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Publication Date

2007

Environment and Behavior

<http://eab.sagepub.com>

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Environment and Behavior 2007; 39; 494 originally published online May 21, 2007;

DOI: 10.1177/0013916506292329

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Exploring the Cognitive and Affective Mechanisms Behind Subjective Assessments of Travel Amounts

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Travel demand models focus on explaining how much individuals actually travel but offer no insight into how much individuals think they travel. The authors propose that the latter is an important determinant of traveler behavior, and that actual mobility is refracted through a variety of filters that magnify or diminish those subjective evaluations of travel amounts. Linear regression models of subjective mobility measures provided by 1,358 San Francisco Bay Area commuters were estimated earlier; the focus of this article is on identifying the potential cognitive and affective mechanisms that influence subjective mobility upward or downward, after controlling for objective mobility. The authors find three major types of mechanisms: awareness-heightening, affective, and comparison-inducing. Recurring patterns of effects in these three categories are analyzed in the light of psychological and marketing research concepts including the availability heuristic, social comparison, relative deprivation, autobiographical memory, and motivation theory.

Keywords: *travel behavior; positive utility of travel; perceptual enhancement; affective intensity; autotelic motivation*

Consider two individuals who commute from neighboring homes to neighboring job locations at the same time each morning in their respective late-model automobiles. If they were asked to qualitatively assess their travel amounts, would they give the same answer? What would dissimilar answers tell us about traveler behavior? Consider the possible

Authors' Note: This work was funded by the University of California Transportation Center.

policy implications if one of the two commuters answered that she traveled “a lot” for work and the other answered that he traveled “very little” for work. Would the person who said he traveled “very little” for work be as receptive to travel-reducing policies, such as telecommuting and compressed work schedules, as the person who thought she traveled a lot?

These and similar questions motivated the current study, which explores the idea of subjective mobility. Here, *subjective mobility* refers to individuals' qualitative assessment of their travel amounts. It was captured by a survey instrument that asked respondents the following question (among many others) across a variety of types of travel: “How would you describe the amount of travel you do?” with a 5-point ordinal scale of response options. The goal of the current work is to discuss and investigate the factors that shape these subjective judgments, after controlling for the actual amount of travel they did.

Transportation policy makers have long been aware of the importance of psychological factors in travel. In current practice, almost every travel demand model used in the United States (and elsewhere) considers waiting for a transit vehicle to be substantially more onerous than riding in a transit vehicle (it is typical for the negative coefficient of wait time in a utility function to be 2 to 3 times larger in magnitude than the coefficient of in-vehicle travel time). As a result, proposed transit alternatives that have more frequent service may be favored by demand models over faster alternatives with less frequent service. Thus, the psychological impact of waiting for a transit vehicle is directly reflected in transportation policy decision making. In the work presented here, we follow in the footsteps of several other researchers who have investigated the impacts of psychological factors on travel behavior by investigating the perceived assessments of travel amounts. For example, Koppelman (1981) used nonlinear utility functions to assess the increasing burden of travel time, while Horowitz (1981) used magnitude estimation, a psychological scaling technique, to relate various time elements of a bus transit trip to an automobile trip. Although these and other studies have focused on relating objective travel distances or times for specific trips or trip segments, to individuals' perceptions of those same quantities, our investigation is (to our knowledge) among the first¹ to assess individuals' qualitative perceptions of the amount of traveling they do in general terms, as a function of their actual travel and other potential explanatory variables. A counterpart study in the time-use context is Moens (in press), which modeled a subjective assessment of time pressure as a function of objective time use measures.

The work presented here extends a previous effort by Collantes and Mokhtarian (in press), who modeled subjective mobility using a host of potential explanatory variables and interpreted the results in the light of social

cognition theory, their collective intuition, and the literature (mostly in travel behavior). For this article, we systematically examined the significant findings from the models and identified a number of recurring themes, or types of filters, through which one's objective mobility can be refracted to produce subjective mobility. We then related those themes to concepts well known in the psychology and marketing research literatures, and it is the discussion of those themes and relationships that constitutes the framework for this article.

The remainder of this article is organized as follows. The next section presents some plausible mechanisms by which individuals may subjectively assess their travel amounts. The third section introduces the data used for the investigation; the next section discusses the relationship between actual, perceived, and reported travel amounts. The empirical evidence, taken from survey data, is the focus of the fifth section. Here, the model results are analyzed in the context of the mechanisms suggested in the second section. A concluding section ends the article.

Discussion of Key Mechanisms

The purpose of the current study is to understand the possible mechanisms by which actual amounts of mobility are magnified or diminished in the individual's formation of her subjective assessment of the amount of travel she does. In reviewing the literature to identify any approaches similar to ours, we found three terms that initially seemed relevant: the concepts of *perceptual bias*, in consumer research (Glazer, 1984), political science (Gerber & Green, 1999), and neurology (numerous references); *perceptual enhancement*, in marketing research (Dick & Lord, 1998), psychology (e.g., Jacoby, 1983), and neurology; and *perceptual discounting*, in transportation (Hensher, 2001), marketing (da Cunha, Janiszewski, & Cooke, n.d.), and psychology (Foster & Matheson, 1999). Although the contexts in which these terms are used are not exactly analogous to ours, at a very general level the concepts are similar: that there are factors that diminish or enhance one's perception of objective reality. As Glazer (1984) suggested, the idea also relates to the multivariate analysis technique of multidimensional scaling, when individual differences are analyzed (Carroll & Chang, 1970; Ritchie, 1974). This model holds that individuals position objects in perceptual space in idiosyncratic ways, where the multiple axes of the space represent perceptual dimensions that are stretched or shrunk consistent with each individual's judgments about the position of each object relative to the others.

Let us first consider *magnification mechanisms*: For a given objective amount of travel, what would lead one person to evaluate her travel as being greater on a qualitative ordinal scale than another person? Three major types of factors suggest themselves: awareness heightening, affective, and comparison inducing. Some factors influence the evaluative process simply by making the act of traveling more highly salient to the individual (increasing her awareness of the travel she does). For example, the presence of a large number of people in the household increases the demands on one's time and the need for schedule coordination, which may heighten one's sensitivity to the travel undertaken. The other two types of factors, affective and comparison-inducing, are actually different special cases of awareness-heightening, in which awareness is magnified because of particular reasons. In the case of affective factors, that heightening is due to an emotional affinity or disaffinity toward travel, whereas in the case of comparison-inducing factors, awareness of one's travel is magnified by an implicit or explicit contrast of one's own current circumstances with some other set of salient circumstances. In contrast to the affective ones, simple awareness-heightening and comparison-inducing factors can be more or less cognitive, though the induced comparisons probably often influence one's affective beliefs (one dislikes the bus in part because of resentment at having to take it while "everyone else" drives), and as a general rule, cognition and affect are often bound together in ways that are difficult to disentangle (Crites, Fabrigar, & Petty, 1994).

