterns and time allocation. *Transportation* 38(2): 273-303.
- Paltrey TR, Prisbrey JE (2007) Anomalous behavior in public goods experiments: how much and why? *American Economic Review* 87(5): 829-846.
- Parthasarathi P, Srivastava A, Geroliminis N, Levinson D (2011) The importance of being early. *Transportation* 38(2): 227-247.
- Pas E, Huber JC (1992) Market segmentation analysis of potential rail travellers. *Transportation* 19(2): 177-196.
- Pech W, Milan M (2009) Behavioral economics and the economics of Keynes. *Journal of Socio-Economics* 38(6): 891-902.
- Peeters K (2000) The windshield perspective: ways of implicit car thinking [in Dutch: Het vooruitperspectief: wegen van het impliciete autodenken]. Leuven: Garant.
- Perdok J, Kalfs N (1995) The strike in regional public transport 1995: a retrospect in figures and opinions [in Dutch: De staking in het streekvervoer 1995: een terugblik in cijfers en opinies]. Delft: Openbaar Vervoer Colloquium 1995/05: 215-226.
- Petit J (2002) Characterizing travel behaviour as a social experience. *Recherche Transports Sécurité* 76(1): 190-207.
- Pollak RA (1976) Habit formation and long run utility functions. *Journal of Economic Theory* 13(2): 272-297.
- Popuri Y, Prousaloglou K, Ayvalik C, Koppelman F, Lee A (2011) Importance of traveler attitudes in the choice of public transportation to work: findings from the Regional Transportation Authority Attitudinal Survey. *Transportation* 38(4): 643–661.
- Prousaloglou KE, Vaidya R, Haskell K, Ben-Akiva M (2001) An attitudinal market segmentation approach to commuter mode choice and transit service design. Washington, DC: Proceedings of the 2001 Annual Transportation Research Board Meeting.

- Pulles MPJ (1990) Public transport or private car? Choosing environment-friendly behaviour [in Dutch: Openbaar Vervoer of Eigen Auto? Kiezen van Milieurelevant Gedrag]. *Milieu* 1(1): 28-29.
- Punj G, Brookes R (2001) Decision constraints and consideration set formation in consumer durables. *Psychology & Marketing* 18(8): 843-863.
- Rabin M (1998) Psychology and economics. *Journal of Economic Literature* 36(1): 11-46.
- Rachlin H (2003) Rational thought and rational behavior: a review of bounded rationality: the adaptive toolbox. *Journal of the Experimental Analysis of Behavior* 79(3): 409-412.
- Rajé F (2007) Using Q-methodology to develop more perceptive insights on transport and social inclusion. *Transport Policy* 14(6): 467-477.
- Raney EA, Mokhtarian PL, Salomon I (2000) Modeling individuals' consideration of strategies to cope with congestion. *Transportation Research F* 3(3): 141-165.
- Raux C, Andan O (1997) Residential mobility and daily mobility: what are the ties? In: Stopher P, Lee-Gosselin M. *Understanding travel behaviour in an era of change*. Oxford: Pergamon.
- Rich JH (2001) Two aspects of location modelling: short-term versus long-term and the case of two-worker households. In: Hensher D (Ed.) *Travel behaviour research: The leading edge*. Amsterdam: Elsevier.
- Rietveld P, Bruinsma FR, van Vuuren DJ (2001) Coping with unreliability in public transport chains: A case study for Netherlands. *Transportation Research A* 35(6): 539-559.
- Rietveld P, Nijkamp P (2003) *Spatial Interaction Models*. In: Hall RW (Ed.) *Handbook of Transportation Science*. New York: Springer.
- Rietveld P, Zwart B, van Wee B, van den Hoorn T (1999) On the relationship between travel time and travel distance of commuters: reported versus network travel data in the Netherlands. *Annals of Regional Science* 33(3): 269-288.
- Risdon A, Eccleston C, Crombez G, McCracken L (2003) How can we learn to live with pain? A Q-methodological analysis of the diverse understandings of acceptance of chronic pain. *Social Science & Medicine* 56: 375-386.
- Rooijers AJ (1992) Beliefs and motives with respect to car use for commuting [in Dutch: Meningen en motieven ten aanzien van autogebruik voor woon-werkverkeer]. Haren: Rijksuniversiteit Groningen, Verkeerskundig Studiecentrum.

List of references

- Rooijers AJ (1998) The reliability of transport modes: Perceptions and travellers' behavioural response [in Dutch: Betrouwbaarheid van vervoerwijzen: Percepties en gedragsaanpassingen van de reizigers]. Den Haag: Ministry of Transport, Projectbureau Integrale Verkeers- en Vervoerstudies.
- Rooijers AJ, Welles H (1996) Mastering habit [in Dutch: Gewoonte de baas]. Haren: Rijksuniversiteit Groningen, Verkeerskundig Studiecentrum.
- Rose G, Ampt E (2001) Travel blending: an Australian travel awareness initiative. *Transportation Research Part D* 6(2): 95-110.
- Rose-Ackerman S (1998) Bribes and gifts. In: Ben-Ner A, Putterman L (Eds.) *Economics, Values, and Organization*. Cambridge University Press.
- Rosetti MA, Eversole BS (1993) Journey to work trends in the United States and Major Metropolitan Area, 1960-1990. Washington DC: US Department of Transportation, Federal Highway Administration.
- Roth AE (1996) Individual rationality as a useful approximation: Comments on Tversky's "Rational theory and constructive choice". In: Arrow K, Colombatto E, Perlman M, Schmidt C (Eds.) *The rational foundations of economic behavior*. London: Macmillan.
- Rothman AJ, Salovey P (1997) Shaping perceptions to motivate healthy behavior: The role of message framing. *Psychological Bulletin* 121: 3-19.
- ROVER (2001) Black-book railways [in Dutch: Zwartboek spoorwegen]. Amersfoort: Dutch public transport travellers association ROVER.
- Rubinstein A (2006) A sceptic's comment on the study of economics. *The Economic Journal* 116(510): C1-C9.
- Russell B (1995) The history of western philosophy [in Dutch: De geschiedenis van de westerse filosofie]. 3rd edition. Cothen: Serviere.
- RVW (2010). Who I am and where I go: recommendation on the effects of changes in demography and lifestyle on mobility [in Dutch: Wie ik ben en waar ik ga: advies over de effecten van veranderingen in demografie en leefstijlen op mobiliteit]. Den Haag: Raad voor Verkeer en Waterstaat.
- Sachs W (1992) For love of the automobile: looking back into the history of our desires. University of California Press.
- Salkeld G, Ryan M, Short L (2000) The veil of experience: do consumers prefer what they know best? *Health Economics* 9(3): 267-270.

