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1 Introduction

1.1 Objective

This paper, which is part of the MIT-Portugal working paper series, describes a study that has been conducted to measure travel well-being and explore its relationship with travel behavior modification from car to public transportation. While this study does not technically fall within the work packages of the SCUSSE project, it is closely related to the overall objectives of SCUSSE which is concerned with modeling new transportation modes and services for increased sustainability and efficiency.

1.2 Traffic Congestion and Mitigation Efforts

Traffic congestion has been a problem facing urban commuters for several decades. The economic inefficiencies due to congestion are manifested in the form of extended travel delays, wasted fuel, and air pollution. It is estimated that in 2003 the average annual delay per peak traveler in the United States was 47 hours, resulting in a total delay of 3.7 billion hours at a total cost of more than $63 billion (Schrank and Lomax, 2005). Moreover, about 51% of carbon monoxide and 34% of nitrogen oxides in the air are attributed to on-road mobile sources (Environmental Protection Agency, 2007).

These inefficiencies have led communities worldwide to devise measures that aim at congestion mitigation. While traditional measures have initially focused on increasing roadway capacity to accommodate travel demand, more recent congestion mitigation strategies aim at modifying travel behavior, such as reducing auto use or shifting it to less congested periods of the day, to match the demand to the existing supply. Examples of these policies include road and parking pricing, flexible work schedules, telecommuting, improved public transportation services, awareness and education campaigns, and temporary incentives to try public transportation.

Public transportation advocates, driven by a general concern for building sustainable transportation systems which promote travelers' well-being (O'Brien, 2005; O'Brien, 2003; Salvucci, 2005), have developed policies to encourage the use of public transportation and non-motorized means of travel. In fact, sustainability and well-being (or happiness) are so closely linked that governments have also started to build them into their public policies. For example, in Bogota, former mayor Enrique Peñalosa, through his "politics of happiness", stressed the importance of planning sustainable cities and created a new mass transit system, additional pedestrian streets and bikeways, and policies such as car-free days (Project for Public Spaces, 2008). The Kingdom of Bhutan has introduced the concept of Gross National Happiness which holds priority over economic growth and is closely linked to the promotion of long-term sustainable development (Planning Commission, Royal Government of Bhutan).

1.3 Habitual Behavior and Travel Behavior Modification

Despite these efforts to reduce auto use, "the love affair with the automobile" is a well known phenomenon in the United States as well as in many other countries. The level of car use is related to a host of symbolic and affective motives such as the comfort, convenience, freedom, and status that the car provides (Steg, 2005). In addition, frequent

car drivers often hold negative theories about other transportation options, particularly public transportation, for various reasons such as inadequacy of information or unpleasant past experience. For example, Fujii et al. (2001) found that frequent car drivers tend to overestimate the commute time by public transportation. These factors, along with the repetitive nature of travel mode choice decisions which reinforces the habit of using the car (Verplanken et al., 1994), hamper efforts aimed at travel behavior modification from car to public transportation. A key factor then to travel behavior modification is to disrupt the habit of car use by inducing people to try out alternative means. The psychological interpretation is that once a habit is interrupted, the behavior becomes more deliberate and may then be more strongly influenced by reason-based factors such as intentions, attitudes (Ajzen, 1985, 1991), or norms (Schwartz, 1977; Schwartz and Howard, 1981) as opposed to habit.

Various methods to influence behavior have been attempted, including communication/deliberation, commitments, and incentives, and have been found to be relatively effective in changing behavior. For example, Fujii et al. (2001) studied the effect of a temporary freeway closure on mode switching and perceptions and found that the temporary change was effective in increasing public transportation use substantially by drivers during the closure as well as correcting their misperceptions of travel time by public transportation. A follow-up survey (Fujii and Gärling, 2003) indicated that those who temporarily used public transportation during the closure continued to use it more frequently one year later than those who did not use public transportation during the closure. Fujii and Kitamura (2003) offered an experimental group of students a one-month free bus ticket and observed an improvement in attitude, a stronger habit, and a higher frequency of public transportation use during the treatment. These changes were sustained to some extent one month after the treatment.

1.4 Well-Being and Behavior

Despite the insights gained from these studies about the effectiveness of temporary interventions in inducing behavioral change, one important limitation is that they do not account for travelers' well-being and its relationship with travel choices. Moreover, travel choices have traditionally been modeled using the concept of generalized cost. We postulate, however, that travel choices are more likely to be motivated by a broader goal of maintaining and enhancing travel well-being. For example, a habitual car driver who is unhappy with his/her public transportation experience will be unlikely to change his/her commuting behavior.

To our knowledge, the link between happiness and behavior has not been studied in the transportation field (with the exception of a recent exploratory mode choice study, see Duarte et al. (2007)). However, empirical studies in other domains lend support to the hypothesis of well-being as a driver of behavior. For example, subjects in laboratory experiments undergoing colonoscopy (Redelmeier et al., 2003) or immersing hands in cold water (Kahneman et al., 1993) selected to repeat experiments which they remembered as less painful than others, and students chose to repeat vacations for which they held positive retrospective affective memories (Wirtz et al., 2003).

