Chapter 7
Travel Mode Use, Travel Mode Shift and Subjective Well-Being: Overview of Theories, Empirical Findings and Policy Implications

Dick Ettema, Margareta Friman, Tommy Gärling and Lars E. Olsson

Abstract This chapter discusses how travel by different travel modes is related to primarily subjective well-being but also to health or physical well-being. Studies carried out in different geographic contexts consistently show that satisfaction with active travel modes is higher than travel by car and public transport, and that satisfaction with travel is lowest for different forms of public transport. These differences are shown to be explained by a variety of factors, which stem from fundamental differences between the travel modes in terms of the intensity of physical activity, mental involvement in the act of travel itself, exposure to and interaction with the vehicle and the wider travel surroundings, and the degree of control over travel circumstances. Taken together, the overview suggests that active modes are an attractive alternative to car travel. Public transport can be a good alternative to car travel, if requirements of seat availability, accessibility, safety, and cleanliness are met. Regarding the shift from one travel mode to another, some evidence indicates that most car commuters, when switching to public transport, experience lower satisfaction with travel by car. Yet, those who experience public transport more positive than car are likely to keep using it. Other evidence suggests, however, that car commuters' experience of public transport is better than they anticipate, but that they tend to "forget" this after some time. Switchers from car to active travel on average report higher levels of subjective well-being after the switch. Policies aimed at promoting the use of more sustainable modes should recognize that heterogeneity exists between travelers, and aim at targeting those with positive attitudes toward changing to active modes and public transport. Future research should address the dynamics in experienced travel satisfaction and mode choice.

D. Ettema (✉)
Faculty of Geosciences, Utrecht University, 80115, 3508 TC Utrecht, The Netherlands
e-mail: D.F.Ettema@uu.nl

M. Friman · T. Gärling
Karlstad University, Karlstad, Sweden

L.E. Olsson
University of Gothenburg and Karlstad University, Karlstad, Sweden

D. Wang and S. He (eds.), *Mobility, Sociability and Well-being of Urban Living*,
DOI 10.1007/978-3-662-48184-4_7

Keywords Well-being · Travel satisfaction · Travel mode choice · Behavior change · Mode switching

7.1 Introduction

Over the past several decades, increasing car traffic in industrialized and developing countries has led to negative side effects, such as air pollution, traffic accidents, greenhouse gas emissions, congestion, and health problems due to lack of physical exercise. While some of these side effects can be partially abated by technological and design measures (e.g., developing cleaner and more efficient engines, building more or safer infrastructure), behavior change is seen by many as an important strategy to reduce the negative impacts of car traffic (e.g., Bamberg 2014). As a consequence, behavior change programs have been implemented throughout the world (Brög et al. 2009; Richter et al. 2011) to make car drivers switch to more sustainable travel modes, such as public transport, walking, and cycling. Such programs apply various measures, including providing tailored information of travel options, providing feedback on behavior (either relative to a target or relative to others' behavior), providing information about environmental and health consequences of car travel and incentivizing travelers to implement their plans. While the effects of such measures on behavior change have been well documented, the effects on travelers' experience or their well-being after a travel mode change is largely unknown (Ampt 2004). Nevertheless, the effects of mode change on travel satisfaction and well-being are relevant for a number of reasons. First, if a forced or stimulated mode change leads to changes in travel satisfaction, care should be taken so that sufficient travel satisfaction remains for all travelers and reductions in travel satisfaction do not exceed acceptable levels. Second, if behavior change is to be sustained over a longer period, behaviors that lead to higher levels of satisfaction are more likely to be intrinsically motivating and therefore maintained. Thus, care should be taken so that travel mode alternatives and behavior change programs are developed to maximize satisfaction with travel.

In conventional cost–benefit analyses, assessment of the social benefits of mode change is based on econometric utility functions describing the existing modal split as a function of the characteristics of the transportation system and travelers. However, this approach is based on assumptions that are questionable in the context of mode change, such as the assumption that all travelers have complete knowledge of their choice options and do not face constraints in terms of availability or spending power. In addition, cost–benefit analysis is usually based on the unrealistic assumption that individuals' preferences and assessment of choice outcomes is invariant over time.

To complement the traditional approaches, this chapter will describe the implications of mode choice and mode change from the perspective of subjective well-being. Key to this approach is that subjective well-being associated with travel

is directly measured (using psychometric scales) instead of being solely derived from observed choices. To this end, the chapter starts with a discussion of the conceptualizations of subjective well-being, as well as the definitions and measurement issues when applied to travel. Next, for various travel modes (private car, public transport, and walking/cycling), we give a detailed account of the factors that influence satisfaction with travel and subjective well-being. These factors are largely specific to the travel mode because travel modes differ in terms of interaction with the physical and social environment and the physical and mental processes involved. Then, we analyze the effects of travel mode change on travel satisfaction. In particular, we review the ways in which travelers form expectations of an alternative travel mode, and what factors influence their experience of the new travel mode. In addition, we discuss the broader implications of travel mode change by offering an overview of health, sustainability and equity effects, which may influence the subjective well-being of the travelers and of others. The chapter ends with a discussion of implications for research and policymaking.

7.2 Subjective Well-Being and Satisfaction with Travel

In the context of cost–benefit analyses, assessing satisfaction with travel is commonly based on utility maximization theory (McFadden 2001). In this theory it is assumed that people make choices that maximize (random) utility and result in satisfaction with the outcomes of their choices. Satisfaction with travel is, therefore, derived from the observed choices (Carrasco et al. 2005; Hess et al. 2007; Newman and Bernardin 2010). However, this assumed correspondence between utility and satisfaction has been challenged. Kahneman et al. (1997) made a distinction between experienced utility and decision utility. Experienced utility is the satisfaction with the outcome of a choice (i.e., the degree to which it is good or bad), whereas decision utility is the degree to which the outcome is (anticipated to be) desired when the choice is made. Empirical research (e.g., Kahneman and Sugden 2005) has shown that experienced utility frequently differs from decision utility. Later, Kahneman (1999, 2000a, b) associated experienced utility with happiness. For decades, happiness, subjective well-being, or life satisfaction have been the focus of research in economics (e.g., Dolan et al. 2008), psychology (e.g., Diener et al. 1999), and sociology (e.g., Veenhoven 1984). Its roots have been traced back to ancient Greek philosophy (McMahon 2008).

Diener and Suh (1997) were first to posit that subjective well-being consists of three components (see Busseri and Sadava 2011): a cognitive judgment of satisfaction with life as a whole, positive affect (PA), and negative affect (NA). Life satisfaction judgments have usually been assessed by the 5-item *Satisfaction With Life Scale* (SWLS) (Diener et al. 1985; Pavot and Diener 1993), where five self-report statements (e.g., "I am satisfied with my life") are rated on 7-point Likert scales ranging from "totally disagree" to "totally agree." It is also common to assess life satisfaction by a single-item judgment such as Cantril's *Self-Anchoring Scale*

that asks participants to rate their current life on a "ladder" from 0 "the worst possible life for you" to 10 "the best possible life for you" (Kahneman and Deaton 2010).