When we consider *diminution mechanisms*, we conclude that in fact essentially the same three types of factors are at work, but in reverse. If the presence of an awareness-heightening circumstance would tend to magnify one's subjective assessment of travel amounts, then a factor that reduces one's awareness of the travel experience would tend to diminish that assessment. If a strongly valent affect works to increase the summary evaluation of travel amount, then a factor that attenuates that valence (renders it more neutral) should work to decrease it. And if some types of comparisons serve to influence one's subjective assessment upward, others may serve to influence it downward.

In the subsections below, we discuss each of these three major factors in turn, anchoring them in well-known concepts from psychology and marketing research.

Awareness-Heightening Factors

Variables that heighten one's awareness of his travel illustrate the *availability heuristic*. This principle says that in estimating the frequency or likelihood of an event, individuals are disproportionately influenced by events

or factors that are more readily available in memory (Tversky & Kahneman, 1973). One experiment used by Tversky and Kahneman (1973) to illustrate this principle was to read two lists to respondents: one contained 19 famous men and 20 less famous women; the other 19 famous women and 20 less famous men. When asked if the first list contained more men's names or women's names, the respondents more often responded with the former; a similar result held in the second experiment, where the famous names again carried the day. More recent work attempted to disentangle the roles of ease of recall and amount of recall (Schwarz et al., 1991).

Affective Factors

There is an enormous literature on affective beliefs, and their relationship to cognitive and conative beliefs (Myers, 1999). Perhaps most relevant to the current context is the role of affect in *autobiographical memory* (remembering things about oneself).² Specifically, we are interested in the difference between the recall of pleasant and unpleasant events.

Although most researchers agree that positive memories are recalled with more accuracy than neutral ones, the literature is not as clear on the recall of unpleasant memories. Banaji and Hardin (1993) reviewed and discussed the evidence for the influence of affect on recall ability. The so-called affective asymmetry hypothesis supposes that as the positive affect for events increases, so does the ability to recall details associated with these events—suggesting a monotonically increasing relationship between affect and recall accuracy. Alternatively, the affective intensity hypothesis argues that the intensity of the affect, be it of positive or negative valence, positively influences recall—which leads to something like a quadratic relationship between affect and recall accuracy. The authors provide ample evidence supporting both claims.

Applying this literature somewhat liberally to the current context, we can reasonably postulate similar affective intensity or affective asymmetry relationships between the liking for travel and one's subjective evaluation of travel amounts; that is, two types of relationships are conceptually plausible: a monotonic one or a quadratic one. As explained in more detail in Collantes and Mokhtarian (in press), we initially hypothesized an affective asymmetry relationship, with higher levels of dislike associated with higher judgments of travel amount. Our assumption was that the more burdensome travel was felt to be, the greater the weight a given amount of travel would have in one's subjective assessment, while conversely, the more pleasurable it was felt to be, the lighter the weight a given amount would have. Such a view is

expressed in popular thought with the saying, “time flies when you’re having fun” (see, e.g., Agarwal & Karahanna, 2000; Danckert & Allman, 2005; also see Csikszentmihalyi, 1990, and Feldman and Hornik, 1981, on “The Subjective Meaning of Time”), indicating that positive affect toward an activity reduces one’s perception of the amount of time elapsing while conducting that activity.

However, many studies challenge this popular notion in different ways (see, e.g., Kellaris & Kent, 1992), and in fact, similar to the discussion of Banaji and Hardin (1993), our empirical evidence was quite mixed as well. Much of it was consistent with the affective intensity model, in which both factors associated with travel being a pleasure, as well as those associated with it being a burden, were found to be positively associated with subjective mobility. A similar kind of “non-monotonic and single-peaked” relationship was reported by Glazer (1984, p. 518), who found that the most-preferred and least-preferred brands were most easily recognized, compared to moderately preferred brands. However, we also found several situations in which increasing affection for travel diminished subjective mobility, as would be expected from the affective asymmetry hypothesis.

Another relevant source for exploring the role of affect in influencing cognitive judgments is the literature on motivation theory (see Reiss, 2004, for a useful review and analysis). Scholars in this field (e.g., Deci & Ryan, 1985) distinguish between two key types of motivation: intrinsic (performing an activity for the innate pleasure of doing it) and extrinsic (performing an activity for the sake of some other desired benefit). Activities resulting from these two types of motivations are sometimes (Csikszentmihalyi, 1990) categorized as *autotelic* (from the Greek words *auto*, meaning self, and *telos*, meaning goal or purpose) versus instrumental. Market researchers have applied these concepts to the adoption of new information technology applications and suggest that an intrinsic motivation to adopt will reduce one’s perception of the difficulties involved. For example, Venkatesh, Speier, and Morris (2002) found that high levels of intrinsic motivation led respondents to “underestimate” the perceived difficulty of using new technologies, whereas Shang, Chen, and Shen (2005) noted in the context of online shopping that “The intrinsically motivating state of cognitive absorption will lower the perceived cognitive burden associated with the task: the individual is experiencing pleasure and is willing to expend more effort on it” (p. 404). In the current context, the hypothesis would be that the greater the individual’s liking for travel (connoting an enjoyment of it as an autotelic activity, not just for its instrumental value in taking her where she needs to go), the lower her perception of it being a burden, and hence the

lower her perception of the amount she does—in other words, the affective asymmetry hypothesis from a different perspective.

Comparison-Inducing Factors

Making comparative judgments not only is the essence of scientific observation but also is a fundamentally human cognitive process. A number of different frames of reference are available for making comparisons. In some contexts, comparisons are made to a peer group; in others an individual compares herself to a group she views as superior on some dimension(s) (and which she may aspire to join); in still others a person compares herself to a reference group deemed inferior. In some cases an individual compares his current circumstances to those he experienced earlier in life; in others he compares his situation (e.g., travel amounts) in one realm of his life (e.g., work) to that in another realm (e.g., entertainment); and in yet others, the comparison may be to a largely internally conceived ideal state.

The study of social comparison refers to “how people choose others for comparison, and how they make use of that information” (Masters & Smith, 1987, p. 1). The field grew out of the work of Festinger (1954) and is still an active area of research. Suls (1986) provided a theoretical framework for comparison mechanisms at different stages of development, proposing that adolescents and young adults compare themselves to similar others, whereas those of middle age compare themselves more to dissimilar others (primarily in the workplace), and the elderly use previous versions of themselves for comparison.

In the context of subjective mobility we suggest that social comparison can work in several different ways. For example, if a group (or condition) that an individual aspires to join travels more than he is currently doing (either overall, or in a specific category such as entertainment, or personal vehicle travel), his dissatisfaction when contrasting his circumstances to theirs is likely to lower his subjective assessment of the amount of travel he does (in that category), compared to an individual traveling an identical objective amount but with a different frame of reference. In other words, we hypothesize that a sense of *relative deprivation* (Masters & Smith, 1987) will act to depress one’s assessment of travel amounts for categories in which one feels deprived and possibly elevate it for categories that reflect one’s current, undesirable circumstances.

Issues of deservingness, equity, and equality could certainly affect one’s subjective assessment of travel amounts. Consider a worker traveling from a distant suburb to a downtown job location. On her journey, the worker may

be reminded that her vehicle is rather small and old compared to others she sees on the roadway; she may ponder if her job pays well enough to sacrifice so much of her time commuting each morning; passing by city dwellers walking to their jobs, she may grow angry at housing prices in the city center and think that more housing is needed; she may watch a family emerge from a hotel and load into a minivan headed to the zoo and wish she were on vacation. Further consider individuals with disabilities who may feel deprived when watching others travel freely and easily on foot or in automobiles.