A better understanding of travel well-being will therefore lead to a more accurate depiction of people's travel choices. This is particularly relevant for quantifying the choices that people make when faced with transportation policies or incentives aiming at changing their behavior.

1.5 Organization

The remainder of this paper is organized as follows. Section 2 describes studies that have measured travel well-being. It provides a review of those studies and motivates the need for enhanced measures of travel well-being. Section 3 describes the design and implementation of a field experiment that we conducted to measure travel well-being in the context of mode switching from car to public transportation. Section 4 presents descriptive analyses from a small scale implementation of this experiment in Switzerland. Section 5 concludes the paper.

2 The Measurement of Travel Well-Being

2.1 A Review

Efforts to measure well-being in the travel domain have focused for the most part on the measurement of commuting stress and its determinants through both self-reported and physiological measures. With self-reported measures, respondents are asked to provide their cognitive evaluations and/or affective reactions to their travel experiences by rating satisfaction and attitudinal statements on a given scale (Hennessy and Wiesenthal, 1997; Kluger, 1998; Lucas and Heady, 2002; Novaco et al., 1990; Van Rooy, 2006). A number of physiological measures of commuting stress have been used, including the analysis of adrenaline excretion based on urine specimens (Singer et al., 1978), blood pressure and heart / pulse rate (Schaeffer et al., 1988), salivary cortisol (Wener et al., 2003), electrocardiogram, electromyogram, skin conductance, and respiration (Healey and Picard, 2005). Some researchers (Schaeffer et al., 1988; Wener et al., 2003) have also assessed performance on behavioral tasks, such as proofreading, as additional measures of stress.

More recently, travel liking (Ory and Mokhtarian, 2005) and travel happiness (Duarte et al., 2007) have been measured using self-reported methods. A travel well-being survey that we conducted (Abou-Zeid and Ben-Akiva, 2007) measured commuting satisfaction as well as a host of affective reactions including stress, enjoyment, anxiety, etc.

A number of factors have been found to affect travel well-being, including subjective and objective impedance, social comparison to others, perceived control (such as availability of choices, variability, predictability), personality (such as feelings of time urgency, trait stress), overall well-being, attitudes towards travel, travel time use, and various socio-economic characteristics.

Most of the above studies have been conducted in a cross-sectional setting except for a few studies where measures of stress have been collected over a few days (Schaeffer et

al., 1988; Singer et al., 1978) or before and after a change in transportation level of service (Wener et al., 2003).

2.2 Accounting for Routine Situations: Study Hypothesis

The cross-sectional measurement of travel well-being established evidence for correlations among happiness and behavior. However, we postulate that when people are in a routine, they don't engage in a cognitive process of evaluating their travel happiness. Only when people evaluate their options and reconsider their decisions will they think of their travel happiness. An example would be when changes take place in people's lives (such as a change in job or residence) or in the transportation system (such as new infrastructure or policies). Thus, the key to elicit people's travel happiness is to measure it as they reconsider their travel decisions following, for example, a travel-related change in their lives. Such a measure of travel happiness would be more relevant for situations involving decision-making.

The main objective of this paper is to develop and test an approach for measuring travel well-being that accounts for the routine nature of travel. We test our hypothesis in a mode choice context through an experiment inducing a temporary change in behavior from car to public transportation to disrupt the travel habit and cause travelers to carefully consider their options following the intervention. Through this direct experience with an alternative non-habitual mode, people would confirm or update their perceptions about public transportation and would consequently re-evaluate their mode choice for their daily commute. The next sections describe the design, implementation, and analysis of this experiment.

3 Experiment Design and Implementation

3.1 Design

This section describes an experiment we conducted aiming at collecting travel well-being measures that account for the routine nature of travel. This experiment consists of three phases: pre-treatment, treatment, and post-treatment, where treatment refers to the required use of public transportation for 2-3 days in a certain week.

In the pre-treatment phase, potential recruits are interviewed to determine their eligibility to participate and to collect their socio-economic and demographic characteristics. Eligibility conditions entail being a habitual car commuter and having public transportation available to the place of residence and work. Eligible individuals who agree to participate fill out a questionnaire about their travel happiness and perceptions and attitudes towards car and public transportation. They also fill out a daily travel pre-treatment diary intended to measure their baseline travel behavior.

In the treatment phase, participants are required to commute by public transportation for at least 2-3 days in a given week. As an incentive, they are given a free public transportation pass that is valid throughout the treatment period. This type of treatment therefore combines a commitment device (see, for example, Bachman and Katzev, 1982;

Matthies et al., 2006) with an incentive (see, for example, Abou-Zeid et al., 2008; Everett et al., 1974; Foxx and Hake, 1977; Fujii and Gärling, 2003; Fujii et al., 2001; Fujii and Kitamura, 2003). Participants continue to fill out the daily travel diaries during the treatment period.