The affective components (PA and NA) are assessed by different methods including instantaneous self-reports of specific emotions and moods or recalled past emotions or moods. Instantaneous self-reports may be obtained by the *Ecological Momentary Assessments* (EMA) or the *Experience Sampling Method* (ESM) (Stone et al. 1999). In these methods, participants report their affective experiences during an activity (referred to as an episode) by using, for instance, a smartphone. This produces low levels of "noise" (e.g., due to memory distortions) in the measures. However, EMA and ESM impose a considerable response burden on participants. In developing the *Day Reconstruction Method* (DRM), Kahneman et al. (2004) showed that ratings of specific momentary emotions from the memory of past episodes (the day before) are highly correlated with the results of ESM when the participants describe the episodes before making the ratings. It has also been suggested that the same procedure may be used to provide a reliable measure for less recent episodes if they are infrequent (the *Event Reconstruction Method* or ERM; Schwartz et al. 2009). As an alternative to self-reports of specific emotions, conventional self-report rating scales, such as the *Positive Affect and Negative Affect Scale* (PANAS, Watson et al. 1988) or the *Swedish Core Affect Scale* (SCAS, Västfjäll et al. 2002; Västfjäll and Gärling 2007) have been used to measure the affect components both from memory (e.g., how people have felt during a past period) and as instantaneous reports of current moods. Regardless of the measurement technique, repeated measurements of the affect component during some period are usually aggregated to indexes for the period as a whole. One index that has been argued as being highly correlated with life satisfaction judgments is the ratio of the frequencies of PA and NA (Diener et al. 1991). Another index assesses the net affect as the average intensity of PA minus the average intensity of NA (Kahneman et al. 2004). A third index captures duration-weighted intensities of positive and negative affects (the U-index, Kahneman and Kreuger 2006; the Diffmax index, Krueger and Schkade 2008).

We view satisfaction with travel as domain-specific life satisfaction (Ettema et al. 2010) and argue that, analogous to global life satisfaction, a measure of satisfaction with travel should include both cognitive and affective components. Previous studies have found that domain-specific satisfaction with work, family life, and leisure correlates positively with global life satisfaction (Schimmack 2008). Using the method that we developed to measure travel satisfaction, which is described below, Olsson et al. (2013) similarly found a positive correlation between satisfaction with travel and global life satisfaction. Personal travel is generally viewed as being instrumental for participation in activities in different places (Axhausen and Gärling 1992; Ettema and Timmermans 1997). We assume this is primarily captured by cognitive judgments of satisfaction with the transport system related to cost, travel time, and punctuality (Fellesson and Friman 2008). Other research has focused on the positive affective experiences of travel itself (Mokhtarian and Salomon 2001;

Table 7.1 The satisfaction with travel scale (STS)

Cognitive evaluation
Travel was worst (−4)—best I can think of (4)
Travel was low (−4)—high standard (4)
Travel worked well (−4)—worked poorly
Positive activation–negative deactivation
Tired (−4)—alert (4)
Bored (−4)—enthusiastic (4)
Fed up(−4)—engaged (4)
Positive deactivation–negative activation
Time pressed (−4)—relaxed (4)
Worried I would not be in time (−4)—confident I would be in time (4)
Stressed (−4)—calm (4)

Note In administering the STS, the items appear in counterbalanced order

Mokhtarian et al. 2001). In the following sections, evidence is presented for that affect plays an important role in satisfaction with travel.

The multi-item Satisfaction with Travel Scale (STS) that we have developed may be used for any type of travel, although when applying the scale, details of the targeted travel need to be specified. In Olsson et al. (2013) and Suzuki et al. (2014), STS was used to measure satisfaction with the most recent normal commute to and from work, either as a whole or for each stage (e.g., walk to bus stop, ride bus, walk from bus stop to workplace), that users of car, public transport, or walking/cycling modes were able to recall. STS combines cognitive judgments of travel satisfaction with measures of two orthogonal affect dimensions. The three first items in Table 7.1 are averaged to the composite measure of the cognitive judgments of the quality of the travel. To measure the two affective dimensions of STS, we chose SCAS (Västfjäll et al. 2002; Västfjäll and Gärling 2007), which consists of validated adjective scales in the participants' natural language, Swedish. SCAS is derived from the affect circumplex (Russell 1980, 2003; Yik et al. 2011; Kuppens et al. 2013) that includes the orthogonal core affect dimensions *valence* (varying from positive to negative) and *activation* (varying from activated to deactivated). The affect circumplex is shown in Fig. 7.1. Our choice of adjective scales that measure affect varying from positive activation to negative deactivation (the measure referred to as PAND obtained by averaging items 4 to 6 in Table 7.1) and affect varying from positive deactivation to negative activation (the measure referred to as PDNA obtained by averaging items 7 to 9 in Table 7.1) is dictated by a high content validity in representing discrete emotion states (alertness, boredom, relaxation, stress) frequently experienced during travel. The dimensions, which are orthogonal to each other, represent a 45-degree rotation of the main valence and activation axes. Note that the measures obtained on the PAND and PDNA dimensions may be converted to valence and activation. As shown in Fig. 7.1, they may also be converted to the PA and NA dimensions of PANAS.

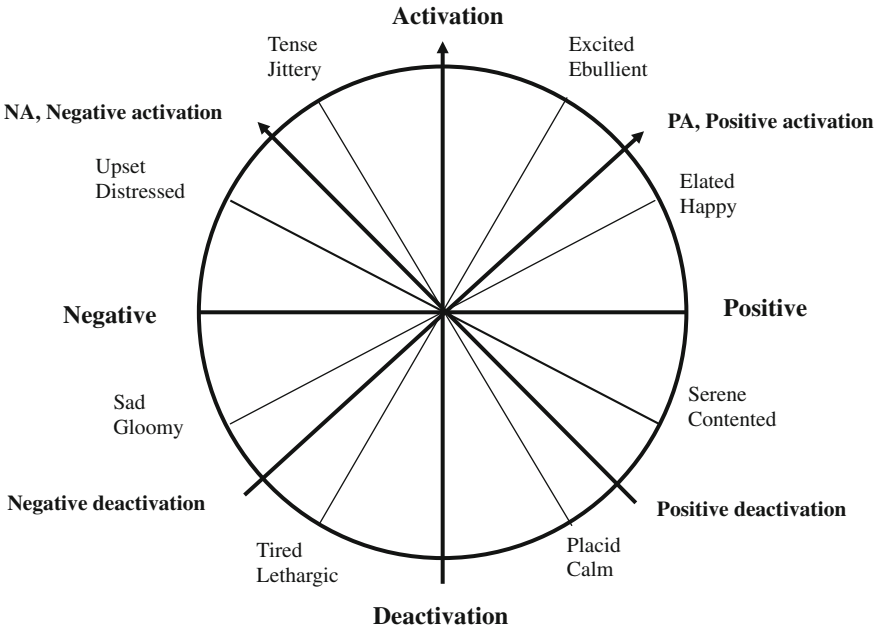

Fig. 7.1 The affect grid (see text for further explanation), from Yik et al. (2011)

A psychometric analysis of the STS is reported in Friman et al. (2013). The data analyzed were obtained from a mail survey of a population-based sample of work commuters in the three largest urban areas of Sweden (see details in Olsson et al. 2011). A confirmatory factor analysis (Byrne 2010) was conducted showing that the three STS composite measures (cognitive judgment of satisfaction, positive activation–negative deactivation, and positive deactivation–negative activation) were found to be distinct constructs, positively correlated with each other and subsumed to a latent higher order global measure interpreted as satisfaction with travel. As expected, the measurement model was found to be invariant across the three urban areas and across the three primary commute modes of private car, public transport (bus, subway, or train) and walking or cycling. The measures were also found to have acceptable reliability and to discriminate between urban areas and modes.

It is concluded that STS is general enough to be used to test specific hypotheses about satisfaction with travel by different modes in different urban contexts. In an experimental study (e.g., Ettema et al. 2011), STS was measured for three hypothetical weekdays differing in travel mode, travel time, access to bus stops, and daily activity agenda. In further support of its validity and reliability, STS was found to reliably differentiate between the fictitious changes in travel conditions.