- Salomon I, Bovy P, Orfeuil J-P (1993) A billion trips a day: Tradition and transition in European travel patterns. Dordrecht: Kluwer Academic Publishers.
- Samenwerkingsverband Spitsmijden (2009) Effecten van belonen in Spitsmijden in het OV: Hoe verleid je OV-reizigers? (retrieved from www.spitsmijden.nl/).
- Samuelson PA (1937) A note on measurement of utility. *Review of Economic Studies* 4(2): 155-161.
- Samuelson PA (1993) Altruism as a problem involving group versus individual selection in economics and biology. *American Economic Review* 82(3): 142-148.
- Samuelson PA, Nordhaus WD (1995) *Economics*. New York: McGraw-Hill.
- Samuelson W, Zeckhauser R (1988) Status quo bias in decision making. *Journal of Risk and Uncertainty* 1(1): 7-59.
- Savage LJ (1972) *The foundations of statistics*. New York: Dover Publications.
- Schlich R (2003) Homogenous groups of travellers. Lucerne: Proceedings of the 10th International Conference on Travel Behaviour Research.
- Schor JB (1997) *Beyond an economy of work and spend*. Tilburg University Press.
- Schwanen T, Dijst M (2002) Travel-time ratios for visits to the workplace: the relationship between commuting time and work duration. *Transportation Research Part A* 36(7): 573-592.
- Scitovsky T (1976) *The joyless economy*. Oxford University Press.
- SCP (1993) Socio-cultural motives: an investigation of the influence of changing lifestyles on mobility growth since the 1970s [in Dutch: Sociaal-culturele beweegredenen: onderzoek naar de invloed van veranderende leefpatronen op de mobiliteitsgroei sinds de jaren zeventig]. The Hague: Social and Cultural Planning Office of the Netherlands.
- SCP (1997) Social and individual determinants of car use [in Dutch: Maatschappelijke en individuele determinanten van autogebruik]. Cahier 144. The Hague: Social and Cultural Planning Office of the Netherlands.
- SCP (2000) Each time again that car! Social-psychological research in transport policy [in Dutch: Altijd weer die auto! Sociaal- en gedragswetenschappelijk onderzoek en het verkeers- en vervoersbeleid]. Research Report 2000/2. The Hague: Social and Cultural Planning Office of the Netherlands.
- SCP (2003) Mobility through time [in Dutch: Mobiel in de tijd]. The Hague: Social and Cultural Planning Office of the Netherlands.

List of references

- Sela A, Berger JA (2011) Decision Quicksand: When trivial choices suck us in. Working paper. Gainesville: Department of Marketing, University of Florida.
- Sen A (1977) Rational fools: a critique of the behavioural foundations of economic theory. *Philosophy and Public Affairs* 6(4): 317-344.
- Sen A (1982) *Choice, welfare and measurement*. Oxford: Basil Blackwell.
- Sen A (1987) *On ethics and economics*. New York: Blackwell.
- Sen A (1995) Rationality and social choice. *American Economic Review* 85(1): 1-24.
- Sen A (1998) Foreword. In: Ben-Ner A, Putterman LG (Eds.) *Economics, values, and organization*. Cambridge University Press.
- Sheffin SM (1996) *Rational expectations*. Cambridge University Press.
- Shefrin H, Caldwell D (2001) Determinants of the magnitude of willingness to accept relative to willingness to pay. *Journal of Behavioral Decision Making* 14 (2): 87-105.
- Shefrin HM, Thaler RH (1992) Mental accounting, saving, and self-control. In: Loewenstein G, Elster J (Eds.) *Choice over time*. New York: Russell Sage Foundation.
- Shifan Y, Outwater ML, Zhou YS (2008) Transit market research using structural equation modeling and attitudinal market segmentation. *Transport Policy* 15(3): 186-195.
- Shiller RJ (1995) Rhetoric and economic behavior: conversation, information and herd behavior. *American Economic Review* 85(2): 181-185.
- Shiller RJ (1999) Human behavior and the efficiency of the financial system. In: Taylor JB, Woodford M (Eds.) *Handbook of Macroeconomics*. Amsterdam: Elsevier.
- Shiller RJ (2000) *Irrational exuberance*. Princeton University Press.
- Silberman J, Klock M (1989) The behavior of respondents in contingent valuation: Evidence on starting bids. *Journal of Behavioral Economics* 18(1): 51-60.
- Simma A, Axhausen KW (2001) Structures of commitment in mode use: A comparison of Switzerland, Germany and Great Britain. *Transport Policy* 8(3): 279-288.
- Simma A, Axhausen KW (2003) Commitments and modal usage: An analysis of German and Dutch panels. *Transportation Research Record* 1854: 22-31.
- Simon HA (1965) *Administrative behavior: a study of decision-making process in administrative organization*. New York: The Free Press. 1965.
- Simon HA (1976) From substantive to procedural rationality. In: Latsis SJ (Ed.) *Method and appraisal in economics*. Cambridge University Press.

- Simon HA (1990) A mechanism for social selection and successful altruism. *Science* 250(4988): 1665-1669.
- Simon HA (1993) Altruism and economics. *American Economic Review* 83(2): 156-161.
- Small KA (1979) The scheduling of consumer activities: Work trips. Princeton University, Econometric Research Program, Research Memorandum 243.
- Smith A (1776) *An inquiry into the nature and causes of the wealth of nations*. London: Strahan & Cadell.
- Smith NW (2001) *Current systems in psychology: History, theory, research, and applications*. Belmont, CA: Wadsworth.
- Snyder AW, Mitchell DJ (1999) Is integer arithmetic fundamental to mental processing?: The mind's secret arithmetic. *Proceedings of The Royal Society London: Biological Sciences* 266: 587-592.
- Sohn K, Yun J (2009) Separation of car-dependent commuters from normal-choice riders in mode-choice analysis. *Transportation* 36(4): 423-436.
- Solof M (2010) Travelers behaving badly: behavioral economics offers insights and strategies for improving transportation. *InTransition Magazine*, Spring/Summer edition [www.intransitionmagazine.org].
- Spash CL, Biel A (2002) Social psychology and economics in environmental research. *Journal of Economic Psychology* 23: 551-555.
- Spiegler R (2011) 'But can't we get the same thing with a standard model?' Rationalizing bounded-rationality models. *Economics and Philosophy* 27(1): 23-43.
- Spitsmijden Group (2007) *Effects of rewards Experimental design and modelling Spitsmijden Zoetermeer - Den Haag 2006/ 2007*. (retrieved from www.spitsmijden.nl/).
- Spitsmijden Group (2009) *The effects of rewards in Spitsmijden 2: How can drivers be persuaded to avoid peak periods? Spitsmijden Gouda - Den Haag 2008/ 2009*. (retrieved from www.spitsmijden.nl/).
- Staal PE (2003) *Automobilism in the Netherlands: a history of use, misuse and utility* [in Dutch: *Automobilisme in Nederland: een geschiedenis van gebruik, misbruik en nut*]. PhD Thesis, Technical University Eindhoven.
- Stark O (1995) *Altruism and beyond: an economic analysis of transfers and exchanges within families and groups*. Cambridge University Press.