In the post-treatment phase, participants are no longer required to commute by public transportation. At the beginning of this phase, they fill out the same questionnaire they had filled out in the pre-treatment phase, with a few additional questions related to their public transportation experience (satisfaction, difference from expectations, attributes, etc.) and their current commute mode. The purpose of this questionnaire is to measure the changes in participants' travel happiness, perceptions, attitudes, plans, and mode choice. For a certain period during this phase, participants continue to fill out the daily travel diaries. A follow-up survey is conducted a few months later to collect data on their travel happiness and usage of public transportation.

3.2 Implementation

This experiment was conducted at three employment centers in Switzerland (Geneva airport, Université de Lausanne (UNIL), and Ecole Polytechnique Fédérale de Lausanne (EPFL)) from May to July 2008 and at the Massachusetts Institute of Technology (MIT) from September to October 2008. The remainder of this paper focuses on the Swiss study. The MIT study is currently being analyzed, and results will be described in future publications by the authors.

The Swiss experiment included 30 self-selected individuals who participated during three weeks: a 1-week pre-treatment period, a 1-week treatment period, and a 1-week post-treatment period, in addition to an initial telephone interview and questionnaire and a follow-up survey. Participants were recruited via emails sent to all employees of Geneva airport and to employees with parking permits at UNIL and EPFL. Participants were given a free public transportation pass that was valid for two weeks or for a month starting from the second week of the experiment. No control group was used since the number of volunteers was small. The next section describes the findings from the Swiss study.

4 Swiss Experiment Analysis

4.1 Sample

About half of the participants were male. The majority of participants were between 30 and 60 years old, with an average age of 43 years. The average household size was 3.1, and all participants had 2 or more cars in the household.

All participants were not accustomed to commuting by public transportation. Out of 30 participants, 7 participants have never commuted by public transportation to their current workplace; 9 participants have used it more than one year before the study; 10 participants have used it 3 months or more before the study; and 4 have used it a few weeks before the study.

4.2 Commute Satisfaction

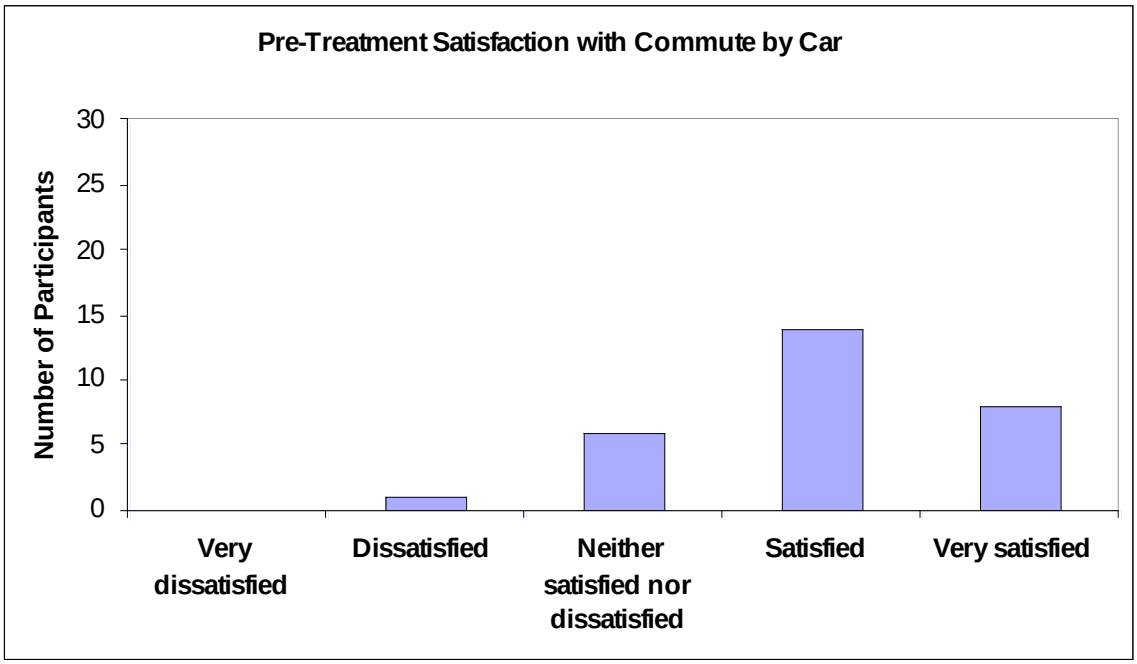
4.2.1 Car Satisfaction

Prior to the experiment, participants rated their satisfaction with the commute by car on a 5-point scale anchored by "Very dissatisfied" to "Very satisfied", as a response to the following question:

"Taking all things together, how satisfied are you with your commute by car between your residence and EPFL/UNIL/Geneva airport?"

Figure 1 shows the distribution of responses. Most participants are satisfied or very satisfied with their commute by car.

Figure 1. Distribution of participants' pre-treatment satisfaction with their commute by car (N=29).