7.3 Travel Satisfaction by Mode

7.3.1 Private Car

The private car has drastically altered the development of the world like few other human inventions. In developed countries, and now in developing countries, its versatility strongly contributes to why it is the preferred mode of urban, suburban, and rural travel (Jakobsson 2007). Preferences for the private car have traditionally been conceptualized as determined by instrumental factors, such as saving time or increasing reliability (Brownstone and Small 2005; Hensher 2004). Instrumental factors have also been empirically found to be a strong motive for car use (Jakobsson Bergstad et al. 2011; Steg 2005).

The private car allows easy access to out-of-home mundane activities such as, among other things, work, participation in children's activities, restaurant visits and shopping, that have been shown to be important for subjective well-being (Jakobsson Bergstad et al. 2012). Few, if any, alternatives to the private car manage to compete in reliability, convenience, and flexibility.

But factors other than the instrumental factors are also important, such as joy, independence, freedom, mastery, and prestige. It is obvious that commercials aim at triggering such emotion-laden motives—and for good reasons. A well-known method used by advertisers is to make the car (like many other products) appealing to potential consumers. Research examining the motives for car use has also documented that psychological motives are important for ownership and use (Jakobsson Bergstad et al. 2011; Steg 2005). These motives are connected to the emotions that driving a car evokes (such as pleasure to use, excitement, and feelings of freedom), as well as the symbolic motives associated with ownership (such as prestige, identity, and self-presentation) (Jakobsson Bergstad et al. 2011; Steg 2005).

Car travel has been shown to be an enjoyable activity in itself (Gatersleben 2007; Mokhtarian 2005), and the pleasure of driving for its own sake include adding variety to one's daily experience, viewing beautiful scenery, experiencing speed and, especially for men, a sense of mastery in operating the car (Jakobsson Bergstad et al. 2011; Ory and Mokhtarian 2005). It is also argued that the feelings associated with the car, such as the physical sensations of controlling it, need to be considered (Kent 2014). Thus, it can be noted that driving has positive affective consequences that partly may explain why it is attractive.

The private car is also attractive because it provides privacy and security (Gatersleben 2014). Commutes by car are used by some travelers as time to think or relax, or as the only time for themselves during the day (Jain and Lyons 2008). Some people, thus, cherish the time on the car commute as a buffer between their family and work roles, both spatially and psychologically (Mokhtarian and Salomon 2001). In a similar vein, Hartig (2007) proposes that the use of a car may be seen as an opportunity for restoration, "a safe and isolated haven from pressing role demands or aversive surroundings, and so a place that permits restoration."

In contrast, some drivers experience high levels of stress, and it has been found that long car commutes in congested traffic cause residual stress in the workplace (Novaco et al. 1990; see review in Novaco and Gonzales 2009). Although stress is important, Gatersleben and Uzzell (2007) suggest that a focus on stress may be too limited and that other emotions such as boredom and depression need to be taken into account. Commuting by car has then been found to be a worse experience than active commuting (walking and cycling) and about the same (Olsson et al. 2013) or slightly better than public transport (Friman et al. 2013). A study analyzing 18 waves of a British household panel survey (1992–2009) showed that car use is worse for psychological well-being than both active modes and public transport (Martin et al. 2014). The results also showed that travel time is negative for car users and that, although reducing travel time may be important, a shift to an active mode is more beneficial than reducing travel time. Experienced traffic safety, annoyance with other road users, the trip being tiring, being distracted by billboards, and the lack of freedom to choose speed and lanes are additional factors negatively influencing a car driver (Ettema et al. 2013).

To summarize, the private car is the main mode of travel in Western societies and will soon be in the developing countries. The environmental burden stemming from car use will probably continue to increase. One way to reduce the negative impacts is to make car users switch to other modes that are less detrimental to the environment. To accomplish this, it is important to understand and consider the motives of car use. As presented above, these motives can be strong and are instrumental, affective, and symbolic. However, although car users may be fully aware of these motives, they sometimes lack the knowledge of the potential negative consequences, not only for the environment, but also for their subjective well-being (Martin et al. 2014; Olsson et al. 2013).

7.3.2 Public Transport

European cities generally offer public transport services that are reliable, accessible, comfortable, safe, and flexible (Mees 2010; Newman and Kenworthy 1999; Pucher and Kurth 1996). In 2012 local public transport in the EU carried 57 billion passengers (UITP database 2012) and the majority of journeys (56 %) were taken by bus. The shares for each mode in the member states vary with five countries (Austria, Croatia, Czech Republic, France, and Germany) having a higher share of urban rail than buses. Metro networks, where they exist (in 16 of the 28 member states), attract a significant share of the number of public transport journeys. In Austria, France and Spain, for instance, metro journeys make up over one-quarter. Eurostat (2012) estimates that current public transport services account for 16 to 17 % of the total daily distance of passenger travel.

Public transport on other continents shows both similarities and differences to Europe. In the US, people are less likely to use public transport with a total market share of 5 % (Rapino and Field 2012). Investments in large bus systems and rail

infrastructure have positively increased the number of users in some US cities (e.g., in Los Angeles, New York, Washington DC, and Seattle). In Asia, the market share varies widely, from very low in Indonesian cities (2 %), to very high in cities such as Hong Kong (90 %) and Singapore (60 %). Buses and trains represent less than 10 % of all urban passenger transport in Australia (Hensher 2000). Eight percent of the population in Africa (e.g., Sierra Leone, Niger, and Liberia) uses public transport to travel to and from work (Households National Travel Survey 2013).

Improvement of public transport in places where it is required should be based on solid knowledge of what promotes satisfaction with travel by public transport. A review of studies that have investigated various quality factors in public transport shows that accessibility, reliability, and mobility provisions are particularly important (Redman et al. 2013). From this review it is clear that other quality attributes important for user satisfaction vary between different contexts, among different groups of users and between different types of public transport. In large cities, seat availability can be very important due to crowdedness, whereas the number of departures is crucial in rural areas due to infrequent service. Travelers who have access to a car but choose to use public transport may be more sensitive to security issues, cleanliness of stations, and user information than those with no other alternatives. It has also been shown that satisfaction differs between different modes of public transport (rail, metro, and bus). Rail passengers are generally more satisfied with their travel than bus and metro passengers (St-Louis et al. 2014). The study concludes that service quality is important for travel satisfaction, but the relative weight of different factors depends primarily on the context and particularities of the targeted segments.

Apart from service quality, improved physical health also contributes to public transport users' satisfaction. Several studies classify public transport as an active mode because it is frequently combined and integrated with walking and/or cycling at the beginning and/or end stage of a public transport trip. Physical activities are, in general, known to have a positive effect on physical as well as mental health. This is also confirmed in public transport studies. From a recent review of studies focusing on the physical activity associated with public transport use (Rissel et al. 2012), it is clear that there is an additional amount of walking (from 8 to 33 min) associated with public transport use. In addition, Wen and Rissel (2008) found that men who use public transport are less likely to be sedentary or obese than men who do not use public transport. Also, switching from car to public transport helps people to lose weight and become healthier physically (Martin et al. 2014). To be physically active combined with the possibility to relax during the trip or to do various activities (e.g., reading newspapers/books, talking to friends, or playing games) may explain some of the satisfaction that public transport travelers feel (Ettema et al. 2012).