List of references

- Steelman TA, Maguire LA (1999) Understanding participant perspectives: Q-methodology in national forest management. *Journal of Policy Analysis and Management* 18(3): 361-388.
- Steer J, Willumsen L (1983) An investigation of passenger preference structures. In: Carpenter S, Jones P. *Recent advances in travel demand analysis*. Aldershot: Gower Publishing.
- Steg L (2003) Factors influencing the effectiveness of transport pricing. In: Schade J, Schlag B (Eds.) *Acceptance of transport pricing strategies*. Amsterdam: Elsevier.
- Steg L (2005) Car use: lust and must. Instrumental, symbolic and affective motives for car use. *Transportation Research A* 39(2/3): 147-162.
- Steg L, Geurs K, Ras M (2001) The effects of motivational factors on car use: a multidisciplinary modelling approach. *Transportation Research A* 35(9): 789-806.
- Steg L, Vlek C, Slotegraaf G (2001) Instrumental-reasoned and symbolic-affective motives for using a motor car. *Transportation Research F* 4(3): 151-169.
- Stenner PHD, Dancey CP, Watts S (2000) The understanding of their illness amongst people irritable bowel syndrome: A Q-methodological study. *Social Science & Medicine* 51(3): 439-452.
- Stephenson W (1935) Correlating persons instead of tests. *Character and Personality* 4(1): 17-24.
- Stigler GJ, Becker GS (1977) De Gustibus Non Est Disputandum. *American Economic Review* 67(2): 76-90.
- Stiglitz JE (1989) Imperfect information in the product market. In: Schmalensee R, Willig RD (Eds.) *Handbook of industrial organization*. Amsterdam: North-Holland.
- Stopher P, Lee-Gosselin M (1997) *Understanding travel behaviour in an era of change*. Oxford: Pergamon.
- Sutton S (1994) The past predicts the future: Interpreting behaviour-behaviour relationships in social psychological models of health behaviour. In: Rutter DR, Quine L, *Social Psychology and health: European perspectives*. Brookfield, VT: Avebury.
- Tertoolen G (1994) Free to move...?! A field experiment on attempts to influence private car use and the psychological resistance it evokes [in Dutch: Uit eigen beweging...?! Een veldexperiment over beïnvloedingspogingen van het autogebruik en de daardoor opgeroepen psychologische weerstanden]. PhD thesis, University of Utrecht.

- Tertoolen G, van Krefeld D, Verstraten B (1998) Psychological resistance against attempts to reduce private car use. *Transportation Research A* 32(3): 171-181.
- Thaler RH (1980) Towards a positive theory of consumer choice. *Journal of Economic Behavior and Organization* 1(1): 39-60.
- Thaler RH (1981) Some empirical evidence on dynamic inconsistency. *Economic Letters* 8(3): 201-207.
- Thaler RH (1985) Mental accounting and consumer choice. *Marketing Science* 4(3): 199-214.
- Thaler RH (1991) *Quasi rational economics*. New York: Russell Sage Foundation.
- Thaler RH (1997) Irving Fisher: Modern behavioral economist. *American Economic Review* 87(2): 439-441.
- The Economist (2000) Bused-up, the LA transport strike. *The Economist* (print edition), September 23rd (<http://www.economist.com/node/374197>).
- Thøgersen J, Møller B (2004) Breaking car-use habits: The effectiveness of economic incentives. Nottingham: Proceedings of the International Conference on Traffic & Transport Psychology.
- Thurow LC (1980) *The zero-sum society: Distribution and the possibilities for economic change*. New York: Basic Books.
- Tielen M, NJA van Exel, MC van Buren, L Maasdam, W Weimar. Attitudes towards medication non-adherence in elderly kidney transplant patients: a Q-methodology study. *Nephrology Dialysis Transplantation* 2011;26(5): 1723-1728.
- Tielen M, van Staa A, Jedeloo S, van Exel NJA, Weimar W (2008) Q-methodology to identify young adult renal transplant recipients at risk for non-adherence. *Transplantation* 85(5): 700-706.
- Tiemeijer WL (2009) *The human decision maker: about the psychology of choice and behaviour* [in Dutch: *De menselijke beslisser: over de psychologie van keuze en gedrag*]. Amsterdam University Press.
- Tiemeijer WL (2011) *How people make choices: the psychology of decision making* [in Dutch: *Hoe mensen keuzes maken: de psychologie van het beslissen*]. Amsterdam University Press.
- Tillema T, van Wee B, Ettema D (2010) The influence of (toll-related) costs in residential location decisions of households: a stated choice approach. *Transportation Research A* 44(10): 785-796.