In each of these anecdotal hypothetical scenarios, the comparison to others may lead to feelings of deprivation and injustice. It is posited here that these feelings could result in differing subjective assessments of travel amounts. Thus, suppose that two individuals travel the same objective amounts, in terms of time, distance, and trip frequency. If individual A travels in a newer car (and presumably one with more amenities) than individual B, we hypothesize that individual B will assess his travel to be greater than individual A: The relative discomfort (e.g., in terms of noise, seat quality, performance, and/or internal temperature) of his vehicle will heighten B's awareness of how much he travels. This heightened awareness may be most often a consequence of B's comparison of himself to A's group but could also arise, at least in part, simply from B's imagined ideal for what travel in a car should be like.

On the other hand, social comparisons need not lead to feelings of relative deprivation *per se*. Hornsey and Jetten (2004) commented that one way of maintaining a balance between the dual needs for group belongingness and for individual identity is by "perceptually enhancing the distinctiveness of one's group. This . . . can be achieved by perceptually exaggerating intergroup differences or by psychologically shrinking the size of the group" (p. 259; also see Pickett, Silver, & Brewer, 2002). In the current context, this suggests that magnifying one's assessment of personal travel amounts may be a way of distinguishing one's (self-identified) group (e.g., depending on the travel category, corporate managers, athletes, "car buffs," "jetsetters") from others—or, perhaps, one may magnify the difference between one's group and others through diminishing one's assessment of one's own group's travel, compared to that of the other group.

Empirical Setting and Available Data

The data analyzed in the current study are collected from a 14-page self-administered survey of San Francisco Bay Area residents. A total of 8,000

surveys were mailed in May 1998 to randomly selected households in three neighborhoods, namely North San Francisco (one half of the surveys), Concord (one fourth) and Pleasant Hill (one fourth). North San Francisco is an urban neighborhood, located close to the regional central business district (CBD) and well served by transit. Concord and Pleasant Hill, in contrast, are contiguous but different suburban cities, located across the San Francisco Bay from the regional CBD. This article uses a subset of the 2,000 respondents who returned the survey—those who work either part-time or full-time and commute at least once a month. This subset contains 1,358 respondents with relatively complete data on most variables of interest. The decision to use only commuting workers was based on the assumption (supported by a few tests) that relationships among attitudes, personality, and mobility variables (described later in this section) could be rather different for commuters than for noncommuters.

The data (see Ory et al., 2004, for more details) are relatively balanced in terms of gender and neighborhood location. The youngest and oldest age categories have few observations; however, as the sample comprises full- and part-time workers, this is not surprising. Higher incomes are overrepresented compared to the Census, as is typical for self-administered surveys (see Curry, 2000, for further discussion).

Dependent Variable: Subjective Mobility

The survey measured subjective mobility using the following question: “For each of the following categories, circle the number on the scale which best describes how *you* view the amount of travel *you* do.” The 5-point scale ranged from *none* to *a lot*. Respondents were asked to answer this question for a variety of categories, only the most important of which were analyzed for the current study. Specifically, we examined short-distance travel overall and for three different purposes (commuting to work or school, for work- or school-related activities, and for entertainment/recreation/social activities), one short-distance travel mode (driver or passenger in any personal vehicle), long-distance³ travel overall and for two different purposes (work- or school-related and entertainment/recreation/social), and two different long-distance travel modes (driver or passenger in a personal vehicle and in an airplane). To reduce the burden on the respondent, travel modes and purposes were treated separately (i.e., no question inquired about, for example, short-distance commute travel in a personal vehicle). Summaries of the survey responses are shown in Table 1.

Table 1
Subjective Mobility Dependent Variables (N = 1,357^a)

Subjective Mobility Variable		1 (None)	2	3	4	5 (A lot)	Average
Short distance							
Overall	<i>n</i>	3	177	502	345	320	3.60
	Row %	.2	13.1	37.3	25.6	23.8	
Purpose							
Commute	<i>n</i>	29	302	328	267	431	3.57
	Row %	2.1	22.3	24.2	19.7	31.8	
Work- or school-related	<i>n</i>	249	542	302	118	146	2.54
	Row %	18.3	39.9	22.3	8.7	10.8	
Entertainment/ social/recreation	<i>n</i>	55	509	518	209	66	2.80
	Row %	4.1	37.5	38.2	15.4	4.9	
Personal vehicle mode	<i>n</i>	37	190	230	284	616	3.92
	Row %	2.7	14.0	16.9	20.9	45.4	
Long distance							
Overall	<i>n</i>	77	537	485	166	92	2.75
	Row %	5.7	39.6	35.7	12.2	6.8	
Purpose							
Work- or school-related	<i>n</i>	603	399	170	85	100	2.03
	Row %	44.4	29.4	12.5	6.3	7.4	
Entertainment/ social/recreation	<i>n</i>	134	488	430	210	95	2.74
	Row %	9.9	36.0	31.7	15.5	7.0	
Mode							
Personal vehicle	<i>n</i>	154	419	328	236	220	2.96
	Row %	11.3	30.9	24.2	17.4	16.2	
Airplane	<i>n</i>	170	506	335	222	124	2.72
	Row %	12.5	37.9	24.7	16.4	9.1	

a. The sample size for each variable is 1,357, except for overall short-distance ($N = 1,354$).

At first glance, the responses in Table 1 seem as expected: Most believed that they traveled more for work and in private vehicles than for overall long-distance travel or for short- or long-distance entertainment travel. These patterns in fact correspond closely to the patterns for the actual amounts people travel. What intrigues us is thinking about what objective measures (distance? time? speed? frequency?) most strongly shape these subjective opinions and, after controlling for objective travel measures, investigating why two individuals who travel the same objective amount consider their travel to be different. The influence of objective measures is addressed in more detail in Collantes and Mokhtarian (in press) and (for commuting in particular) Ory et al. (2004). The focus of this article is on

Table 2
Summary of Potential Explanatory Variables

Variable Category	Description
Objective mobility	<p>Questions about short-distance and long-distance travel by a variety of modes for a variety of purposes</p> <p>Short-distance questions asked respondents to indicate frequency of travel (six categorical choices) and distance traveled (write-in response)</p> <p>Long-distance questions required respondents to indicate the number of trips made to each of nine regions of the world in the past year, by purpose and mode (distance estimates were created by measuring approximate distances from a central position in the Bay Area)</p>
Travel liking	<p>Operationalization of affect for travel, in the same categories as the subjective mobility questions</p> <p>Respondents rated travel on a 5-point scale from <i>strongly dislike</i> to <i>strongly like</i></p>
Attitudes	<p>Thirty-two statements regarding travel, land use, and the environment</p> <p>Respondents agreed or disagreed with the statements using a 5-point Likert-type scale</p> <p>Factor analyses (see Mokhtarian, Salomon, & Redmond, 2001, or Redmond, 2000) revealed six dimensions: travel dislike, proenvironmental solutions, commute benefit, travel freedom, travel stress, pro-high density</p>
Personality	<p>Seventeen traits expected to relate to travel</p> <p>Respondents indicated how well the attributes described them on a 5-point scale (<i>hardly at all</i> to <i>almost completely</i>)</p> <p>Factor analyses (Mokhtarian et al., 2001) revealed four dimensions: adventure-seeker, organizer, loner, calm. Because of limited survey space, the factors are not specifically based on a typology such as the so-called Big Five (Norman, 1963), though they can be loosely related (adventure-seeker and loner factors relate to Norman's extroversion, organizer to conscientiousness, and calm to emotional stability)</p>
Lifestyle	<p>Eighteen statements related to work, family, money, status, and the value of time</p> <p>Respondents agreed or disagreed with the statements using a five-point Likert-type scale</p> <p>Factor analyses (Mokhtarian et al., 2001) revealed four factors: status seeker, workaholic, family- or community-oriented, frustrated</p>