Does high-quality public transport influence people´s subjective well-being? A recent longitudinal study (Martin et al. 2014) shows that public transport is more beneficial for people's mental health than driving. According to our theoretical model (Ettema et al. 2010), a positive relationship with subjective well-being should occur when the traveler experience PA (e.g., relaxing) during travel, when

public transport facilitates engagement in activities (progress toward goals), and when the organization of public transport has implications for the ease or difficulty with which activities are performed. In line with this, Cao (2013) showed that people living along high-quality public transport corridors rated the quality of their lives higher compared to people in other corridors. The level of mobility that high-quality public transport provides was assumed to be the explanation. People living in these areas can access all activities they want even if they do not have access to a private car. It is thus suggested that cities providing easy access to convenient public transport promote subjective well-being. Leyden et al. (2011) argue that such cities foster, with the support of public transport, social connections that are important. In this way, public transport may thus enhance the attractiveness of living in a city.

Taken together, there are several benefits of public transport. Satisfaction with public transport can be explained by high service quality, by the fact that it promotes an active and healthy lifestyle, and because it is relaxing and less stressful than driving a car. Instead of dealing with traffic, public travelers are able to engage in various attractive activities during the ride. It is also suggested that high-quality public transport enables participation in preferable activities and foster social interactions which together are important for subjective well-being. Improvements and further integration between public transport and active modes (walking and cycling) would likely have subjective well-being benefits and thus contribute to more livable cities.

7.3.3 Cycling and Walking

Travel satisfaction by slow modes such as cycling and walking is consistently found to be higher than travel satisfaction by automobile and public transport (Olsson et al. 2013; St-Louis et al. 2014; Gatersleben and Uzzell 2007; Martin et al. 2014). Various explanations are offered. Gatersleben and Uzzell (2007) argue that walking and cycling offer better opportunities to enjoy the scenery and bring more enjoyment. In terms of affective appraisal, cyclists and pedestrians are found to rate their travel as being more exiting, relaxing, interesting, and pleasant. Gatersleben and Uzzell (2007) further hypothesize, based on their findings, that slow travel modes are attractive as they bring about an optimal level of arousal. Whereas car driving is evaluated as stressful, and public transport use as boring, cycling and walking are found to be exciting and pleasurable. An alternative explanation is the benefit of the physical activity involved in walking and cycling. Studies of affect related to physical activity (Ekkekakis et al. 2008) suggest that physical activity leads to enhanced mood, with an intensity of 70 % of the maximum capacity as an optimal level. However, the extent to which physical activity improves mood significantly depends on physical condition.

Ettema and Smajic (2015) note various factors that explain the positive benefits of walking, such as autonomy, environmental mastery, and social interaction.

Ziegler and Schwanen (2011) find that elderly's ability to walk confirms their independence and may add to their self-esteem. Likewise, in the case of children walking to school (Whitzman and Tranter 2012), independent walking gives the children a sense of autonomy and opportunity to choose their own activities and topics of conversation. Thus, walking may contribute to a sense of autonomy and mastery of the environment with positive subjective well-being effects. Yet, these effects are strongest for groups with potentially lower levels of autonomy due to parental supervision (youth) or physical limitations (elderly).

Research also provides evidence of walking as contributing to social ties. Ziegler and Schwanen (2011) report that elderly in small town settings, where many people know each other, use their daily walks to catch up with others and engage in social interaction. Likewise, walking is reported to be correlated with perceived neighborhood cohesion and trust (Du Toit et al. 2007; Sugiyama et al. 2008; Grannis 2009).

While in general walking and cycling are favorable travel modes, yielding the highest satisfaction, it is likely that environmental and personal factors moderate the satisfaction with these modes. In reviewing environmental factors that stimulate cycling, Heinen et al. (2010) mention urban form (with implications for trip distances), network layout, mixed land use, quality and safety of infrastructure (including traffic lights and crossings and surface quality), aesthetics of the landscape, hilliness, weather, and season. Other studies have identified environmental factors that stimulate walking (e.g. Saelens and Handy 2008; Rodríguez et al. 2008).

A notable distinction is made between transportation walking and recreational walking. In a meta-analysis, Saelens and Handy (2008) report that transportation walking positively correlates with higher densities and mixed land use. The reason may be that distances to destinations are shorter because higher densities and mixed land use are likely to bring destinations within walking distance. The effects of connectivity, presence of parks and safety are ambiguous, and no effects are found of infrastructure conditions, traffic conditions, aesthetics, or access to physical activity facilities. In contrast, Saelens and Handy (2008) found that recreational walking is influenced by pedestrian infrastructure and aesthetics, and limited evidence is found for the effects of mixed land use and personal safety. It may be supposed that the environmental characteristics that stimulate walking and cycling will also lead to higher levels of satisfaction when walking or cycling. However, this has been investigated only to a limited extent.

With respect to environmental factors, it is found that the duration of trips by slow modes has negative impacts on travel satisfaction (St-Louis et al. 2014), likely attributed to fatigue effects. St-Louis et al. (2014) also find that season effects play a role in satisfaction with slow modes. Both walking and cycling yield lower satisfaction in the Canadian cold, snowy season, with cyclists being affected the most. In terms of daily weather conditions, Böcker and Thorsson et al. (2014) find lower affect levels for pedestrians and cyclists under dark and shimmery conditions, with temperatures above 25 °C and rainy conditions. Ettema and Smajic (2015) find that the affective evaluation of walking trips is higher if the environment is more varied and lively. Also, walking with company leads to higher affective evaluation. Gatersleben and Uzzell (2007) indicate that experiences of danger and

inconveniences are main negative impacts on walking and cycling satisfaction. Such dangers and inconveniences arise from traffic, other people, or (lack of) provisions.

With respect to personal factors that influence the satisfaction with walking and cycling, St-Louis et al. (2014) report that (in the context of commuting) older people have a higher satisfaction with walking and cycling. However, similar evidence is found for car and public transport in the same and other studies (e.g., Böcker et al. 2014; Ettema et al. 2013). St-Louis et al. (2014) further report that men derive a higher satisfaction from walking. Böcker et al. (2014) report similar effects for walking and cycling. Apart from socio-demographic factors, positive attitudes influence their satisfaction with walking and cycling. Willis et al. (2013) report that those who choose to cycle for the intrinsic reason that they like cycling have the highest satisfaction. Manaugh and El-Geneidy (2013) report that among pedestrians, active environmentalists and those who choose walking for exercise report the highest satisfaction. A similar effect of the environmentalist attitude is reported by Böcker et al. (2014).

In summary, the literature suggests that using active travel modes results in higher travel satisfaction than using the car and, in particular, public transport. One explanation suggested is that active travel offers sufficient stimulation, without leading to overstimulation and stress, as occurs in car travel. Also, the physical activity involved may in itself lead to improved mood. In addition, interaction with the physical and social environment, and the sense of autonomy offered to children when walking may add to the explanation of higher satisfaction with active travel. Given the generally higher satisfaction with active travel modes, the satisfaction may depend on contextual factors, such as weather conditions, liveliness of the environment, travel company, and safety issues.

7.4 Travel Mode Change and Travel Satisfaction

Given the differences in satisfaction with different travel modes and the factors influencing satisfaction, a question emerges about how a change in travel mode may affect satisfaction with travel. This issue is relevant in the context of many policies implemented worldwide to persuade or force individuals to change their travel mode.

From a theoretical point of view, various factors are known to influence (in a more general sense) individuals' response to a change of circumstances. First, it has been found that travelers are reasonably capable of predicting the valence of their future affective response (i.e., if the outcome is experienced as good or bad), but much less capable of forecasting its intensity and duration (Pedersen et al. 2011). One reason for this forecasting bias (Wilson and Gilbert 2003) is that memory of previous experiences is used as a predictor of future experiences of a similar event and more intense experiences are more likely to be remembered. As a consequence,

predictions based on memory tend to overestimate the intensity of both positive and negative emotions.