List of references

- Tomer JF (2001) Economic man vs. heterodox men: the concepts of human nature in schools of economic thought. *Journal of Socio-Economics* 30(4): 281-293.
- Tommasi M, Ierulli K (1995) *The new economics of human behavior*. Cambridge University Press.
- Train K (2009) *Discrete choice methods with simulation*. Cambridge University Press.
- Triandis HC (1989) The self and social behavior in differing cultural contexts. *Psychological Review* 96(3): 506-520.
- Tseng Y-Y, Verhoef E, de Jong G, Kouwenhoven M, van der Hoorn T (2009) A pilot study into the perception of unreliability of travel times using in-depth interviews. *Journal of Choice Modelling* 2(1): 8-28.
- Tversky A (1972a) Choice by elimination. *Journal of Mathematical Psychology* 9(4): 341-367.
- Tversky A (1972b) Elimination by aspects: a theory of choice. *Psychological Review* 79(4): 281-299.
- Tversky A, Kahneman D (1974) Judgement under uncertainty: Heuristics and biases. *Science* 185(4157): 1124-1131.
- Tversky A, Kahneman D (1981) The framing of decisions and the psychology of choice. *Science* 211(4481): 453-458.
- Tversky A, Kahneman D (1992) Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and Uncertainty* 5(4): 297-323.
- Ulleberg P (2001) Personality subtypes of young drivers. Relationship to risk-taking preferences, accident involvement, and response to a traffic safety campaign. *Transportation Research F* 4(4): 279-297.
- van Beynen de Hoog P (2004) Unfamiliarity breeds impopularity [in Dutch: Onbekend maakt onbemind]. *Reiswijzer* 3(1): 16-17.
- van de Kaa EJ (2010) Applicability of an extended prospect theory to travel behaviour research: a meta-analysis. *Transport Reviews* 30(6): 771-804.
- van de Klundert T (1999) *Economizing society* [in Dutch: Economisering van de samenleving]. University of Tilburg, Centrum voor Wetenschap en Levensbeschouwing.
- van den Bergh JCJM, Ferrer-i-Carbonell A, Munda G (2000) Alternative models of individual behaviour and implications for environmental policy. *Ecological Economics* 32(1): 43-61.

- van Dijk E, Zeelenberg M (1999) Sunk costs and risky decisions: an economic-psychological reflection [in Dutch: Verzonken kosten en riskante beslissingen: een economisch-psychologische beschouwing]. *Gedrag & Organisatie* 12(2): 116-126.
- van Dijk JJ (1986) Investment behaviour and costs of adjustment. Erasmus University Rotterdam, Institute for Economic Research.
- van Eeten MJG (2000) Recasting Environmental Controversies: A Q Study of the Expansion of Amsterdam Airport. In: Addams H, Proops J (Eds.) *Social Discourse and Environmental Policy: An Application of Q Methodology*. Cheltenham: Edward Elgar.
- van Exel NJA (2003) Off the beaten track: subjective reliability, satisfaction and reconsideration of commuting by public transport (n=1) [in Dutch: Van het begane spoor: subjectieve betrouwbaarheid, tevredenheid en heroverweging van forenzen per openbaar vervoer (n=1)]. Antwerp: Proceedings of Colloquium Vervoersplanologisch Speurwerk.
- van Exel NJA, de Graaf G (2005) Q methodology: A sneak preview. [retrieved from www.qmethod.org/articles/vanExel.pdf].
- van Exel NJA, de Graaf G, Brouwer WBF (2006) "Everyone dies, so you might as well have fun!" Images of youths about their health lifestyle. *Social Science & Medicine* 63(10): 2628-2639.
- van Exel NJA, de Graaf G, Brouwer WBF (2007) Care for a break? An investigation of informal caregivers' attitudes toward respite care using Q-methodology. *Health Policy* 83(2/3): 332-342.
- van Exel NJA, de Graaf G, Rietveld P (2005) Getting from A to B: Operant approaches to travel decision making. *Operant Subjectivity* 27(4): 194-216.
- van Exel NJA, Rietveld P (2000) The traveller has little choice when NS personnel go on strike [in Dutch: De reiziger heeft weinig keus als het NS-personeel staakt]. *OV-Magazine* 6(2): 22-24.
- van Kesteren NCM, Meertens RM (1999) New strategies for behavioural change to influence energy-relevant behaviour [in Dutch: Nieuwe gedragsveranderingsstrategieën voor het beïnvloeden van energie-relevant gedrag]. Universiteit Maastricht, Capaciteitsgroep Gezondheidsvoorlichting.
- van Kleef B (1997) The ideal car country: why the Dutch find themselves in traffic jams [in Dutch: Het ideale autoland: Waarom Nederland in de file staat]. Bussum: Thoth.

List of references

- van Knippenberg DL, van Knippenberg CWF (1988) Influencing mode choice in commuting travel by means of an induced temporary behavioural change [in Dutch; Beïnvloeding van vervoermiddelkeuze in het woon-werkverkeer door middel van een tijdelijke gedragsverandering]. Report VK 88-11. University of Groningen, Verkeerskundig Studiecentrum.
- van Lint JWC, van Zuylen HJ (2005) Monitoring and predicting freeway travel time reliability: using width and skew of day-to-day travel time distribution. *Transportation Research Record* 1917: 54-62.
- van Lint JWC, van Zuylen HJ, Tu H (2008) Travel time unreliability on freeways: why measures based on variance tell only half the story. *Transportation Research A* 42(1): 258-277.
- van Ommeren J (2000) *Commuting and relocation of jobs and residences*. Aldershot: Ashgate.
- van Praag BMS (1971) The welfare function of income in Belgium: An empirical investigation. *European Economic Review* 2(3): 337-369.
- van Praag BMS (1984) *Linking economics with psychology: An economist's view*. Report 8423/E. Erasmus University Rotterdam, Econometric Institute.
- van Praag BMS (1993) The relativity of the welfare concept. In: Nussbaum MC, Sen AK (Eds.) *The Quality of Life*. Oxford: Clarendon Press.
- van Raaij WF (1981) Economic psychology. *Journal of Economic Psychology* 1(1): 1-24.
- van Raaij WF (1991) The time dimension of economic behavior. In: Antonides G, Arts W, van Raaij WF (Eds.) *The consumption of time and the timing of consumption: Toward a new behavioral and socio-economics*. Amsterdam: North-Holland.
- van Raaij WF (1998) The life and work of Amos Tversky. *Journal of Economic Psychology* 19(4): 515-527.
- van Raaij WF, Ye G (2005) Conscious and unconscious processing in consumer motives, goals, and desires. In: Ratneshwar S, Mick DG (Eds.) *Inside consumption: consumer motives, goals and desires*. London: Routledge.
- van Vuuren D (2002) *The market for passenger transport by train: An empirical analysis*. PhD thesis, Free University Amsterdam.
- van Wee B (2010) Prospect Theory and Travel Behaviour: a Personal Reflection Based on a Seminar. *European Journal of Transport and Infrastructure Research* 10(4): 385-394.