(continued)

Table 2 (continued)

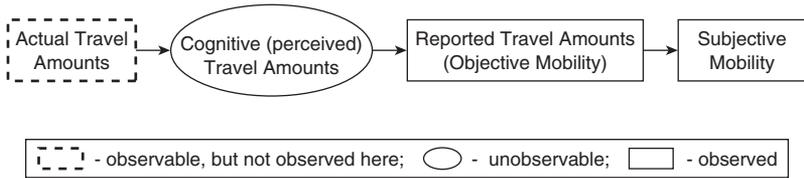
Variable Category	Description
Excess travel	<p>Thirteen questions qualitatively measuring excess travel</p> <p>Respondents indicated how often (“never/seldom,” “sometimes,” “often”) they engaged in activities involving seemingly unnecessary travel</p> <p>Examples:</p> <p>“How often do you travel . . . ,”</p> <p>“ . . . with no destination in mind?”</p> <p>“ . . . just for the fun of it?”</p> <p>“ . . . mainly to be alone?”</p>
Mobility constraints	<p>Seven statements regarding physical conditions or anxieties preventing various types of travel</p> <p>Respondents indicated the degree of the mobility constraint (“no limitation,” “limits how often or how long,” “absolutely prevents”)</p> <p>Examples include: “driving on the freeway,” “driving at night,” “walking,” “flying in an airplane”</p> <p>The percentage of time an automobile is available to the participant is also considered a constraint, oriented in the reverse direction</p>
Sociodemographics	<p>Twenty questions at the end of the survey, measuring age, income, household size, employment type, number of household workers, education level, gender, and make and model of the automobile driven most often (this variable then allocated to one of nine major vehicle types; see Choo & Mokhtarian, 2004, or Curry, 2000, for more details)</p> <p>Data allows for comparison of our sample with more general populations</p>

the variability in subjective assessment after controlling for objective amounts of travel.

Potential Explanatory Variables

The potential explanatory variables used in the models can be placed into eight general categories, namely: objective mobility, travel liking, attitudes, personality, lifestyle, excess travel, mobility constraints, and sociodemographics. Detailed descriptions of each category are available in previously referenced papers and in Collantes and Mokhtarian (2002). Because specific model results have already been discussed elsewhere and this article focuses on a “meta-analysis” of recurring themes within the models, we here present only very brief descriptions, shown in Table 2.

Figure 1
Relationship Between Actual Travel
Amounts and Subjective Mobility



Actual, Perceived, and Reported Travel Amounts

As mentioned, our main goal in this article is to explore the factors that magnify or diminish one's subjective evaluation of his travel amounts, controlling for actual amounts of travel. However, it is important to clarify that we are only able to do so in a limited way.

The objective mobility data captured in the survey were self-reported. As such, the term *objective* is a bit artful but chosen to represent the contrast between the quantitative measures of distance and frequency that could be objectively assessed if resources permitted, versus the qualitative measures of travel amounts that are the subject of the current study. In fact, however, actual travel amounts are filtered twice before they are captured in the survey and their effects on subjective mobility can be modeled (see Figure 1). In the first place, individuals' perception of their actual travel amounts may not accurately reflect reality, and in the second place, the amounts they report on the survey may not accurately reflect even their perception (Groeger, 2000).⁴ Each of these two types of distortions is discussed further below.

Perceived or "cognitive" travel amounts are typically researched through straightforward collection of distance estimates: Psychologists ask respondents to estimate the distance between two places or objects. The researchers then speculate as to why participants' responses are systematically inaccurate, that is, consistently different from the actual distance in similar environments. For example, Canter and Tagg (1975) asked respondents to estimate the distance between two well-known landmarks and/or places in a variety of large cities to determine if physical characteristics of the city (e.g., city form, presence of rivers) influenced estimation. Byrne (1979) and Staplin and Sadalla (1981) found evidence that the presence of turns (angularity) and

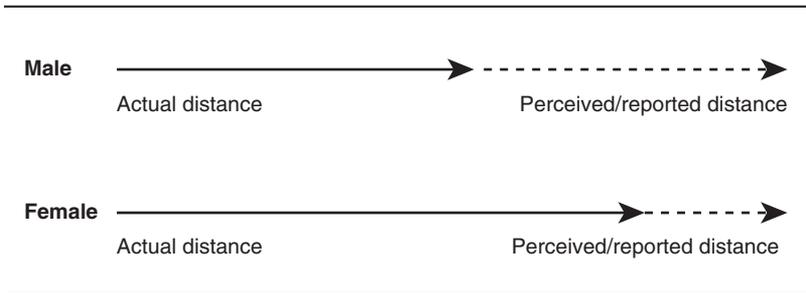
intersections distort distance estimates (also see Ankomah & Crompton, 1992). Sadalla and Magel (1980) and Sadalla and Staplin (1980a) report similar findings in estimates of traversed (on foot) distance; Sadalla and Staplin (1980b) and Sadalla, Staplin, and Burroughs (1979) presented an information storage model that accounts for distortions caused by right turns, intersections, and other “information” likely to be stored on the route.

In collecting the data in these studies, the respondents are required to report their cognitive distance estimates through some medium and, in doing so, other (instrument) errors may enter the analysis. In some cases, respondents may not be able to properly articulate their perceptions. For example, an individual may know in her head “exactly” how long a certain distance is but have a faulty idea of how long a mile is, so that when she reports the distance as being “3 miles,” she is wrongly conveying her accurate perception. In other situations, respondents may be forced to simplify their perceptions by choosing a categorical, rather than an exact, answer (as is the case for the trip frequency measures we collected). In any case, true perceived travel amounts cannot be captured; only their reports filtered through some data-collection instrument.

For the current study, the actual travel amounts are not known. If psychological factors strongly influence the relationship between actual and perceived or reported travel and the relationship between perceived or reported travel and subjective mobility, any inferences we make regarding the latter relationship will be confounded by the former relationship. To illustrate this point, consider two individuals, one male and one female (see Figure 2), who state on the survey instrument that they commute 100 miles per week—that is, their reported perceived distance is 100 miles per week. Further assume that the male actually commutes 60 miles per week, and the female 80 miles per week. If the male were to rate his subjective mobility as a 2 (of 5) and the female a 4, all else equal, our approach would wrongly attribute the difference in the rating to a tendency of men to diminish their subjective assessment of a given objective amount of travel, compared to women. In fact, the man actually is traveling less. There may be no gender difference in how an actual travel amount of 60 miles a week is subjectively evaluated, but rather a gender difference in how actual distances are translated to perceived/ reported distances.