Another factor explaining why people are bad at forecasting their affective response to an event is the focusing illusion (Schkade and Kahneman 1998). The illusion arises because individuals tend to focus on a limited set of factors related to the event, which may bias their expectation in a positive or negative direction. For instance, car drivers switching to public transport may focus on annoying factors, such as having to wait at the bus stop and fight for a seat, while overlooking the possibility of reading a newspaper on board. When experiencing the actual event, it will turn out that many other aspects influence satisfaction than what has been expected, thus possibly dampening the negative evaluation.

In addition, various factors influence satisfaction after the actual change. One factor is referred to as the hedonic treadmill effect (Loewenstein and Ubel 2008), implying that a change in satisfaction or affective response due to a change in circumstances will gradually diminish such that individuals return to the same base level of happiness as before the change. One cause of this effect is that individuals adjust their aspiration level, so that the difference between the outcome and the aspiration level is reduced, leading to a reduced positive or negative evaluation. However, Diener et al. (2006) report that depending on the context, the hedonic treadmill effect may be incomplete and individuals do not necessarily revert to their base level. A related mechanism is that of adaptation (Ubel et al. 2005), which implies that by looking for other sources of pleasure, individuals will actively seek to improve a setting that invokes negative responses. Lyubomirsky (2011) further note that attending to the new circumstances influences the positive or negative effects of a changed context. Over time, individuals will get used to the new context and attend less to it. As a result, the intensity of the emotional impact diminishes and the effect on well-being and mood is attenuated. This mechanism also explains why adaptation to positive changes occurs quicker than adaptation to negative changes. Schwarz and Xu (2011) describe how expected PA when driving a luxury car was significantly higher than the expected PA of driving a budget car. However, when asking actual drivers of luxury and budget cars, respectively, to report their affect during the last commute trip, no differences are observed. Attention given to the driving characteristics is likely to be much less than the attention given to daily hassles and the chores of the working day to come. Therefore, the drivers report much less experienced PA.

In summary, research suggests that due to memory distortions and the focusing illusion, travelers' expectation of the affect impacts of a mode change is likely to differ from their actual experience in terms of affect intensity. When actually making a change to another mode, it is suggested that the initial affective response may change when the new mode is used repeatedly. This may be due to changes in the aspiration level, lowered levels of attention, and mental adaptation processes. Finally, it should be noted that the affective response obviously depends on the direction of change (i.e., toward a more or less attractive setting). While the direction may be clear in many contexts (such as winning a lottery or becoming unemployed), it is less clear in the context of mode choice, where people have

individual preferences for a travel mode. Unfortunately, few studies have directly investigated affective response to mode change. We now review the few studies that have been reported.

Abou-Zeid et al. (2012) describe how a sample of 30 Swiss car commuters responded to a one-week switch to public transport. They asked participants to rate their satisfaction on a 5-point scale. Overall, lower satisfaction was reported for public transport than the car, which is consistent with the participants' initial car preference. Two additional findings emerged. First, those reporting a higher satisfaction with public transport were more likely to occasionally use this mode after the experiment. Second, participants' satisfaction with their car commute increased directly after switching. This may be due to an increased focus on the positive aspects of car use, invoked by their public transport use. After 4–5 months, however, their satisfaction with their car commute returned to the initial level, due to decreased attention. A replication of the experiment in the US (Abou-Zeid and Ben-Akiva 2012) mirrored the results, although with a more heterogeneous outcome. One group clearly reported a lower satisfaction with public transport use as compared to car use and returned to using their cars after the experiment. Another group reported higher satisfaction with public transport as compared to car commutes and remained commuting by public transport. The higher overall satisfaction of switchers and lower satisfaction of non-switchers were consistently mirrored in the rating of aspects, such as overall service, reliability, travel duration, convenience and comfort. In addition, it was found that the difference between switchers and non-switchers regarding their valuation of public transport and car characteristics became larger following the experiment. Apparently, using public transport served to strengthen participants' initial positive attitude toward the travel mode.

Pedersen et al. (2011) conducted an experiment in which car users agreed to switch to public transport for one month. Measures were made of their expected satisfaction, satisfaction during use of public transport and two years after the experiment. As in the US and Swiss experiments, participants reported a higher satisfaction with public transport during the experiment than their expectation prior to the experiment. Two years after, their memory of the satisfaction during public transport use had returned to, and was even slightly lower than, the expected satisfaction before the experiment. This suggests that travelers' perception of an alternative mode may be biased, even after having used the alternative with a positive outcome.

Finally, Martin et al. (2014) used longitudinal data to investigate how changes in commute mode from year to year correlate with changes in subjective well-being. Whereas previous studies investigated changes in the satisfaction of travel itself, Martin et al. (2014) discuss general implications for subjective well-being, which is potentially influenced by many more factors. They report that switching commute mode from car or public transport to walking or cycling is associated with higher subjective well-being. The authors propose an explanation related to the intrinsic enjoyment of physical activity, but they also note that the effects of travel on health may be associated with the higher subjective well-being. The latter would imply an indirect, rather than a direct, effect of travel. It is not clear from the report, whether a

shift in commute mode is related to other changes, such as a change of job, residential relocation, or a shorter commute, which in itself may affect subjective well-being.

In conclusion, scarce research provides first evidence of the existence of expectation and memory biases regarding the satisfaction of travel following a mode shift. This suggests that information and trial programs may serve to make travelers become familiar with a new travel mode and potentially reduce their misperceptions. Also, research suggests that responses to mode shifts are heterogeneous, given existing heterogeneity in travel preferences. Importantly, the online satisfaction (i.e., shortly after the switch) appears to be a significant predictor of sustained mode shift. There is also evidence that a travel mode shift may have implications for well-being at a more general level than the trip itself.

7.5 Societal Implications of Travel Mode Change

This chapter is based on the notion that travelers' experience of a travel mode change, in terms of the emotional response or subjective well-being, is an important indicator to evaluate the social benefits of the travel mode change. Obviously, however, a change of travel mode clearly has wider implications for individuals and society. First, at the level of the individual, a change of travel mode may not only affect the trip experience but may have implications on the level of time use and activity participation. A longer commute resulting from a switch from a car to public transport may limit the time available for other activities, such as recreation and social interaction, which may have negative impacts on subjective well-being, even if the trip itself evokes a positive emotional response. Also, a mode shift may have implications for the flexibility to change travel plans in the case of unforeseen events, again with implications for subjective well-being. On the other hand, it can increasingly be argued that travel may also offer the opportunity to engage in activities, such as reading or using ICT devices while on board public transport.

A second effect of mode change at the individual level, not directly captured by travel satisfaction, is the effect of travel on health. Positive health effects of physical activity when walking, cycling, or using public transport, and negative health effects of stress during car driving may impact physical well-being over and above the direct effect of travel satisfaction. In addition, different travel modes may, depending on the geographical setting, have different accident risks with different degrees of physical harm. Obviously, such health hazards pose a threat to both physical and subjective well-being.

Travel mode change has implications beyond the individual. Obvious examples include differences in the emissions of greenhouse gases, pollutants, and noise. In addition, changes in travel mode may contribute to a decreased claim on urban space needed for roads and parking places. Yet, sustainable travel modes, such as

walking or cycling, may also lay a significant claim on scarce urban space in specific settings. Finally, the health effects of a mode change not only accrue on the individual level, but also on the societal level in the form of reduced costs of the healthcare system.