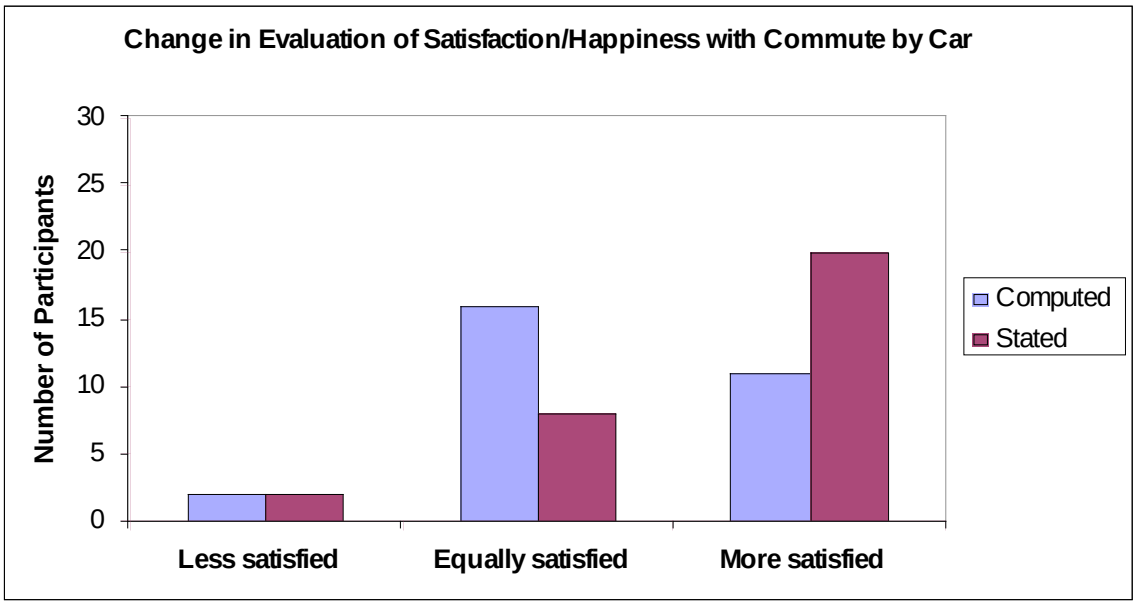
After trying public transportation, participants answered the same question about satisfaction with the commute by car. In addition, they rated the change in their happiness with using car on a 5-point scale anchored by "Less happy" to "Happier", as a response to the following question:

"After your experience during this study, how do you feel about your decision to use the car for commuting to work?"

Therefore, two measures of the change in happiness ratings were collected. The first one (termed "Computed" in Figure 2) is the difference between the two satisfaction ratings they gave (before and after the public transportation usage), and the second one (termed "Stated" in Figure 2) is a stated indicator of the change. Both measures indicate that, for many participants, the reported level of happiness with using the car changed after the

experiment and mostly in a positive direction, as shown in Figure 2. Moreover, the change in ratings was statistically significant. These statistics confirm the hypothesis that the travel happiness measure collected in a cross-sectional setting is different from that collected after people evaluate their options.

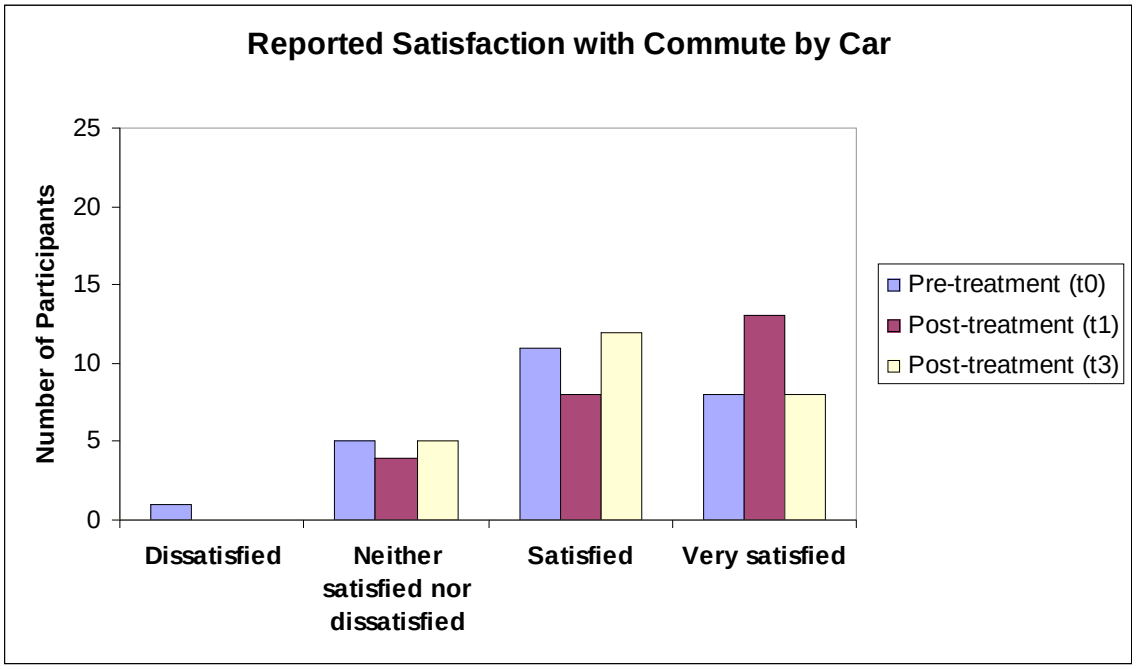
Figure 2. Distribution of the change in participants' satisfaction/happiness with their commute by car. (N=29 for computed measure; N=30 for stated measure).