Thus, a limitation of the current work is that the rating of subjective mobility for a given reported level of objective mobility represents the net effect of factors influencing the cognitive processing of actual into perceived and reported amounts, and factors (cognitive and affective) influencing the translation of perceived or reported amounts into the qualitative subjective assessment that is our main interest here. Three cases can be distinguished: (a) If perceived distance were simply a scaled version of actual distance, roughly uniform across all individuals in the current sample, the interpretation of our models

Figure 2
Hypothetical Example of Perceived and Actual Distance



would not change (only the scale of the coefficients would). (b) If perceived and actual distance differed by amounts that varied randomly across the sample, it is a case of measurement error, which is known to render coefficient estimates inconsistent and biased toward zero (e.g., Greene, 1997). However, given the strongly significant relationships between objective mobility and subjective mobility measures in the models, a downward bias in coefficient magnitudes does not seem to be a major problem (although other coefficient estimates can also be affected, in unknown ways). (c) The worst case is if the relationship between actual and perceived or reported distance varies systematically by the explanatory variables used in the models. In that situation, the various types of effects represented by the arrows in Figure 1 are confounded, as they were for gender in the example above. However, the literature has found very high correlations between actual and cognitive or reported distances (regression R^2 values of near .95 for Canter & Tagg, 1975), and no differences between genders in distance estimation abilities (Byrne, 1979; Staplin & Sadalla, 1981). Hence, as far as we are able to ascertain, it is reasonable to take our objective mobility measures as appropriate proxies for actual travel amounts.

Empirical Findings

Using ordinary least squares regression,⁵ we modeled the 10 subjective mobility variables shown in Table 2, as functions of the various potential explanatory variables defined in the third section. R^2 s for the models ranged from .22 to .42, with an average of .31. Individual coefficient values and t statistics for each model are available in Collantes and Mokhtarian (2002). Summary tables showing the signs of each significant variable in each model are available in Collantes and Mokhtarian (2002, in press) and hence,

in the interests of brevity, are not repeated here. What we do provide here is a higher order synthesis of the findings, in which the significant relationships across all models (other than relationships involving objective mobility variables, which, as indicated earlier, are treated in greater detail in the two references just cited) are grouped and discussed in terms of the tripartite classification described in the second section. Specifically, Tables 3 and 4 categorize the variables illustrating a magnifying effect on subjective mobility (generally those with positive coefficients in the models) after controlling for objective mobility, while Table 5 presents those illustrating a diminishing effect (negative coefficients). It can be seen that each of the three major types of factors identified in the second section is manifested in several different ways in our empirical results. Below, we discuss each table in turn. Note that the same significant variable can have multiple interpretations and hence can appear more than once in the tables.

Factors That Magnify the Mobility Assessment

Tables 3 and 4 present the 13 mechanisms postulated to enhance subjective mobility. Five mechanisms (shown in Table 3) reflect various kinds of affective factors, four can be categorized as comparison-inducing factors (Table 4), and four constitute other awareness-heightening factors (Table 4). We discuss each category of mechanism in turn.

Affective factors. As discussed in the second section, we ultimately identified an affective intensity relationship between one's feelings about travel and his subjective assessment of travel amounts; that is, strongly positive and strongly negative affective beliefs about travel were found to heighten one's awareness of the travel experience and hence influence perceptions upward. Thus, the five affective mechanisms identified in Table 3 fall into two groups: those contributing to a higher enjoyment of one's travel, and those contributing to the perception of travel as a burden. Categories 1 and 2 represent general forms of these two groups, respectively, with the remaining three affective mechanisms constituting specific ways in which travel could be viewed as a burden. Each of these two basic types of mobility-enhancing mechanism is identified in a majority of the models presented here, an indication of their fundamental nature and also of the complexity of the process by which one's mobility is subjectively assessed.

Category 1, then, represents the basic form of the *travel enjoyment* mechanism. Most of the variables in this category are indicators of an affinity for travel—either travel liking directly, the adventure-seeker personality

Table 3
Summary of Affective Factors Magnifying Subjective Mobility

Postulated Mechanism	Dependent Subjective Mobility Variable Modeled									
	Short Distance					Long Distance				
Explanatory Variables Representing This Mechanism	Overall	Commute	Work or School	Entertainment	Personal Vehicle	Overall	Work or School	Entertainment	Personal Vehicle	Airplane
1. Enjoyment of travel (pleasure)	S	S	L	S	S	L	L	L	L	L
Travel liking ^a										
Sport utility vehicle type										•
Personal income										
Adventure seeker factor score	•			•	•	•	•			•
Loner factor score										
Excess Travel indicator			•	•					•	•
2. Burdensomeness of travel (burden)	S				S					•
Travel liking ^{a,b}										
Age										
Male dummy variable ^c						•				

3. Family constraints (burden)	Travel liking chauffeur	•
	Family-oriented factor score	•
	Van or minivan vehicle type	•
	Male dummy variable ^c	•
4. Vehicle inconvenience (burden)	Number of people in the household	•
	Vehicle type ^a	•
5. Negative attitude (burden)	Frustration factor score	•

a. Denotes a category of variables; see Collantes and Mokhtarian (2002) for the specific variables associated with each model. For these categories, *S* denotes that the specific explanatory variable was measured for some form of short-distance travel, while *L* denotes long-distance travel.

b. Represented by the quadratic form in which low as well as high values of the travel liking variables have a positive impact on subjective mobility.

c. This variable has a negative coefficient, but is included here since we argue that long-distance mobility by airplane is more burdensome to women.

factor, the excess travel indicator, or even a vehicle-related variable, the sport utility vehicle type. This category by itself has representation in all 10 of the models estimated, and the association of a travel-magnifying mechanism to variables indicating affinity for travel constitutes a central argument of this work.

The basic form of the *burdensomeness of travel* mechanism shown in category 2 is illustrated by the quadratic form of the travel liking variables in the short-distance overall and personal vehicle models (which also appear in category 1). Two demographic variables are also included here, age and gender. It is plausible that being older would magnify the burden of travel because of increasing physical and cognitive limitations. All else equal, women apparently also consider (specifically long-distance airplane) travel more burdensome than men, which may be in part because of the family considerations mentioned below, but independently of that may also relate to women's greater concerns about safety and the greater impact of the logistical challenges of managing luggage.

Category 3, *family constraints*, is illustrated by five variables in five different models. It is natural to expect that a given amount of travel may feel more burdensome when family issues require greater coordination, impose more constraints, and increase anxiety levels while traveling (see, e.g., Novaco, Kliwer, & Broquet, 1991; Wener, Evans, & Boately, 2005). Categories 4 and 5 represent relatively isolated but still interesting special cases of the burden mechanism: inconvenient vehicle types for commuting (ironically, both large and small vehicle types tend to magnify subjective mobility, for different reasons), and a generally negative attitude.