7.6 Conclusion, Discussion, and Future Research Directions

In this chapter we have discussed how travel by different travel modes is primarily related to subjective well-being and is also related to health or physical well-being. Studies carried out in different geographic contexts consistently show that satisfaction with active travel modes is higher than travel by car and public transport, and that satisfaction with travel is lowest for different forms of public transport. These differences are explained by a variety of factors, which stem from fundamental differences between the travel modes in terms of the intensity of physical activity, mental involvement in the act of travel itself, exposure to and interaction with the vehicle and the wider travel surroundings and the degree of control over travel circumstances. Taken together, the overview suggests that active modes are an attractive alternative to car travel, provided that the travel distance is acceptable. Public transport can be a good alternative to car travel, if requirements of seat availability, accessibility, safety, and cleanliness are met. Also, travelers mostly appreciate rail transport more than the bus. Another attractive characteristic of public transport may be the opportunity to be involved in other activities while traveling.

Regarding the shift from one travel mode to another, limited information is available. Some evidence indicates that when switching to public transport, most car commuters experience lower satisfaction with travel by car. Yet, those who experience public transport more positively than the car are likely to keep using it. Other evidence suggests, however, that car commuters' experience of public transport is better than they anticipate, but that they tend to "forget" this after some time. Switchers from car to active travel, on average, report higher levels of subjective well-being after the switch.

In the context of policies that advocate a shift from car travel to public transport and active travel, the findings we reviewed have a number of implications. First, they suggest that heterogeneity exists in the evaluation of travel modes, such that some evaluate a switch to public transport to be positive whereas others experience it to be negative. At the same time, this suggests that not everyone uses the travel mode that provides the highest subjective well-being. As a consequence, policies that provide information about the implications of travel mode use or stimulate travelers to use alternative modes (e.g., via trial tickets) may lead to more travelers using the mode most beneficial for their subjective and physical well-being, which

would lead to social benefits. Second, the immediate effect of a forced mode change will often be negative as suggested by the finding that many switchers from car to public transport experience public transport to be negative, then become even more positive about car use. Although theories of hedonic adaptation suggest that the negative effects should diminish over time, additional research is needed to determine the pace and to what extent travelers over time will return to their original levels of travel satisfaction. In particular, we advocate for more longitudinal studies in which changes in travel satisfaction and overall subjective well-being are monitored in a period spanning from before the change to a considerable time after the change. Developments in travel satisfaction and well-being can then be understood from both the original and new travel context, from individuals' personal circumstances and their attitudes and value orientations. These types of studies would also provide interesting opportunities for testing the effects of interventions following the travel mode change, aimed at sustaining positive well-being effects, such as stimulating awareness of positive outcomes (e.g., Lyubomirsky 2011).

Finally, we note that while our review has focused on conventional travel modes such as the private car, public transport, cycling and walking, new forms of transportation are being developed. For instance, with car-sharing systems, more effort is needed to access to a car, and more uncertainty may arise with respect to the availability and waiting times. Also, cars in such systems may be less personalized in terms of the attributes on board. Automated vehicles also share the characteristics of conventional cars (privacy, door-to-door service), but differ importantly in terms of the mental effort and concentration needed, and the opportunity to be involved in other activities. E-bicycles that have started to penetrate the market differ from conventional bicycles in terms of required physical activity, speed, and possibly experienced safety. Such new forms of travel may lead to different outcomes of subjective well-being resulting from these different characteristics. More research will be needed to learn about the travel satisfaction derived from these new modes and may also help to optimize the design of the new forms of transportation. For certain newly introduced travel modes, such as e-bikes, electric vehicles and shared cars, empirical studies are already possible. While existing methods, such as the STS scale, are sufficient for measuring travel satisfaction with these modes, it is likely that additional explanatory variables need to be taken into account. For shared cars, issues such as wait times, ease of ordering, access time, and tidiness may be more important than for private cars, requiring studies of users' perception of them. For electric cars, driving characteristics, constraints stemming from charging time and limited charging stations, different noise level and range may be relevant issues. For e-bikes, the speed and safety experience could be relevant (especially for elderly), requiring more research into users' perceptions of them. Studies of satisfaction with these modes are feasible today, and would greatly enhance our insight into the effects of using these modes.

References

Abou-Zeid, M., & Ben-Akiva, M. (2012). Travel mode switching: Comparison of findings from two public transportation experiments. *Transport Policy, 24*, 48–59.

Abou-Zeid, M., Witter, R., Bierlaire, M., Kaufmann, V., & Ben-Akiva, M. (2012). Happiness and travel mode switching: Findings from a Swiss public transportation experiment. *Transport Policy, 19*, 93–104.

Ampt, E. S. (2004). Understanding voluntary travel behaviour change. *Transport Engineering in Australia, 9*, 53–66.

Axhausen, K., & Gärling, T. (1992). Activity-based approaches to travel analysis: Conceptual frameworks, models, and research problems. *Transport Reviews, 12*, 323–341.

Bamberg, S. (2014). Psychological contributions to the development of car use reduction interventions. In T. Gärling, D. Ettema, & M. Friman (Eds.), *Handbook of sustainable travel*. Dordrecht: Springer.

Böcker, L., & Thorsson, S. (2014). Integrated weather effects on cycling shares, frequencies, and durations in rotterdam, the Netherlands. Weather, climate, and society, *6*(4), 468–481.

Brownstone, D., & Small, K. A. (2005). Valuing time and reliability: Assessing the evidence from road pricing demonstrations. Transportation Research Part A: *Policy and Practice*, *39*(4), 279–293.

Busseri, M. A., & Sadava, S. W. (2011). A review of the tripartite structure of subjective well-being: Implications for conceptualization, operationalization, analysis, and synthesis. *Personality and Social Psychology Review, 15*, 290–314.

Byrne, B. (2010) *Structural equation modeling with AMOS. Basic concepts, applications and programming* (2nd ed.). Routledge, NY.

Brög, W., Erl, E., Ker, I., Ryle, J., & Wall, R. (2009). Evaluation of voluntary travel behaviour change: Experiences from three continents. *Transport Policy, 16*, 281–292.

Cao, J. (2013). The association between light rail transit and satisfactions with travel and life: Evidence from Twin cities. *Transportation, 40*, 921–933.

Carrasco, J. A., Miller, J. E., & Roorda, J. M. (2005). A tour-based model of travel mode choice. *Transportation, 32*, 399–422.

Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment, 49*, 71–75.

Diener, E., Sandvik, E., & Pavot, W. (1991). Happiness is the frequency, not the intensity, of positive versus negative affect. In F. Strack, M. Argyle, & N. Schwarz (Eds.), Subjective well-being: *An interdisciplinary perspective* (pp. 119–139). New York: Pergamon.

Diener, E., & Suh, E. (1997). Measuring quality of life: Economic, social, and subjective indicators. *Social Indicators Research, 40*, 189–216.

Diener, E., Suh, E. M., Lucas, R. E., & Smith, H. L. (1999). Subjective well-being: Three decades of progress. *Psychological Bulletin, 125*, 276–302.

Diener, E., Lucas, R. E., & Scollon, C. N. (2006). Beyond the hedonic treadmill: Revising the adaptation theory of well-being. *American Psychologist*, *61*(4), 305.

Dolan, P., Peasgood, T., & White, M. (2008). Do we really know what makes us happy: A review of the economic literature on the factors associated with subjective well-being. *Journal of Economic Psychology, 29*, 94–122.

Du Toit, L., Cerin, E., Leslie, E., & Owen, N. (2007). Does walking in the neighbourhood enhance local sociability?. Urban Studies, *44*, 1677–1695.

Ekkekakis, P., Backhouse, S. H., Gray, C., & Lind, E. (2008). Walking is popular among adults but is it pleasant? A framework for clarifying the link between walking and affect as illustrated in two studies, *Psychology of Sport and Exercise*, *9*, 246–264.