Moreover, participants reported their satisfaction with their commute by car several months after the experiment. Figure 3 shows the distribution of responses at three points in time: pre-treatment (t_0), right after the treatment (t_1), and several months after the treatment (t_3).

The self-reported satisfaction ratings follow a treadmill pattern where the increase in satisfaction with car right after the experiment levels off a few months later. Various hypotheses explaining this treadmill effect will be explored in subsequent stages of this research.

Figure 3. Distribution of participants' satisfaction with their commute by car at different time periods. (N=25).



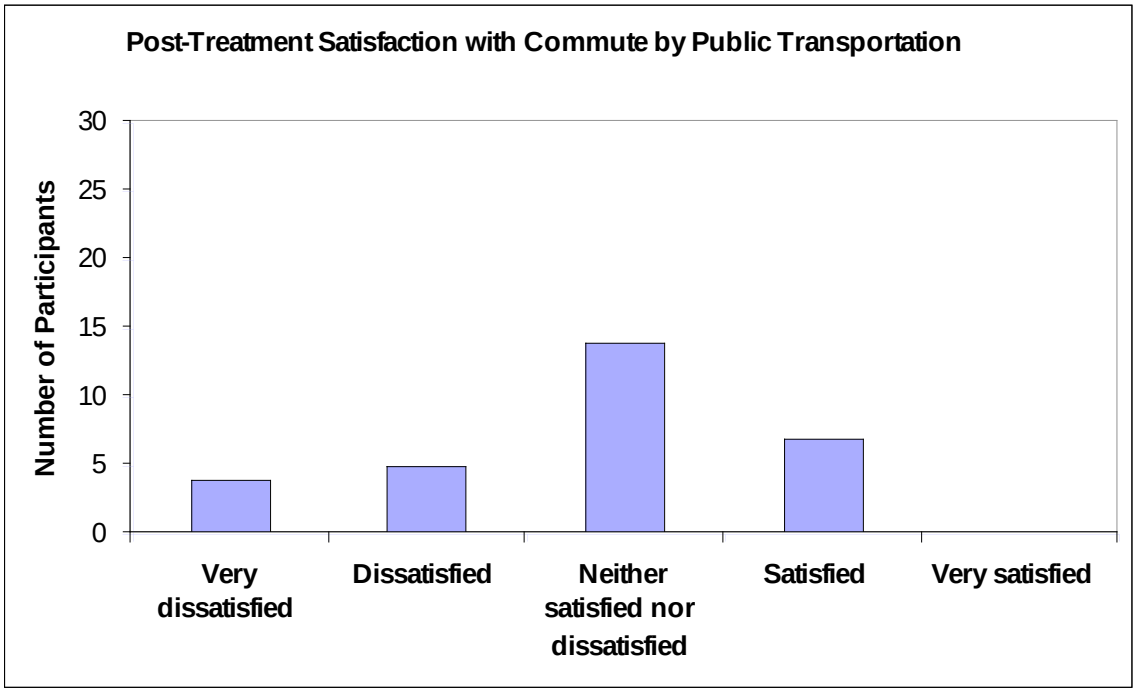
4.2.2 Public Transportation Satisfaction

Participants also rated their satisfaction with public transportation after trying it by answering the following question using a 5-point scale anchored by "Very dissatisfied" to "Very satisfied":

"Taking all things together, how satisfied were you with your commute by public transportation between your residence and EPFL/UNIL/Geneva airport during this study?"

Figure 4 shows the distribution of responses. The majority of participants were neither satisfied nor dissatisfied, but there were slightly more dissatisfied than satisfied commuters.

Figure 4. Distribution of participants' post-treatment satisfaction with their commute by public transportation (N=30).



4.3 Perceptions and Attitudes

Participants rated their perceptions and attitudes towards car and public transportation in the pre-treatment and post-treatment periods. They rated on a 5-point scale anchored by "Strongly disagree" to "Strongly agree" their level of agreement with statements (in the context of their commute) such as:

Perception of reliability: *"I can count on the car (public transportation) to get me to work on time."*
Perception of cost: *"Using the car (public transportation) does not cost much."*
Perception of comfort: "*The car (public transportation) is comfortable."*
Attitude towards transfers: "*I wouldn't mind having to make a transfer when using public transportation."*

Overall, a change in ratings of perceptions and attitudes is observed for both car and public transportation. For car, the change might for instance reflect a change in the frame of reference. For public transportation, the change might be due to prior misperceptions that were corrected once information was gained through direct experience. Table 1 shows the distribution of the change in participants' perception ratings of public transportation. For all aspects of service, there is a fraction of participants that changed their perception ratings. Although most participants provided higher perception ratings of the overall service and certain aspects of it (such as reliability), several others provided lower perception ratings especially of travel time. It must be noted that commuting by

public transportation wasn't convenient to many participants, especially for Geneva airport employees, and in all cases involved longer travel time than car. In fact, in the case of Geneva airport, parking permits are granted only to employees who have difficult public transportation connections or have work schedules that fall outside the hours of operation of public transportation.