Comparison-inducing factors. Several factors appear to magnify one's subjective assessment of travel amounts by prompting a comparison of some kind, against either other people, a more-preferred state, or a conceptual ideal. In Table 4, category 6 (*relative deprivation*), we postulate that a sense of deprivation with respect to one mode of travel (walking, in this instance) enhances one's awareness of travel by another mode (personal vehicle). The feeling of deficiency could arise either through comparisons with other people (e.g., friends who enjoy walking), or through a comparison with one's own preference to be able to walk more.

The *travel saturation* mechanism of category 7 indicates a carryover of the effects of travel in one realm to the assessment of travel in another (related) realm. Alternative explanations for these effects are offered below; however, in this context, we suggest that the effect arises because of a comparison (and "summation") across realms. For example, the greater the

Table 4
Summary of Comparison-Inducing and Awareness-Heightening Factors Magnifying Subjective Mobility

Postulated Mechanism	Explanatory Variables Representing This Mechanism	Dependent Subjective Mobility Variable Modeled									
		Short Distance			Long Distance						
		Overall	Commute	Work or School	Entertainment	Personal Vehicle	Overall	Work or School	Entertainment	Personal Vehicle	Airplane
Comparison-inducing factors											
6. Relative deprivation (comparison to others or to preferred state)	Limitations on walking										
7. Travel saturation (comparison to preferred state)	Frequency of travel ^a	L	S ^c				S	S			
	Travel distance ^a			S ^c	L		S	S		S	
	Pro-high-density factor score ^b										•
8. Competing preferences (comparison to preferred state)	Travel liking ^a	L		L							S
	Frequency of travel ^a										

(continued)

Table 4 (continued)

		Dependent Subjective Mobility Variable Modeled									
		Short Distance				Long Distance					
Postulated Mechanism	Explanatory Variables Representing This Mechanism	Overall	Commute	Work or School	Entertainment	Personal Vehicle	Overall	Work or School	Entertainment	Personal Vehicle	Airplane
		9. Mobility freedom awareness (comparison to ideal state)	Travel freedom factor score Percentage of time a personal vehicle is available								
Awareness-heightening factors											
10. Confounding short distance and long distance	Frequency of travel ^a	L					S	S			S
11. Confounding similar purposes	Travel distance ^a Frequency of travel ^a				L		S	S			S
12. Complementarity	Travel distance ^a Travel liking ^a			S ^c					S ^c	L	
13. Availability heuristic	Frequency of travel ^a Number of people in the household	L								•	

a. Denotes a category of variables; see Collantes and Mokhtarian (2002) for the specific variables associated with each model. For these categories, *S* denotes that the specific explanatory variable was measured for some form of short-distance travel, while *L* denotes long-distance travel.
 b. Although this variable has a negative coefficient, we postulate that it may represent a travel saturation effect, with suburbanites (having a lower score on this factor and more short-distance personal vehicle travel) perceiving their long-distance personal vehicle mobility more intensely, and conversely for urbanites.
 c. The relevant short-distance work/school variable was significant in the model for commuting, and the relevant commuting variable was significant in the model for short-distance work/school.

amount of, say, short-distance work- or school-related travel, the more burdensome long-distance work- or school-related travel feels to the respondent. Several of the instances of this mechanism are of that nature, relating to the impact of short-distance travel on a long-distance counterpart (or vice versa). Several others occur between two related trip purposes. For example, we found that objective mobility for short-distance work- or school-related travel enhanced subjective mobility for commuting, and also the converse.

Category 8 also involves the impact of short-distance variables on long-distance subjective mobility, or vice versa. We have labeled this mechanism *competing preferences*, referring to the idea that an individual's awareness of engagement in one form of travel may be heightened by a liking or preference for engagement in a different form of travel (this can also be considered another type of relative deprivation). For example, a high travel liking for long-distance work-related travel may cause one to more deeply resent, as competition for the time one would rather spend on long-distance travel, the time one must spend on short-distance travel in the same category. In another example of this effect, one's liking for short-distance travel serving others is found to exaggerate one's perceived amount of long-distance airplane travel, presumably because it takes one away from home and the ability to meet those needs. And in the third example, a desired travel-time budget argument (Mokhtarian & Chen, 2004; Mokhtarian & Salomon, 2001) is invoked to suggest that if one is traveling a great deal for long distance, then additional required short-distance travel may be more burdensome than would otherwise be the case. Note that the latter instance of this mechanism also appears in category 7. Simply put, the interpretation for category 7 assumes the impact is driven by exhaustion, whereas here the impact is assumed to be derived from resentment (or at least anxiety) over the reduced ability to spend time as desired.

For category 9, *mobility freedom awareness*, one's actual ability to travel is compared against her desired ability to travel. In the two examples of this mechanism, a sense of freedom to travel—either generally,⁶ or specifically by personal vehicle—enhances one's awareness of her actual travel, for discretionary purposes and by personal vehicle.

Awareness-heightening factors. Categories 10 and 11, *confounding short-distance and long-distance* and *confounding similar purposes*, actually include the same variables as category 7, travel saturation. Although they are different mechanisms, they manifest themselves in the same way and thus cannot readily be distinguished empirically. Both mechanisms typically involve a

short-distance measure of objective mobility (or in one case, an attitude related to short-distance travel) magnifying the assessment of the counterpart or a related long-distance measure of subjective mobility, or conversely. Here, we explain this relationship by suggesting that respondents consciously or subconsciously consider short-distance versions of the long-distance travel in question, and transfer their short-distance experiences to the long-distance range in evaluating their mobility (and conversely). Thus, in its purest sense, this mechanism represents a survey response bias (which is nevertheless a cognitive effect worth knowing about). The travel saturation mechanism, by contrast, represents not a reporting error on the part of the respondents but a genuine carryover of the effects of travel in one realm to the assessment of travel in another realm. That is, for category 7 the suggestion is that the greater the amount of, say, short-distance personal vehicle travel, the more burdensome long-distance personal vehicle travel truly feels to the respondent.

Like category 7, category 12, *complementarity*, also involves the impact of short-distance variables on long-distance subjective mobility, or vice versa. Complementarity refers to the belief that conditions being positive in one realm can contribute to conditions being positive in the other realm. Two variables were identified as possibly representing this effect. One, the number of long-distance personal-vehicle trips in the short-distance overall subjective mobility model, also appeared under category 7. Here, the additional hypothesis is that a high number of long-distance trips by personal vehicle can actually be associated with a high short-distance overall mobility, both because long-distance personal-vehicle trips may literally generate a number of short-distance trips in preparation for them, and also simply because people with high mobility with respect to long-distance personal vehicle travel may tend to have a high local mobility as well (due to some third party variable such as an occupation requiring a lot of travel of both kinds, a general liking for both kinds of travel, or a high income supporting higher mobility in both realms).