- van Wee B, Rietveld P (2008) The Myth of Travel Time Saving': A Comment. *Transport Reviews* 28(6): 688-692.
- van Wee B, Rietveld P, Meurs H (2006) Is average daily travel time expenditure constant? In search of explanations for an increase in average travel time. *Journal of Transport Geography* 14(2): 109-122.
- van Wee GP (1994) Work-locations, residential locations and commuting: A literature review [in Dutch: Werklocaties, woonlocaties en woon-werkverkeer: literatuurstudie]. RIVM rapport 251701017. Bilthoven: Rijksinstituut voor Volksgezondheid en Milieuhygiëne.
- van Wee GP (1997) Office to the station. The influence of office relocations to public transport nodal points on passenger mobility [in Dutch: Kantoor naar het spoor: de invloed van bedrijfsverplaatsingen naar openbaar-vervoerknoppunten op personenmobiliteit]. PhD thesis, University of Amsterdam.
- van Witteloostuijn A (1988) Maximising and satisficing: Opposite or equivalent concepts? *Journal of Economic Psychology* 9(3): 289-313.
- van Witteloostuijn A (1991) Economic psychology and socio-economics: an essay on discourse strategies and research potentials. In: Antonides G, Arts W, van Raaij WF (Eds.) *The consumption of time and the timing of consumption: toward a new behavioral and socio-economics*. Amsterdam: North-Holland.
- Veblen T (1931) *The theory of the leisure class*. New York: The Viking Press.
- Veenhoven R (1997) Advances in understanding happiness. *Revue Québécoise de Psychologie* 18(1): 29-79.
- Verhallen TMM, Pieters RGM (1984) Attitude theory and behavioural costs. *Journal of Economic Psychology* 5(3): 223-249.
- Vermaire JH, J Hoogstraten, C van Loveren, JHG Poorterman, NJA van Exel. Attitudes toward oral health among parents of six-year-old children at risk of developing caries. *Community Dentistry and Oral Epidemiology* 2010;38(6): 507-520.
- Verplanken B, Aarts H, van Knippenberg A, van Knippenberg C (1994) Attitude versus general habit: antecedents of travel mode choice. *Journal of Applied Social Psychology* 24(4): 285-300.
- Vlek C (1990) Head or tail: on the meaning and future of psychologic choice behaviour studies [in Dutch: Hoofd of munt: over betekenis en toekomst van de psychologische besliskunde]. Inaugural address, University of Groningen.

List of references

- Von Neumann J, Morgenstern O (1953) *Theory of games and economic behavior*. Princeton University Press.
- Vrtic M, Schuessler N, Erath A, Axhausen KW (2010) The impacts of road pricing on route and mode choice behaviour. *Journal of Choice Modelling* 3(1): 109-126.
- Wall R (2006) *Psychological and contextual influences on travel mode choice for commuting*. PhD thesis, De Montfort University, Leicester.
- Wall R, Devine-Wright P, Mill GA (2004) *Psychological predictors in context: A qualitative study of travel mode choice for commuting*. Nottingham: Proceedings of the International Conference on Traffic & Transport Psychology.
- Wallenburg I, NJA van Exel, E Stolk, F Scheele, A de Bont, P Meurs. *Between Trust and Accountability: Different Perspectives on the Modernization of Postgraduate Medical Training in the Netherlands*. *Academic Medicine* 2010;85(6): 1082-1090.
- Wardman M (2001) A review of British evidence on time and service quality valuations. *Transportation Research E* 37(2/3): 107-128.
- Wardman M, Tyler J (2000) Rail network accessibility and the demand for inter-urban rail travel. *Transport Reviews* 20(1): 3-24.
- Watts S, Stenner P (2005) Doing Q methodology: Theory, method and interpretation. *Qualitative Research in Psychology* 2(1): 67-91.
- Wegmann FJ, Chatterjee A, Parnell S, Welch GL (1979) Impact of the 1977 transit strike in Knoxville. Washington: TRB Transportation Research Record 719: 6-13.
- Welch I (2000) Herding among security analysts. *Journal of Financial Economics* 58(3): 369-396.
- Williamson OE (1963) A model of rational managerial behavior. In: Cyert RM, March JG. *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice-Hall.
- Williamson OE (1986) *Economic organization: Firms, markets and policy control*. Brighton: Wheatsheaf Books.
- Williamson OE (1989) Transaction cost economics. In: Schmalensee R, Willig RD (Eds.) *Handbook of industrial organization I*. Amsterdam: North-Holland.
- Williamson OE (2000) The new Institutional Economics: taking stock, looking ahead. *Journal of Economic Literature* 38(3): 595-613.
- Wilson RW (1992) Estimating the travel and parking demand effects of employer-paid parking. *Regional Science and Urban Economics* 22(1): 133-145.

- Windervanck C, Tertoolen G (1998) Can car use be steered? [in Dutch: Autogebruik te sturen?]. Den Haag: Ministry of Transport, Adviesdienst Verkeer en Vervoer.
- Wolfson DJ (1998) Will we ever learn? A methodological reconnaissance, as exercise in modesty [in Dutch: Leren we het ooit? Een methodologische verkenning als oefening in bescheidenheid]. Farewell address, Erasmus University Rotterdam. Deventer: Kluwer.
- WRR (2009) The government as the architect of choice. WRR annual lecture. Den Haag: Wetenschappelijk Raad voor het Regeringsbeleid.
- Young RL, Nettelbeck T (1994) The "intelligence" of calendrial calculators. *American Journal of Mental Retardation* 99(2): 186-200.
- Zafirovski M (1999) The 'unbearable lightness' of the economic approach to economic behavior in the social setting: rational action and the sociology of the economy. *Journal for the Theory of Social Behaviour* 29(3): 301-334.
- Zeelenberg M (1999) Anticipated regret, expected feedback and behavioral decision making. *Journal of Behavioral Decision Making* 12(2): 93-106.
- Zeelenberg M, Pieters R (1999) On service delivery that might have been: behavioural consequences of disappointment and regret. *Journal of Service Research* 2(1): 86-97.
- Zeelenberg M, Pieters R (2006) Feeling is for doing: a pragmatic approach to the study of emotions and economic behavior. In: De Cremer D, Zeelenberg M, Murnighan JK (Eds.) *Social psychology and economics*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Zelizer V (1997). *The social meaning of money*. Princeton University Press.
- Zelizer V (1998) A gift, an entitlement, or compensation?. In: Ben-Ner A, Putterman L (Eds.) *Economics, Values, and Organization*. Cambridge University Press.
- Zelizer V (2001) Intimate transactions. In: Collins R, Guillen M, England P, Meyer M (Eds.) *The new economic sociology: Developments in an emerging field*. New York: Russell Sage Foundation.