Table 1. Distribution of the change in participants' perception ratings of public transportation (N =30 for perceptions other than comfort; N=29 for comfort).

Perception	Worse Perception	Same Perception	Better Perception
Overall service	8	9	13
Travel time	9	16	5
Reliability	6	12	12
Flexibility	5	20	5
Comfort	7	14	8
Cost	5	18	7

4.4 Mode Switching

Since this experiment does not involve a control group, every participant's pre-treatment data are used as his/her control. In the first week of the experiment, none of the participants commuted by public transportation. Following the intervention, 10 out of 30 participants commuted by public transportation at least once during the third week of the experiment (when the public transportation pass was still valid but participants were not required to use it anymore), and 12 out of 30 participants indicated that it is likely that they will commute by public transportation in the future.

Moreover, of the 25 participants who were contacted several months after the expiration of the public transportation pass, 5 participants indicated that after the expiration of the pass they commuted by public transportation at a rate higher than that before the intervention. This suggests that the intervention is effective in inducing behavioral modification for a fraction of the participants or at least in having them consider public transportation as part of their choice set for the commute mode.

As to the correlation between satisfaction with public transportation and post-treatment usage of public transportation (in the third week of the experiment), Table 2 shows the average satisfaction (where 1 denotes "very dissatisfied" and 5 denotes "very satisfied") and the proportion of participants who were dissatisfied with their experience. This is shown separately for participants who used public transportation post treatment and those who didn't, as well as for those who indicated that it is likely that they will commute by public transportation in the future and those who indicated that it is unlikely. As expected, the average satisfaction is greater among participants who used public transportation post-treatment or indicated that it is likely that they will use it in the future. Moreover, the proportion of dissatisfied participants is greater among those who didn't use public transportation post-treatment or indicated that it is unlikely that they will use it in the future.

Table 2. Distribution of participants' satisfaction with public transportation and post-treatment (in week 3) usage of public transportation (PT). (N=30)

	Didn't use PT post treatment	Used PT post treatment	Unlikely to use PT in future	Likely to use PT in future
Average PT satisfaction	2.5	3.4	2.4	3.3
Proportion dissatisfied	0.40	0.10	0.44	0.17

5 Conclusion

We presented a new approach to measure travel well-being. We postulated that due to the routine nature of travel, people don't fully consider their travel happiness unless they evaluate their options as they reconsider their travel decisions. To test this hypothesis, we conducted experiments in Switzerland and in Massachusetts involving a temporary change of mode for habitual car drivers, who were asked to commute by public transportation for a few days and were given a free public transportation pass as an incentive. Participants' travel happiness, perceptions, attitudes, plans, and mode choice were measured before and after the public transportation trial. Descriptive findings from the Swiss study were reported in this paper.

Many participants reported significantly different levels of satisfaction with their commute by car before and after the experiment. In most of the cases where there was a change, it was an increase in the reported level of satisfaction with the commute by car. Participants were mostly neither satisfied nor dissatisfied with their public transportation experience, although the number of dissatisfied commuters was slightly larger than that of satisfied commuters. Ratings of perceptions and attitudes towards car and public transportation also changed for several participants, which indicates that people often hold misperceptions of public transportation that may be corrected through direct experience. A number of participants continued to commute by public transportation after the trial (both with and without the free public transportation incentive), which suggests that a temporary change in behavior might be effective in inducing behavioral modification. This finding has also been reported in studies on behavioral modification referenced earlier in this paper.

One caveat of this study is the small sample size that limited the complexity of the models that could be developed from the data. Another caveat is that the required length of the public transportation trial was limited to 2 or 3 days in a given week. A longer experimentation period might have induced different satisfaction levels or perceptions/attitudes towards public transportation from what was reported in this experiment, due to the availability of more opportunities for learning and adjustment. However, this was not feasible for this study.

Work in progress will examine potential behavioral mechanisms driving the change in reported happiness with the commute by car. This change could be for instance due to an actual adaptation process that causes people to be on a hedonic treadmill (Brickman and

Campbell, 1971; Oswald and Powdthavee, 2008; Wu, 2001). Alternatively, the change could be attributed to a measurement effect (Frederick and Loewenstein, 1999), such as scale norming (Groot, 2000), demand effects, context effects, or seasonality, or to self-selection. We will develop a flexible modeling framework that allows testing for changes in adaptation levels and unobserved scale effects and the determination of the relevance of different travel happiness measures in choice behavior.