The other variable representing the complementarity effect involves travel liking directly. In this case, a high travel liking for long-distance work- or school-related travel is associated with a high subjective mobility for short-distance work- or school-related travel. We hypothesize that the liking for the one form is somewhat transferable to the other form, leading possibly to greater short-distance objective mobility in that category (and hence greater subjective mobility) or to an enhanced awareness of short-distance travel in that category, or both. A similar effect is postulated by the excitation-transfer model of Zillman (1971), in which the arousal caused by one stimulus could be, under some circumstances, associated in an individual's

mind with another stimulus. (It is also possible that long-distance and short-distance travel in the same category are being confounded, as in category 11, although none of the other examples of that mechanism involved travel liking.)

Finally, category 13 offers an example of the *availability heuristic*. This variable (number of people in the household) also appeared in category 3, where we suggested that it was a marker for family-related issues. Here, the argument is simply that, irrespective of any implications for scheduling complexity, the mere fact that household members are important and often in mind means that they are likely to influence the respondent's assessment of mobility.

Factors That Diminish the Mobility Assessment

Table 5 presents the nine mechanisms that, we postulate, *reduce* subjective mobility. Two are affective factors, six are comparison-inducing factors, and one is an awareness-diminishing factor.

Affective factors. Category 1 represents the general *burden reduction* mechanism. Note that this is the opposite-direction counterpart to the *burdensomeness of travel* (category 2 and other special cases) mobility enhancing mechanism identified in Table 3; that is, if factors emphasizing the burdensome aspects of travel magnify its subjective assessment, then factors mitigating those burdensome aspects can diminish its assessment. Such factors can include a liking for travel, as illustrated by four variables appearing in five models, such as a liking for airplane travel reducing one's perception of the amount of overall long-distance travel.

However, factors other than travel liking can also serve this subjective mobility-diminishing role. The *vehicle comfort or convenience* category 2 is a special case of the burden reduction mechanism that also has a counterpart in category 4 (*vehicle inconvenience*) of Table 3. These two categories together attest that the "right" vehicle can make travel less onerous.

Comparison-inducing factors. The next six mobility-reducing mechanisms all involve comparisons (perhaps subconscious) acting to diminish the mental weight of the type of travel being modeled. A variety of types of comparisons is supported: to other people, to oneself in the past, to an ideal or preferred state, and across related categories of activity or travel. For example, in category 3, *share of total mileage or perceptual balance*, the hypothesis is that the greater the actual amount of travel of one kind, the lower the perceived amount of travel of a different kind. In five of the eight

observed instances of this mechanism, it was entertainment travel whose perception was affected, suggesting that it is the type of travel most influenced by this type of mental comparison.

In the *relative deprivation* mechanism (category 4), the hypothesis is that a given current level of travel may not seem as high when compared to what others are doing (or are believed to be doing). Note that relative deprivation in other ways can act to enhance subjective mobility, as indicated by category 6 of Table 4. The next two categories may be special cases of the relative deprivation mechanism. In the *comparison to past* mechanism (category 5 of Table 5), the interpretation is that a given current level of travel may not seem as high when it is compared to higher levels in the past (previous analyses of these data have indicated that for most of the sample, the continuous years in the United States variable serves as a proxy for age, which was otherwise only measured in ordinal categories). And one example of the related *perceived mobility constraint* (category 6) was identified by arguing that for some who want more long-distance air travel than they are currently doing, the presence of school-age children can serve as a constraint that makes their actual amount of air travel seem less (either by comparison to peers without children or by comparison to one's ideal amount of such travel) than it would without the constraint.

An individual may satisfy her needs for a particular kind of travel (e.g., social or entertainment, in our case) by engaging in an alternative sort of travel (here, grocery shopping—suggesting the substitution of in-home for out-of-home socializing and entertainment), thereby having a reduced perception of her mobility in the first category. This mechanism, referred to here as the *substitution effect* of category 7, has then strong objective mobility roots. Note, therefore, that the engagement in, or liking for, travel of one kind can either enhance (as in the case of the enjoyment, burdensomeness, confounding short distance and long distance, confounding similar purposes, travel saturation, complementarity, and competing preferences mechanisms of Tables 3 and 4) or diminish (as in the case of the burden reduction, share of total mileage or perceptual balance, and substitution effects of Table 5) one's assessment of the amount of travel of another kind.

The two instances constituting category 8 have at least two possible explanations, which cannot be distinguished empirically in the current study: *cognitive dissonance reduction or rationalization*, and *group distinctiveness enhancement*. The attempted reconciliation of dissonant attitudes and behaviors is a rich area of study in psychology (Festinger, 1957; for a recent example of research in this area, see McKimmie et al., 2003). In the current context, we suggest that individuals could adjust their perceptions of their

mobility to be in concordance with their attitudes or lifestyle. Thus, for example, someone who sees himself as a workaholic may tend to downplay the recreational travel that he does, as inconsistent with his self-image. Similarly, someone who is proenvironmental may want to minimize her perception of her discretionary travel because it could be perceived as frivolous. Without labeling it separately, a similar type of effect in the opposite direction was identified, in which we suggest that the positive impact on subjective mobility of being an adventure seeker or excess traveler (see category 1 of Table 3) may be due in part to responding to the relevant questions in a manner congruent with one's self-image. On the other hand, the same effects could be due simply to individuals who self-identify as workaholics or proenvironmentalists wanting to heighten a perceived distinction (on the amount of one's entertainment/social/recreational travel) between themselves and nonmembers of those groups, per Hornsey and Jetten (2004).

Awareness-diminishing factor. Finally, category 9, *reduced travel awareness or anticipation of destination*, is illustrated by the single variable, educational background, appearing in the models for short-distance overall and commute travel. Our interpretation is that a higher education makes possible more interesting and self-actualizing jobs, so that commuting to or from such a job is viewed as less burdensome because of the compensating rewards that it offers. Thus, this interpretation is based on the idea described in the section discussing affective factors, that intrinsic motivation lessens one's perception of an activity as being burdensome, where the (potentially burdensome) activity of commuting is combined in the individual's mind with the (intrinsically rewarding) activity of work that commuting is conducted to enable.

Summary and Conclusions

Drawing on diverse psychological and marketing research concepts, this article presents and discusses a variety of postulated mechanisms by which one's actual travel is mentally magnified or diminished in the formation of subjective assessments of mobility. Here, *subjective mobility* is defined as a qualitative measure of the amounts individuals think they travel (in various categories), captured on a 5-point ordinal scale anchored by *none* and *a lot* (hence, e.g., "my commute travel is 'a lot'"), whereas *objective mobility* is defined as the actual (reported) amounts individuals travel (e.g., "I commute 35 miles, which takes me 50 minutes, each way to work every

Table 5
Summary of Mechanisms Diminishing Subjective Mobility

		Dependent Subjective Mobility Variable Modeled																			
		Short Distance					Long Distance														
Postulated Mechanism	Explanatory Variables Representing This Mechanism	Overall		Work or School		Entertainment		Personal Vehicle		Overall		Work or School		Entertainment		Personal Vehicle		Airplane			
		S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	
Affective factors (Burden reduction)																					
1. Burden reduction	Travel liking ^{a,b}	S	S							L	L									L	
2. Vehicle comfort or convenience	Vehicle type ^a	•		•																	
	Year of personal vehicle		•																		
	Percentage of time a personal vehicle is available	•																			
Comparison-inducing factors																					
3. Share of total mileage or perceptual balance (comparison among travel categories)	Travel distance ^a																				
	Commute time		L							S,L-A											
	Personal income													•							
4. Relative deprivation (comparison to others)	Percentage of time a personal vehicle is available ^c																				•
	Personal income													•							•
	Workaholic factor score													•							•

day”). Using data collected from 1,358 San Francisco Bay Area commuters, a previous study (Collantes & Mokhtarian, in press) modeled subjective mobility for 10 categories of travel, as a function of objective mobility and a variety of other variables including travel liking and other travel attitudes, personality, lifestyle, mobility limitations, and sociodemographics. In this article, we conduct a meta-analysis of the patterns of results seen for the impact of those other variables on subjective mobility, controlling for objective mobility; that is, for the same amount of actual travel, why do some people magnify their subjective evaluation of how much they travel, whereas others diminish their evaluation?