Ettema, D., & Smajic, I. (2015). Walking, places and wellbeing. *The Geographical Journal*, *181* (2), 102–109.

Ettema, D., Friman, M., Gärling, T., Olsson, L. E., & Fujii, S. (2012). How in-vehicle activities affect work commuters' satisfaction with public transport. *Journal of Transport Geography, 24*, 215–222.

Ettema, D., Gärling, T., Eriksson, L., Friman, M., Olsson, L. E., & Fujii, S. (2011). Satisfaction with travel and subjective wellbeing: Development and tests of a measurement tool. *Transportation Research Part F, 14*, 167–175.

Ettema, D., Gärling, T., Olsson, L. E., & Friman, M. (2010). Out-of-home activities, daily travel, and subjective well-being. *Transportation Research Part A: Policy and Practice, 44*, 723–732.

Ettema, D., Gärling, T., Olsson, L. E., Friman, M., & Moerdijk, S. (2013). The road to happiness: Measuring Dutch car drivers' satisfaction with travel. *Transport Policy, 27*, 171–178.

Ettema, D., & Timmermans, H. J. P. (Eds.). (1997). *Activity-based approaches to travel analysis*. Oxford: Elsevier Science Ltd.

Eurostat (2012). *Europe in figures*. Luxembourg: Publications Office of the European Union.

Fellesson, M., & Friman, M. (2008). Perceived satisfaction with public transport services in nine European cities. *Journal of Transportation Research Forum, 47*, 93–103.

Friman, M., Fujii, S., Ettema, D., Gärling, T., & Olsson, L. E. (2013). Psychometric analysis of the satisfaction with travel scale. *Transportation Research Part A, 48*, 132–145.

Gatersleben, B. (2014). *Our handbook.*

Gatersleben, B. (2007). Affective and symbolic aspects of car use.

Gatersleben, B., & Uzzell, D. (2007). Affective appraisals of the daily commute: Comparing perceptions of drivers, cyclists, walkers and users of public transport. *Environment and behavior, 39*, 416–431.

Grannis R (2009), From the ground up. Translating Geography into Community through neighbor networks, Princeton University Press.

Hartig, T. (2007). Congruence and conflict between car transportation and psychological restoration. In T. Gärling & L. Steg (Eds.), *Threats from car traffic to the quality of urban life: Problems, causes, and solutions* (pp. 103–122). Amsterdam, The Netherlands: Elsevier.

Heinen, E., Van Wee, B., & Maat, K. (2010). Commuting by bicycle: An overview of the literature. *Transport Reviews: A Transnational Transdisciplinary Journal*, *30*, 59–96.

Hensher, D. A. (2000). Urban public transport challenges. *The Drawing Board: An Australian Review of Public Affairs, 1*, 47–62.

Hess, S., Daly, A., Rohr, C., & Hyman, G. (2007). On the development of time period and mode choice models for use in large scale modelling forecasting systems. *Transportation Research A: Policy and Practice, 41*, 802–826.

Housholds National Travel Survey. (2013). Statistics South Africa. P0320. Pretoria: South Africa.

Jain, J., & Lyons, G. (2008). The gift of travel time. *Journal of Transport Geography*, *16*(2), 81–89.

Jakobsson Bergstad, C., Gamble, A., Hagman, O., Polk, M., Gärling, T., Ettema, D., et al. (2012). Influences on subjective well-being of affect associated with routine out-of-home activities. *Applied Research in Quality of Life*, *7*, 49–62.

Jakobsson Bergstad, C., Gamble, A., Hagman, O., Polk, M., & Gärling, T. (2011). Affective-symbolic and instrumental-independence psychological motives mediating effects of socio-demographic variables on daily car use. *Journal of Transport Geography*, *19*, 33–38.

Jakobsson, C. (2007). Instrumental motives for private car use. In T. Gärling & L. Steg (Eds.), Threats from car traffic to the quality of urban life: Problems, causes, and solutions (pp. 205–217). Amsterdam, The Netherlands: Elsevier.

Kahneman, D., & Krueger, A. B. (2006). Developments in the measurement of subjective well-being. *Journal of Economic Perspectives*, *20*, 3–24.

Kahneman, D. (1999). Objective happiness. In D. Kahneman, E. Diener & N. Schwarz (Eds.), *Well-being: The foundations of hedonic psychology* (pp. 3–25). New York: Russell Sage Foundation.

Kahneman, D. (2000a). Evaluation by moments: Past and future. In D. Kahneman & A. Tversky (Eds.), *Choices, values, and frames* (pp. 693–708). New York: Cambridge University Press.

Kahneman, D. (2000b). Experienced utility and objective happiness: A moment-based approach. In D. Kahneman & A. Tversky (Eds.), *Choices, values and frames* (pp. 673–692). New York: Cambridge University Press.

Kahneman, D., & Deaton, A. (2010). High income improves evaluation of life but not emotional well-being. *Proceedings of the National Academy of Sciences, 107*(38), 16489–16493.

Kahneman, D., & Sugden, R. (2005). Experienced utility as a standard of policy evaluation. *Environmental and Resource Economics, 32*, 161–181.

Kahneman, D., Krueger, A. B., Schkade, D., Schwarz, N., & Stone, A. (2004). A survey method for characterizing daily life experience: The day reconstruction method (DRM). *Science, 306*, 1776–1780.

Kahneman, D., Wakker, P., & Sarin, R. (1997). Back to Bentham? Explorations of experienced utility. *Quarterly Journal of Economics, 112*, 375–405.

Kent, J. L. (2014). Still Feeling the Car–The Role of Comfort in Sustaining Private Car Use, *Mobilities*, 1–22.

Krueger, A. B., &Schkade, D. A. (2008). The reliability of subjective well-being measures. *Journal of Public Economics 92*, 1833–1845.

Kuppens, P., Tuerlinckx, F., Russell, J. A., & Barrett, L. F. (2013). The relation between valence and arousal in subjective experience. *Psychological Bulletin, 139*, 917–940.

Leyden, K. M., Goldberg, A., & Michelbach, P. (2011). Understanding the pursuit of happiness in ten major cities. *Urban Affairs Review, 47*, 861–888.

Loewenstein, L., & Ubel, P. A. (2008). Hedonic adaptation and the role of decision andexperience utility in public policy. *Journal of Public Economics, 92*, 1795–1810.

Lyubomirsky, S. (2011). Hedonic adaptation to positive and negative experiences. In S. Folkman (Ed.), *The Oxford handbook of stress, health, and coping* (pp. 200–226). New York: Oxford University Press.

Manaugh, K., & El-Geneidy, A. (2013). Does distance matter? Exploring the links among values, motivations and satisfaction in walking trips. *Transportation Research Part A: Policy and Practice, 50*, 198–208.

Martin, A., Goryakin, Y., & Suhrcke, M. (2014). Does active commuting improve psychological wellbeing? Longitudinal evidence from eighteen waves of the British Household Panel Survey. *Preventive Medicine,* Available online August 23, 2014.

McFadden, D. (2001). Disaggregate behavioral travel demand's RUM side—a 30 years retrospective. In D. A. Hensher (Ed.), *Travel behavior research* (pp. 17–63). Amsterdam: Elsevier.

McMahon, D. M. (2008). The pursuit of happiness in history. In M. Eid & R. J. Larsen (Eds.), *The science of subjective well-being* (pp. 80–93). New York: Guildford Press.

Mees, P. (2010). *Transport for suburbia: Beyond the automobile age*. London: Earthscan.

Mokhtarian, P. L., (2005). Travel as a desired end, not just a means. Transportation Research Part A: *Policy and Practice*, *39*(2), 93–96.