There are various implications of this research. First, with respect to measurement, the findings suggest that if the objective is to measure travel happiness that is relevant to decision-making, then travel well-being should be measured at points in time when changes occur in people's lives leading them to evaluate their options. Examples of these changes include residential moves, job changes, etc. More generally, this implication could be extended to certain domains other than transportation involving routine behavior, where satisfaction surveys are typically conducted, and would imply a shift in the context of measurement from routine conditions to points in time when changes or "transactions" occur. Second, with respect to modeling and assuming that happiness or satisfaction is the same as utility, the usual utility specification can be enriched with variables that affect satisfaction, such as disconfirmation and expectations related to a new service or mode (Oliver, 1980). The happiness indicators can also be used as additional indicators of utility, thus increasing the efficiency of the estimation. Finally, with respect to policy implications, it seems that even a few days of experimentation with public transportation could be effective in attracting a fraction of habitual car drivers to public transportation or at least in modifying their choice sets to include public transportation. The implication is that public transportation agencies could provide occasional free service or institutions could give their employees permanent or occasional public transportation subsidies to encourage habitual car drivers to try public transportation and increase sustainability.

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References

Abou-Zeid, M. and Ben-Akiva, M. (2007). The Effect of Social Comparisons on Commute Well-Being. Presented at the Frontiers in Transportation Workshop, the Netherlands.

Abou-Zeid, M., Ben-Akiva, M., Tierney, K., Buckeye, K., and Buxbaum, J. (2008). Minnesota Pay-As-You-Drive Pricing Experiment. *Transportation Research Record: Journal of the Transportation Research Board*, No. 2079, pp. 8-14.

Ajzen, I. (1985). From Intentions to Actions: A Theory of Planned Behavior. In *Action Control: From Cognition to Behavior* (Kuhl, J. and Beckmann, J., Eds.), pp. 11-39. Heidelberg: Springer.

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, Vol. 50, pp. 179-211.

Bachman, W. and Katzev, R. (1982). The Effects of Non-Contingent Free Bus Tickets and Personal Commitment on Urban Bus Ridership. *Transportation Research Part A*, Vol. 16, No. 2, pp. 103-108.

Brickman, P. and Campbell, D.T. (1971). Hedonic Relativism and Planning the Good Society. In *Adaptation Level Theory: A Symposium* (Appley, M.H., Ed.), pp. 287-302. New York: Academic Press.

Duarte, A., Garcia, C., Giannarakis, G., and Limão, S. (2007). New Approaches in Transportation Planning: Happiness and Transport Economics. TRANSPORTNET report, 1st Stream Course on Transport, Markets and Business.

Environmental Protection Agency. (2007) *Mobile Source Emissions – Past, Present, and Future*. Retrieved 11 January, 2009 from: http://www.epa.gov/otaq/invntory/overview/pollutants/index.htm

Everett, P.B., Hayward, S.C., and Meyers, A.W. (1974). The Effects of a Token Reinforcement Procedure on Bus Ridership. *Journal of Applied Behavior Analysis*, Vol. 7, No. 1, pp. 1-9.

Foxx, R.M. and Hake, D.F. (1977). Gasoline Conservation: a Procedure for Measuring and Reducing the Driving of College, Students. *Journal of Applied Behavior Analysis*, Vol. 10, No. 1, pp. 61-74.

Frederick, S. and Loewenstein, G. (1999). Hedonic Adaptation. In Well-Being: the Foundations of Hedonic Psychology (Kahneman, D., Diener, E., and Schwarz, N., Eds.), pp. 302-329. New York: Russell Sage.

Fujii, S., Gärling, T., and Kitamura, R. (2001). Changes in Drivers' Perceptions and Use of Public Transport During a Freeway Closure: Effects of Temporary Structural Change on Cooperation in a Real-Life Social Dilemma. *Environment and Behavior*, Vol. 33, No. 6, pp. 796-808.

Fujii, S. and Gärling, T. (2003). Development of Script-Based Travel Mode Choice after Forced Change. *Transportation Research Part F*, Vol. 6, pp. 117-124.

Fujii, S. and Kitamura, R. (2003). What Does a One-Month Free Bus Ticket Do to Habitual Drivers? An Experimental Analysis of Habit and Attitude Change. *Transportation*, Vol. 30, pp. 81-95.

Groot, W. (2000). Adaptation and Scale of Reference Bias in Self-Assessments of Quality of Life. *Journal of Health Economics*, Vol. 19, pp. 403-420.

Healey, J. and Picard, R. (2005). Detecting Stress During Real-World Driving Tasks Using Physiological Sensors. *IEEE Trans. on Intelligent Transportation Systems*, Vol. 6, No. 2, pp. 156-166.

Hennessy, D.A. and Wiesenthal, D.L. (1997). The Relationship Between Traffic Congestion, Driver Stress and Direct Versus Indirect Coping Behaviours. *Ergonomics*, Vol. 40, No. 3, pp. 348-361.

Kahneman, D., Fredrickson, B., Schreiber, C.M., and Redelmeir, D. (1993). When More Pain Is Preferred to Less: Adding a Better End. *Psychological Science*, Vol. 4, No. 6, pp. 401-405.

Kluger, A.N. (1998). Commute Variability and Strain. *Journal of Organizational Behavior*, Vol. 19, No. 2, pp. 147-165.