Summary

Behavioural Economic Perspectives on Inertia in Travel Decision Making

“Why is it so difficult to persuade car drivers to use public transport more often?”, is a much discussed question among policy makers and researchers engaged with travel behaviour. Despite many policy initiatives aimed at making alternative modes of transportation more attractive, car use has steadily increased during the past decades. Nowadays, each second EU citizen owns a car and about 85% of all passenger kilometres are made by car. As a consequence of this growth in car ownership and use, car users are increasingly faced with traffic congestion, the accessibility of important economic, residential and social centres has become problematic, and concerns over traffic safety and quality of life near major roads have risen. A number of reasons can be put forward for the increasing dominance of the car during the past decades: a substantial improvement in the price-quality ratio of travelling by car, various socio-economic and cultural trends such as increasing welfare and individualisation, and travel policies that were chiefly concerned with accommodating increasing demand for road capacity. Most car users will favour investments in the public transport system, but despite the fact that they experience the disadvantages of car use themselves, they are barely willing to abandon their car occasionally and use alternative modes of transport more often.

This is only one example of individual travel choices that are sometimes difficult to explain for transportation researchers and policy makers. The aim of this thesis is to advance our understanding of individual travel behaviour by exploring this inertia from a behavioural economic

perspective. Inertia was defined as invariant behaviour while from a mainstream economic perspective change of behaviour is deemed rational (or vice versa) because it would be utility maximising for the individual. Behavioural economics is a relatively new stream within the economic sciences, in which traditional, neoclassical economics, assuming individual utility maximizing behaviour, is the mainstream. Behavioural economists attempt to find better explanations for observed behaviour that the traditional economic model has difficulties accounting for, by adapting or extending this model with insights from, among others, psychology and sociology.

This thesis investigated whether perspectives from behavioural economics could contribute to a better understanding of inertia in travel behaviour. For this purpose, section 2.1 gave an overview of how individual behaviour has generally been approached in transportation research. Next, section 2.2 described the basic assumptions underlying the mainstream economic approach to behaviour and section 2.3 the principal alternative approaches that have been proposed in behavioural economics. In chapters 3 to 7 a number of these alternative approaches have been further investigated in the context of travel behaviour. Chapter 8 finished with discussion and conclusion.

Chapter 2 found that a basic premise in transportation research is that generally travel is not a goal in itself, but derived from the need or desire to participate in activities spread over space and time. Moreover, travel choices are subordinated to mobility related choices. The suitability and relative desirability of means of transport are strongly influenced by long-term commitments. Decisions such as where to live and work, and in which means of transport to invest, are examples of this. A further assumption is that travellers are informed about the advantages and disadvantages of the available modes of transport and consider these carefully to choose the best, utility maximising alternative. Rational

behaviour thus is an important premise in travel behaviour analysis. In recent years there has been increasing attention for differences in preference, habituation and choice set between travellers. The difference between the objective choice set, which is the starting point of conventional analysis and contains all transport alternatives available to a person, and the subjective choice set, which contains only the subset of alternatives actually considered by this person, has been advanced as one of the principal causes of inertia. For now, however, an analytical framework incorporating heterogeneity among travellers has not been developed.

Traditional, neoclassical economics assumes that people behave rationally, individual utility maximising, as a *homo economicus*. This assumption has been criticised a long time, also within economics. A main argument is that it does not fit with how people actually make choices. After all, people are limited in their capacity to gain and process information and their reasoning is regularly clouded by emotions. Meanwhile, six alternative approaches have been proposed in behavioural economics that may describe behaviour better: bounded rationality, prospect theory, judgement of probabilities, interdependence, adaptive and relative preferences, and intertemporal choice. They approach in different ways peoples' limitations in ability and motivation to comprehend choice problems, judge the advantages and disadvantages of choice alternatives, evaluate these, and arrive at a decision. Applications of these six alternative approaches in transportation research have been discussed, but their number was limited.

Chapters 3 to 7 report the findings of research into a selection of these alternative approaches in the context of travel behaviour, with a particular focus on the choice set people use in travel decision making. Chapters 3 and 4 investigated the effect of strikes in public transport on the behaviour and subjective choice set of travellers. Following a strike, public

transport travellers' preferred alternative disappears from their choice set and they are forced to search for alternative means of transport and to (re-)consider and possibly (re-)try them. It turns out that some travellers have no (suitable) alternative option, but most travellers reach their destination using an alternative mode, or with help from others. Especially travellers with alternative options in their choice set and young travellers judge negatively about strikes in public transport and state that it may affect their future travel behaviour. Various studies have shown that negative experiences with a strike in combination with positive experiences with the chosen alternative may lead a proportion of the unsatisfied travellers to adapt their travel behaviour structurally. The market share of public transport suppliers eventually decreases after a strike and, therefore, it is important to prevent strikes (or their negative effects on travellers) as much as possible.

Chapters 5 and 6 investigated the subjective choice set of car and public transport users in relation to characteristics of the traveller, the trip and perceptions of alternative modes of travel. About half of the train users was a choice traveller and now and then considered the car for their trip. The main reasons for not choosing the car included a preference for public transport, habituation and anticipated congestion and parking problems when travelling by car. Investments in solving traffic congestion or increasing parking capacity may therefore lead these travellers to use the car more often. This induces extra car traffic. The proportion of car users considering public transport for their trip was substantially smaller. An important reason for this was their perception of the travel time by public transport for the same trip, which on average was 2.3 times higher than by car. A comparison of objective and perceived travel times showed that car users overestimated travel time by public transport by about a half, and that the extent of overestimation was associated with familiarity with the public transport system. In case car users' perception of travel time by

public transport would be accurate, the proportion of car users considering public transport would possibly rise to two out of three. This does not necessarily mean that these car users will actually change their behaviour, but it does underline the importance of correct information for making good travel decisions.

Chapter 7 explored differences in preferences and decision making between travellers. Using a novel method for transportation research, Q methodology, four distinct preference segments for middle-distance travel were revealed: choice travellers with a preference for public transport, deliberate-choice travellers, choice travellers with car as dominant alternative, and car-dependent travellers. These preference segments differ as follows: The cognitive effort spent on travel decision making; the extent to which they find means of transport suitable and consider them for use; and the susceptibility to policy measures aimed at influencing their travel behaviour. In a way, all car users could be stimulated to consider and perhaps use public transport more often, but policies may be most effective when they are directed at choice travellers and explicitly take into account their preference structures.