We classified the key types of postulated mechanisms into three categories: factors that simply heightened or reduced one’s awareness of his travel amounts, factors prompting a comparison of some kind (e.g., of oneself to others, or to oneself in the past, or to an ideal or desired state), and those involving an affective (liking or disliking) response to travel. The affective factors were especially prevalent, appearing in all 10 of the models, usually in multiple ways. The form of the relationship was also interesting: The evidence mostly supported a quadratic, or “affective intensity” relationship, in which elevated levels of affect in either direction (liking or disliking) had a positive impact on subjective mobility. Thus, seeing travel as either a burden or a pleasure tended to increase its subjective weight. However, we also found several instances in which a liking for travel was negatively associated with subjective mobility, supporting the alternative “affective asymmetry” hypothesis.

The policy implications of this work are indirect, but nonetheless relevant. Other analysis of the same data set (Choo, Collantes, & Mokhtarian, 2005) has found that relative desired mobility (RDM, a 5-point ordinal measure indicating the desire to travel *much less* to *much more* than currently, in the same mode- and purpose-specific categories as subjective mobility and travel liking) is positively influenced by travel liking, and negatively influenced by subjective (and objective) mobility; that is, the more people *like* to travel in a given category, the more they want to increase (or the less they want to decrease) their travel in that category, and the more they *think* they travel, the less they want to increase it. Thus, as hinted in the beginning, someone with a high subjective mobility is likely to be more receptive to policies that are intended to reduce travel. Although this relationship is logical, the current study shows that it is also more complex than originally envisioned. Combining the direct impact of travel liking on RDM with its indirect impact through its quadratic⁷ relationship to subjective mobility, we can see that low levels of travel liking will strongly

tend to reduce RDM (directly and through elevating subjective mobility, which in turn reduces RDM), whereas high levels of travel liking will have a weaker total impact that is ambiguous in sign (because the direct impact is positive, but the effect on subjective mobility is also positive, which then has a negative impact on RDM). This suggests that it might be important in future studies to segment the population into those with positive, negative, and neutral affective beliefs about travel.

The application of various concepts from psychology and consumer behavior research to our findings is *post hoc* but does suggest a host of interesting questions for further research. For example, social comparison theory might ask, are commuters more likely to compare themselves to those they live near, or those they work with? Are travel amount comparisons made in isolation, or considered with the trade-offs made in housing size and cost? The manners in which feelings of relative deprivation may manifest themselves in the face of transport policy efforts are intriguing. For example, the model results suggest that if individual A shares a car, he assesses his travel to be less than individual B, who travels the same (objective) amount but is the sole user of her car. Will individual A increase his travel if he eventually has sole use of an automobile? Will individual B feel deprived if policy makers encourage her to share a vehicle? In general, studies linking these psychological concepts more specifically to attitudes toward travel, especially subjective mobility, would be valuable.

Another extremely interesting direction for future research is to explore more systematically the relationship between actual and reported distance. Measures of "actual" distance in the current study were self-reported, which inevitably introduces some error into the measures of objective mobility. Global Positioning System (GPS) devices (e.g., Pendyala, 2003) are beginning to enable the cost-effective collection of accurate data on actual travel amounts, on a scale that has been prohibitively expensive before now. The ideal study would compare reported travel amounts and subjective mobility to externally obtained measurements of actual travel (and to the network-derived "shortest paths" that travelers are assumed to take) and analyze the differences as a function of demographic, attitudinal, and other variables similar to those employed here (for an example of such a study in the area of route choice, see Parkany, Aultman-Hall, & Gallagher, 2006).

Finally, these and other analyses of the current data set have highlighted the interrelated nature of the key variables measured with the current survey (e.g., the direct and indirect impacts of travel liking on relative desired mobility). Future studies using the same data will involve structural equations modeling as a means of sorting out multiple causal relationships, with further refined insights into travel attitudes and behavior expected to result.

Notes

1. The only other one we are aware of is the unpublished, Hebrew-language dissertation of Ramon (1981), which provided partial inspiration for the multifaceted study of which this article is one component.

2. There is also a literature on the role of affect in perceptual judgments, which is at least peripherally relevant. For example, Kitayama (1990) referred to “perceptual reduction” and “enhancement,” meaning decreases or increases in perceptual accuracy depending on affect. However, the perceptual judgments in those studies are typically short term, highly concentrated activities such as identifying a word flashed quickly before the respondent, not the summary type of judgment about one’s general travel amounts that is our concern here. Nevertheless, the key principle of that literature, that affective beliefs influence cognitive judgment, is certainly applicable here.

3. *Long distance* was defined to respondents as trips greater than 100 miles one way, a threshold consistent with the American Travel Survey (available at www.bts.gov/publications/1995_american_travel_survey/index.html) in use at the time of data collection.

4. In the case of distances for long-distance trip types, there is yet a third source of distortion, arising from our mapping of reported numbers of trips in different world areas to approximate distances.

5. Although ordered probit models would be more theoretically appropriate in this context, regression models were presented, mainly because they allowed us to better explore and quantify the relative importance of objective mobility as a determinant of subjective mobility, using the decomposition-of-sums-of-squares aspect of R^2 . Although we could have presented a similar set of outcomes using log-likelihoods and/or pseudo- R^2 measures for ordered probit, such measures are less well known and less well understood than R^2 s for ordinary least squares, and there is not unanimity with respect to the optimal measure. An ordered probit version of the short-distance commute model is presented in Ory et al. (2004), and ordered probit versions of the other models were in fact estimated. In keeping with the reputation of linear regression for being robust with respect to departures from its technical requirements, there were essentially no differences in the interpretation of the regression models and their ordered probit counterparts.

6. A high score on the travel freedom factor represents strong agreement with the statement, “In terms of local travel, I have the freedom to go anywhere I want to,” and similarly for “long-distance travel.”

7. As discussed in more detail in Collantes and Mokhtarian (2006), quadratic travel liking terms were significant in only 3 of the 10 final models for subjective mobility. However, given the extensive presence of other variables representing the pleasure and the burdensomeness of travel, both types having a positive impact on subjective mobility, it seems reasonable to conclude that in broad terms, the impact of affective indicators of travel on subjective mobility is essentially quadratic.

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