Lucas, J.L. and Heady, R.B. (2002). Flextime Commuters and Their Driver Stress, Feelings of Time Urgency, and Commute Satisfaction. *Journal of Business and Psychology*, Vol. 16, No. 4, pp. 565-571.

Matthies, E., Klöckner, C.A., and Preßner, C.L. (2006). Applying a Modified Moral Decision Making Model to Change Habitual Car Use: How Can Commitment Be Effective? *Applied Psychology: An International Review*, Vol. 55, No. 1, pp. 91-106.

Novaco, R., Stokols, D., and Milanesi, L. (1990). Objective and Subjective Dimensions of Travel Impedance as Determinants of Commuting Stress. The University of California Transportation Center, Berkeley, California.

O'Brien, C. (2005). Planning for Sustainable Happiness: Harmonizing Our Internal and External Landscapes. Prepared for *Rethinking Development: 2nd International Conference on Gross National Happiness,* Antigonish, Nova Scotia, Canada.

O'Brien, C. (2003). Transportation That's A*ctually G*ood for the Soul. *National Center for Bicycling and Walking Forum.*

Oliver, R. (1980). A Cognitive Model of the Antecedents and Consequences of Satisfaction Decisions. *Journal of Marketing Research*, Vol. 17, No. 4, pp. 460-469.

Ory, D. and Mokhtarian, P. (2005). When Is Getting There Half the Fun? Modeling the Liking for Travel. *Transportation Research Part A***,** Vol. 39, pp. 97-123.

Oswald, A.J. and Powdthavee, N. (2008) "Does Happiness Adapt? A Longitudinal Study of Disability with Implications for Economists and Judges. *Journal of Public Economics*, Vol. 92, pp. 1061-1077.

Planning Commission, Royal Government of Bhutan. *Bhutan 2020: A Vision for Peace, Prosperity and Happiness.* Retrieved 11 January, 2009 from: http://unpan1.un.org/intradoc/groups/public/documents/APCITY/UNPAN005249.pdf

Project for Public Spaces. (2008) *Enrique Peñalosa*. Retrieved 11 January, 2009 from: http://www.pps.org/info/placemakingtools/placemakers/epenalosa

Redelmeier, D.A., Katz, J., and Kahneman, D. (2003). Memories of Colonoscopy: A Randomized Trial. *Pain*, Vol. 104, No.1-2, pp. 187-194.

Salvucci, F. (2005). Sustainable Urban Mobility: Transport Solutions for the 21st Century. Lecture Presented at the Massachusetts Institute of Technology, 2005.

Schaeffer, M.H., Street, S.W., Singer, J.E., and Baum, A. (1988). Effects of Control on the Stress Reactions of Commuters. *Journal of Applied Social Psychology*, Vol. 18, No. 11, pp. 944-957.

Schrank, D. and Lomax, T. (2005). The 2005 Urban Mobility Report. Texas Transportation Institute, The Texas A&M University System.

Schwartz, S. H. (1977). Normative Influences on Altruism. In *Advances in Experimental Social Psychology* (Berkowitz, L., Ed.), Vol. 10, pp. 221-279. New York: Academic Press.

Schwartz, S. H. and Howard, J.A. (1981). A Normative Decision-Making Model of Altruism. In *Altruism and Helping Behavior* (Rushton, J.P. and Sorrentino, R.M., Eds.), pp. 189-211. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Singer, J.E., Lundberg, U., and Frankenhaeuser, M. (1978). Stress on the Train: a Study of Urban Commuting. In *Advances in Environmental Psychology: Volume 1, The Urban Environment* (Baum, A., Singer, J., and Valins, S., Eds.). Hillsdale, New Jersey: Lawrence Elrbaum Associates.

Steg, L. (2005). Car Use: Lust and Must. Instrumental, Symbolic and Affective Motives for Car Use. *Transportation Research Part A*, Vol. 39, pp. 147-162.

Van Rooy, D.L. (2006). Effects of Automobile Commute Characteristics on Affect and Job Candidate Evaluations: A Field Experiment. *Environment and Behavior*, Vol. 38, pp. 626-655.

Verplanken, B., Aarts, H., Van Knippenberg, A., and Van Knippenberg, C. (1994). Attitude Versus General Habit: Antecedents of Travel Mode Choice. *Journal of Applied Social Psychology*, Vol. 24, No. 4, pp. 285-300.

Wener, R.E., Evans, G.W., Phillips, D., and Nadler, N. (2003). Running for the 7:45: The Effects of Public Transit Improvements on Commuter Stress. *Transportation*, Vol. 30, pp. 203-220.

Wirtz, D., Kruger, J., Scollon, C.N., and Diener, E. (2003). Research Report: What To Do on Spring Break? The Role of Predicted, On-Line, and Remembered Experience in Future Choice. *Psychological Science*, Vo. 14, No. 5, pp. 520-524.

Wu, S. (2001). Adapting to Heart Conditions: a Test of the Hedonic Treadmill. *Journal of Health Economics*, Vol. 20, No. 4, pp. 495-508.