The discussion in chapter 8 commented on the focus of this thesis and some of the data used. This study was focused on the choice set people use in travel decision making, and therefore only a selection of the potential causes for inert travel behaviour has been highlighted. The analyses presented in chapters 4, 5 and 6 were based on secondary data. It is recommended to replicate them with data that was collected specifically for the aim of the respective studies. The conclusion was that this study has contributed to our understanding of travel behaviour by showing the importance of taking into account choice sets explicitly in travel policy and analysis. Travellers make their decisions from a choice set, which may or may not have been generated in a rational way. The choices from this subset of the available alternatives, in turn, can also be

either rational or inert. The model that is most appropriate as approach of the travel behaviour analysed in any study should therefore follow the context and purpose of that particular study. Further, it is noteworthy that invariant behaviour does not necessarily imply inertia. It can also be rational behaviour. Moreover, invariant behaviour is not necessarily undesirable. It can also be a good habit, that should be sustained by policy. The chapter finishes with the main implications for transport policy and discusses some interesting directions for further research.

Samenvatting

Gedragseconomische perspectieven op inertie in reisgedrag

“Waarom is het zo moeilijk om automobilisten te overtuigen vaker het openbaar vervoer te gebruiken?”, is een veel besproken vraag onder beleidsmakers en onderzoekers die zich bezighouden met reisgedrag. Ondanks veel initiatieven om alternatieven voor de auto aantrekkelijker te maken, is het autogebruik gedurende de afgelopen decennia gestaag gegroeid. Momenteel bezit ongeveer elke tweede inwoner van de EU een auto en wordt van alle personenkilometers 85% met de auto afgelegd. Door de groei van het autobezit en -gebruik hebben steeds meer weggebruikers met verkeersopstoppingen te maken gekregen, is de bereikbaarheid van belangrijke economische, woon- en recreatielocaties een probleem geworden, en nemen de zorgen over veiligheid in het verkeer en leefbaarheid rond verkeerswegen toe. Er zijn een aantal redenen te noemen voor de toegenomen dominantie van de auto gedurende de afgelopen decennia: een substantiële verbetering in de relatieve prijs-kwaliteitverhouding van reizen per auto, diverse socio-economische en culturele trends, zoals groeiende welvaart en individualisering, en verkeersbeleid dat zich vooral heeft gericht op het faciliteren van de toegenomen vraag door uitbreiding van wegcapaciteit. Veel autogebruikers vinden dat er meer geïnvesteerd moet worden in het openbaar vervoer, maar ondanks dat ze zelf de nadelen ondervinden van het autogebruik, zijn ze nauwelijks bereid de auto af en toe te laten staan en vaker gebruik te maken van alternatieven.

Dit is slechts één voorbeeld van keuzes die reizigers maken die voor verkeersonderzoekers soms lastig te verklaren zijn vanuit het gangbare

denkmodel van rationeel gedrag. Het doel van dit proefschrift was om bij te dragen aan het begrip van reisgedrag door deze inertie te onderzoeken vanuit een gedragseconomisch perspectief. Inertie is hier gedefinieerd als doorgaan met een bepaald gedrag terwijl verandering van gedrag rationeel lijkt (of vice versa) omdat het tot een hoger nut leidt voor het individu. Gedragseconomie is een relatief jonge stroming binnen de economische wetenschappen, waarin de traditionele, neoklassieke economie, die uitgaat van rationeel individueel nutmaximaliserend gedrag, de hoofdstroom is. Gedragseconomen proberen tot een betere benadering te komen van geobserveerd gedrag dat het traditionele economische model niet goed kan verklaren, door dit model aan te passen of uit te breiden met inzichten uit onder andere de psychologie en de sociologie.

Dit proefschrift beziet of inzichten uit de gedragseconomie kunnen bijdragen aan een beter begrip van inert reisgedrag. Hiervoor kijk ik in paragraaf 2.1 allereerst naar hoe gedrag over het algemeen wordt benaderd in verkeersonderzoek. Vervolgens beschrijf ik in paragraaf 2.2 de traditionele economische benadering van gedrag, en in paragraaf 2.3 de belangrijkste alternatieve benaderingen die zijn voorgesteld vanuit de gedragseconomie. In de hoofdstukken 3 tot en met 7 onderzoek ik een aantal van deze alternatieve benaderingen nader in de context van reisgedrag. Hoofdstuk 8 sluit dit proefschrift af met discussie en conclusie.

In hoofdstuk 2 blijkt dat bij de bestudering van reisgedrag ervan uit wordt gegaan dat reizen geen doel op zich is, maar afgeleid van de behoefte om aan activiteiten deel te nemen die in tijd en plaats verschillen. Reisgedrag is bovendien ondergeschikt aan mobiliteitsgerelateerde keuzes. De geschiktheid en relatieve aantrekkelijkheid van vervoermiddelen worden in belangrijke mate beïnvloed door lange termijn verplichtingen die mensen aangaan. Keuzes zoals waar te wonen en te werken, en in welke vervoermiddelen te investeren, zijn hier voorbeelden van. Verder wordt verondersteld dat reizigers de voor- en nadelen van alle beschikbare

alternatieve vervoerwijzen kennen en zorgvuldig overwegen om vervolgens het beste, nutmaximaliserende alternatief te kiezen. Rationeel gedrag is dus een belangrijk uitgangspunt bij de analyse van reisgedrag. De laatste jaren is er wel toenemende aandacht voor verschillen tussen reizigers in voorkeur, mate van gewoontevorming en keuzeset. Het verschil tussen de objectieve keuzeset, waar reguliere analyses van uitgaan en waarin alle beschikbare vervoersalternatieven zitten, en de subjectieve keuzeset, waarin alleen de subset van alternatieven zit die door de reiziger daadwerkelijk in beschouwing wordt genomen, wordt als een belangrijk aanknopingspunt voor inert gedrag gezien. Vooralsnog is er echter geen analysekader ontwikkeld waarin de heterogeniteit onder reizigers wordt geïntegreerd.