Mokhtarian, P. L., & Salomon, I. (2001). How derived is the demand for travel? Some conceptual and measurement considerations. *Transportation Research Part A: Policy and Practice, 35*, 695–719.

Mokhtarian, P. L., Salomon, I., & Redmond, L. S. (2001). Understanding the demand for travel: It's not purely 'derived'. *Innovation, 14*, 355–380.

Newman, P., & Kenworthy, J. (1999). *Sustainability and cities: Overcoming automobile dependence*. US: Island Press.

Newman, J. P., & Bernardin, L. V. (2010). Hierarchical ordering of nests in a joint mode and destination choice model. *Transportation, 37*, 677–688.

Novaco, R. W., & Gonzales, O. I. (2009). Commuting and well-being. In Y. Amichai-Hamburger (Ed.), *Technology and well-being* (pp. 174–205). New York: Cambridge University Press.

Novaco, R. W., Stokols, D., & Milanesi, L. (1990). Objective and subjective dimensions of travel impedance as determinants of commuting stress. *American Journal of Community Psychology, 18*, 231–257.

Olsson, L. E., Gärling, T., Ettema, D., Fujii, S., Lekedal, H., & Friman, M. (2011). *Relationship between satisfaction with daily travel and subjective well-being in three urban areas in Sweden: Description of survey questionnaire, sample characteristics, and preliminary results*. Karlstad University Studies, 2011:23, Karlstad, Sweden.

Olsson, L. E., Gärling, T., Ettema, D., Friman, M., & Fujii, S. (2013). Happiness and satisfaction with work commute. *Social Indicators Research, 111*(1), 255–263.

Ory, D. T., & Mokhtarian, P. L. (2005). When is Getting there Half the Fun? Modeling the Liking for Travel. *Transportation Research Part A*, *39*, 97–123.

Pavot, W., & Diener, E. (1993). Review of the satisfaction with life scale. *Psychological Assessment, 5*, 164–172.

Pedersen, T., Friman, M., & Kristensson, P. (2011). Affective forecasting: Predicting and experiencing satisfaction with public transportation. *Journal of Applied Social Psychology, 41* (8), 1926–1946.

Pucher, J., & Kurth, C. (1996). Verkehrsverbund: The success of regional public transport in Germany, Austria and Switzerland. *Transport Policy*, *2*, 279–291.

Rapino, M. A., & Field, A. K. (2012). *Mega commuting in the U.S. Time and distance in defining long commutes using the 2006-2010 American Community Survey*. Poster presented at the Presented at the Association for Public Policy Analysis and Management (APPAM) Fall Conference, Baltimore, MD, November 8–10, 2012.

Redman, L., Friman, M., Gärling, T., & Hartig, T. (2013). Quality attributes of public transport that attract car users. *Transport Policy, 25*, 119–127.

Richter, J., Friman, M., & Gärling, T. (2011). Soft transport policy measures: Gaps of knowledge and research needs. *International Journal of Sustainable Transportation, 5*, 199–215.

Rissel, C., Curac, N., Greenaway, M., & Bauman, A. (2012). Physical activity associated with public transport use—a review and modelling of potential benefits. *International Journal of Environmental Research and Public Health, 9*, 2454–2478.

Rodríguez, D.A., S. Aytur., A. Forsyth et al. (2008), Relation of modifiable neighborhood attributes to walking. *Preventive medicine 47*(3), pp.260–264.

Russell, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology, 39*, 1161–1178.

Russell, J. A. (2003). Core affect and the psychological construction of emotion. *Psychological Review, 110*, 145–172.

Saelens, B.E., & Handy, S.L. (2008), Built environment correlates of walking: A review. *Medicine and science in sports and exercise*, *40*(7 SUPPL.1), pp.S550–S566.

Schkade, D. A., & Kahneman, D. (1998). Does living in California make people happy? A focusing illusion in judgments of life satisfaction. *Psychological Science, 9*, 340–346.

Schwartz, N., Kahneman, D., & Xu, J. (2009). Global and episodic reports of hedonic experience. In R. Belli, F. Stafford & D. Alwin (eds.), *Calendar and Diary Methods in Life Course Research*, (pp. 156–176). Thousand Oaks, CA: Sage.

Schwarz, N., & Xu, J. (2011). Why don't we learn from poor choices? The consistency of expectation, choice, and memory clouds the lessons of experience. *Journal of Consumer Psychology*, *21*(2), 142–145.

UITP database. (2012). Statistics brief—World metro figures. Retrieved September 22, 2014.

Schimmack, U. (2008). The structure of subjective well-being. In M. Eid & R. J. Larsen (Eds.), *The science of subjective well-being* (pp. 97–123). New York: Guilford Press.

St-Louis, E., Manaugh, K., van Lierop, D., & El-Geneidy, A. (2014). The happy commuter: A comparison of commuter satisfaction across modes. *Transportation Research Part F, 26*, 160–170.

Steg, L. (2005). Car use: lust and must. Instrumental, symbolic and affective motives for car use. *Transportation Research Part A: Policy and Practice*, *39*(2), 147–162.

Stone, A. A., Shiffman, S. S., & DeVries, M. W. (1999). Ecological momentary assessment. In D. Kahneman, E. Diener, & N. Schwarz (Eds.), *Well-being: The foundations of hedonic psychology* (pp. 26–39). New York: Russell-Sage.

Sugiyama, T., Leslie, E., Giles-Corti, B., Owen, N. (2008). Associations of neighbourhood greenness with physical and mental health: Do walking, social coherence and local social interaction explain the relationships?. *Journal of Epidemiology and Community Health*, *62*, 1–6.

Suzuki, H., Fujii, S., Gärling, T., Ettema, D., Olsson, L. E., & Friman, M. (2014). Rules for aggregating satisfaction with stages of work commute. *Transportation, 41*, 495–506.

Ubel, P. A., Loewenstein, G., & Jepson, C. (2005). Disability and sunshine: Can hedonic predictions be improved by drawing attention to focusing illusion or emotional adaptation? *Journal of Experimental Psychology: Applied, 11*, 111–123.

Västfjäll, D., Friman, M., Gärling, T., & Kleiner, M. (2002). The measurement of core affect: A Swedish self-report measure. *Scandinavian Journal of Psychology, 43*, 19–31.

Västfjäll, D., & Gärling, T. (2007). Validation of a Swedish short self-report measure of core affect. *Scandinavian Journal of Psychology, 48*, 233–238.

Veenhoven, R. (1984). *Conditions of happiness*. Boston: Reidel.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS Scales. *Journal of Personality and Social Psychology, 47*, 1063–1070.

Wen, L. M., & Rissel, C. (2008). Inverse associations between cycling to work, public transport, and overweight and obesity: Findings from a population based study in Australia. *Preventive Medicine, 46*, 29–32.

Whitzman, C., Tranter, P. J. (2012), Children's independent mobility and active travel: The relative influence of social, built and policy environments, paper presented in AAG Annual Meeting, February 2012, New York.

Willis, D., Manaugh, K., & El-Geneidy, A. (2013). Uniquely satisfied: Exploring cyclists trip satisfaction. *Transportation Research Part F: Traffic Psychology and Behaviour, 18*, 136–147.

Wilson, T. D., & Gilbert, D. T. (2003). Affective forecasting. *Advances in Experimental Social Psychology, 35*, 345–411.

Yik, M., Russell, J. A., & Steiger, J. H. (2011). A 12-point circumplex structure of core affect. *Emotion, 11*, 705–731.

Ziegler, F., Schwanen, T. (2011), 'I like to go out to be energized by different people': An exploratory analysis of mobility and wellbeing in later life. *Ageing and Society*, *31*, 758–781.