In de traditionele, neoklassieke economie wordt verondersteld dat mensen zich rationeel, individueel nutmaximaliserend gedragen –als een *homo economicus*. Deze veronderstelling wordt echter al lange tijd bekritiseerd, ook binnen de economische wetenschappen. Een belangrijk argument hiervoor is dat deze niet past bij hoe mensen in werkelijkheid keuzes maken. Mensen zijn immers beperkt in hun vermogen om keuzeproblemen te doorgronden, beschikken meestal niet over volledige informatie, en hun oordeelsvorming wordt nog al eens beïnvloed door emoties. Binnen de gedragseconomie zijn inmiddels zes alternatieve benaderingen voorgesteld om gedrag beter te beschrijven: *bounded rationality*, *prospect theory*, *judgement of probabilities*, *interdependence*, *adaptive and relative preferences*, en *intertemporal choice*. Deze benaderen op verschillende manieren de beperkingen in capaciteit en motivatie van mensen om keuzeproblemen te doorgronden, de voor- en nadelen van keuzemogelijkheden te beoordelen, deze tegen elkaar af te wegen en tot een beslissing te komen. Voor deze zes benaderingen zijn toepassingen op het gebied van verkeersonderzoek besproken, maar het aantal gevonden toepassingen is beperkt.

Hoofdstuk 3 tot en met 7 doen verslag van onderzoek naar een aantal van deze alternatieve benaderingen in de context van reisgedrag, en zijn met name gericht op de keuzeset die mensen hanteren bij hun reisgedrag. Hoofdstukken 3 en 4 behandelen het effect van stakingen in het openbaar vervoer op het reisgedrag en de subjectieve keuzeset van reizigers. Door een staking verdwijnt de geprefereerde vervoerwijze uit de keuzeset en worden reizigers gedwongen naar alternatieven te zoeken en deze (opnieuw) te beoordelen en wellicht uit te proberen. Sommige reizigers blijken geen alternatief te hebben (of geschikt te vinden), maar de meeste reizigers komen met een alternatief vervoermiddel, of met hulp van anderen, toch op hun bestemming. Vooral reizigers met alternatieve vervoerwijzen in hun keuzeset en jonge reizigers beoordelen stakingen negatief en geven aan dat het van invloed zal zijn op hun toekomstige reisgedrag. Uit diverse studies blijkt dat negatieve ervaringen van stakingen en positieve ervaringen met alternatieven er toe kunnen leiden dat een deel van de ontevreden reizigers hun reisgedrag structureel aanpast. Het marktaandeel van openbaar vervoerbedrijven neemt als gevolg van een staking uiteindelijk af en het is daarom van belang om stakingen (of de negatieve effecten ervan op reizigers) zoveel als mogelijk te voorkomen.

Hoofdstukken 5 en 6 onderzoeken de subjectieve keuzeset van reizigers met de auto en het openbaar vervoer in relatie tot kenmerken van de reiziger, de verplaatsing en percepties van alternatieve vervoerwijzen. Ongeveer de helft van de treinreizigers is keuzereiziger en overweegt ook wel eens de auto voor hun verplaatsing. Redenen om niet voor de auto te kiezen zijn onder andere een voorkeur voor reizen per openbaar vervoer, gewoontevorming en verwachte congestie en parkeerproblemen bij het reizen met de auto. Investerings in het oplossen van files of extra parkeercapaciteit kunnen daarom betekenen dat deze reizigers vaker de auto gaan gebruiken, en leiden dus tot extra autoverkeer. Het aandeel

van autogebruikers dat het openbaar vervoer overweegt is aanzienlijk kleiner. Een belangrijke reden hiervoor is dat hun inschatting van de reistijd met het openbaar vervoer voor dezelfde verplaatsing gemiddeld 2.3 keer langer is dan met de auto. Vergelijking van geschatte en werkelijke reistijden laat zien dat autogebruikers de reistijd per openbaar vervoer met ongeveer de helft overschatten, en dat de mate van overschatting gerelateerd is aan bekendheid met het openbaar vervoer. Indien de inschatting van reistijd per openbaar vervoer nauwkeurig zou zijn, zou het aandeel van de autogebruikers dat het openbaar vervoer overweegt bij benadering stijgen tot twee op de drie. Daarmee is niet gezegd dat dit ook daadwerkelijk tot gedragsverandering leidt, maar het onderstreept het belang van juiste informatie voor het maken van goede keuzes.

Hoofdstuk 7 bekijkt verschillen in voorkeuren en keuzegedrag tussen reizigers. Met behulp van Q methodologie, voor verkeersonderzoek een nieuwe methode, zijn vier typen reizigers geïdentificeerd: keuzereizigers met een voorkeur voor openbaar vervoer, bewuste keuzereizigers, keuzereizigers met de auto als dominant alternatief, en autoafhankelijke reizigers. Deze typen reizigers verschillen als volgt: De mate waarin ze nadenken over hun reisgedrag; de mate waarin ze verschillende vervoerwijzen acceptabel vinden en overwegen deze te gebruiken; en de gevoeligheid voor beleid en specifieke beleidsmaatregelen gericht op het beïnvloeden van hun reisgedrag. In zekere zin kunnen bijna alle autogebruikers gestimuleerd worden om het openbaar vervoer vaker te overwegen, en wellicht ook te gebruiken. Maar beleid is naar verwachting het meest effectief indien het gericht is op keuzereizigers en nadrukkelijk rekening houdt met hun benadering van reisgedrag en hun voorkeuren.

De discussie in hoofdstuk 8 plaatst een kanttekening bij de focus van dit onderzoek en een deel van de gebruikte data. Dit onderzoek richt zich op de keuzeset die mensen hanteren bij hun reisgedrag, en belicht daarom

slechts een selectie van de potentiële oorzaken van inert reisgedrag. De bevindingen van hoofdstukken 4, 5 en 6 zijn gebaseerd op secundaire data. Het verdient aanbeveling deze onderzoeken te herhalen met voor het specifieke doel verzamelde data. De conclusie is dat dit onderzoek bijdraagt aan meer inzicht in reisgedrag door te laten zien waarom het belangrijk is expliciet rekening te houden met keuzesets in verkeersbeleid en -onderzoek. Reizigers beslissen op basis van een keuzeset, die al dan niet rationeel tot stand is gekomen. De keuzes vanuit deze subset van de beschikbare alternatieven kunnen op hun beurt ook weer rationeel of inert zijn. Welk model het best gebruikt kan worden om reisgedrag te benaderen is daarom afhankelijk van de context en het doel van de studie. Het is verder belangrijk te beseffen dat onveranderlijk gedrag niet per se duidt op inertie. Het kan ook rationeel gedrag zijn. Bovendien is onveranderlijk gedrag niet per se onwenselijk. Het kan ook een goede gewoonte zijn, die je met beleid wilt bestendigen. Het hoofdstuk eindigt met de voornaamste implicaties van de bevindingen voor transportbeleid en bespreekt enkele interessante richtingen voor verder onderzoek.