Scope and Potential of Interactive Stated Response Data Collection Methods

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The scope of the growing number of interactive data collection methods directed at transport user response in future situations is reviewed. A brief introduction is given to the application of these methods under both the utility-maximization framework and a series of alternative assumptions about travel choice proposed by Garling. It is suggested that the term most used in this domain of transport surveys, stated preference (SP), should be reserved for a particular subset of a diverse body of techniques that deserve a new nomenclature under the general term stated response (SR). A taxonomy of four classes of SR approaches according to whether constraints or behavioral outcomes (or both) are predefined rather than elicited in the survey designs is presented. In view of the considerable existing literature on conventional SP, the discussion focuses mostly on the other SR approaches. Examples of these approaches are given from travel survey research, as well as some broad guidelines for the selection of techniques and some directions for further research

The label "stated preference" (SP) has been increasingly applied since the 1980s to various ways of surveying user response to hypothetical travel attributes and choices, thus distinguishing them from "revealed preference" (RP) surveys of actual travel patterns. Such techniques have generated considerable methodological debate in recent years, and this has spilled over to metropolitan planning organizations and others who must decide how to assign limited resources to new data collection, especially in the context of the requirements of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA).

Charged with anticipating change, many transportation planners are faced with a dilemma: whereas they may have a strong sense that it is not enough to observe current travel patterns, many are suspicious or unsure of what the SP tool kit may measure. The waters are further clouded by confusion over the word "preference," which has its roots in the early preoccupation of these methods with responses to alternatives, presented in surveys, in which the attributes of journeys (such as fare or travel time) were varied according to a predetermined design. In the SP workshop of the Third International Conference on Survey Methods in Transport, the comment was made that "stated response" (SR) might be a more accurate general term (*1*). I agree, and in the remainder of the paper, SR is used as the generic term, still referring to SP as it is used in the (largely econometric) literature on this subject.

In this discussion paper, it is suggested that (*a*) the notion of stated preference/response translates into many different data collection techniques and strategies, (*b*) the term SP should be reserved for a particular subset of techniques mainly used to estimate utility functions, and (*c*) SP data collection may or may not be necessary or sufficient, depending on which aspects of future choice are of interest and what time horizon is specified. The dimensions of transportation policy that are creating the demand for SR type data are examined, and an attempt is made to scope and classify these data collection techniques. Because much of the recent variety in SR is found in interactive data collection methods, these are the focus of the paper Examples of the various classes of interactive stated response (ISR) are identified in such policy areas as congestion pricing, the potential use of electric vehicles, and energy contingency planning. Recommendations for considering ISR in data collection strategies are made, and some priorities for the research agenda are suggested.

The mandate for this discussion paper was to take a broad view of interactive SR methods. Current issues in SP experimental design and analysis techniques are discussed by Polak and Jones (*2*). The fact that most of the discussion in this paper goes beyond the "mainstream" of SP should not be interpreted as a dismissal of its usefulness.

Policy Planning Context for Stated Response Data Collection

Fundamentally, SR techniques are needed where information is sought about user responses to new situations These may vary from highly specific situations, such as a change in a single supply characteristic (e g , the frequency of a given bus service), to very comprehensive situations, such as the policy packages that might be used to improve air quality in a metropolitan area. The planner is, moreover, interested in alternatives, so the survey must provide the means of comparing different scenarios or versions of the potential change. Considering hypothetical alternatives is attractive from a sampling efficiency perspective Each individual provides multiple sets of responses, each of which would require a different respondent if the survey were directed instead to "revealed" choices in a particular policy context.

Four dimensions of transportation planning policy in which SR may play a significant data collection role are discussed now, leaving methodological details for later sections of the paper.

Infrastructure Investment

Many of the well-developed SP techniques for collecting and analyzing data have addressed the benefits of infrastructure investments, notably through reducing travel time. An important objective has been to discover the monetary value of time for use in cost-benefit analyses of alternative investments. In the current investment climate, it is becoming increasingly important to discover the distribution of values of travel time and not just the mean values (*2*). However, the implicit idea is that the various components of travel time (walking access time, waiting time, in-vehicle travel time, etc.) have associated average levels of perceived satisfaction or utility, which the survey must measure. The planner may also want to know how the user trades off travel time against other transport supply attributes, such as the comfort and availability of seating or the reliability of information. Thus a major objective has been to develop models that predict choices in the presence of changed levels of attributes, under the assumption that individuals maximize their utility. Modeling utility functions for attributes is a major contribution to evaluating competing potential infrastructures or competing features of particular infrastructures.

Evaluating Novel Interventions

The introduction of a novel transport service or the building of an entirely new road are, of course, also investment decisions. But in common with regulatory innovations, such as con-

gestion pricing, they add another element to the difficulty of data collection: respondents are now being asked to consider situations that not only do not yet exist but of which they have little or no experience. Consider the case of proposals for a new river crossing that alters the time-map of a whole region, or for the provision of a driverless light rail system. Here the survey researcher faces the challenge of evaluating responses in the light of an image constructed partly from information supplied by the survey instrument and partly from the highly variable impressions respondents carry from other situations.

One of the problems of novel interventions is that adaptive responses by users may be very complex. This is particularly so in the case of unfamiliar technologies, such as intelligent transportation systems, telecommuting, or limited-range electric vehicles, the use of which may have implications for the linking of activities between travelers within or even between households. Responses to interventions affecting car use also tend to be complex because of the inherent flexibility of the mode. A further complexity is that transport innovations may be packaged with other products, such as hotel accommodations in the case of tourist travel

Lowering the Risk of Strategic Planning

Here we must consider the data needs of planning with long time horizons to meet broad objectives such as sustainability, quality of life, or regional competitiveness In fact, understanding the time horizon of anticipated changes is one of the most important steps in the specification of appropriate SR survey techniques. As noted in a recent overview of SP methods (2), longer-term horizons mean that structural changes can be contemplated by respondents. These changes may be in demography, life-style, or the economy, not just in the transport system. We may be very far from forecasting travel demand over long horizons, but nonetheless there is a need to imagine how travelers may respond to alternative futures envisaged by such planning policies as housing redensification, car restraint in historic city centers, demand restraint in nonattainment air quality districts, or the introduction of an open-skies policy in the regulation of the airline industry. A fundamental problem in the design of SR surveys is the instability of stated responses projected over a long period during which responses are likely to change as a result of accumulated experience. It is suggested later in this paper that such learning processes should themselves be one of the targets of data collection

Emergency Planning

Transport planners are increasingly expected to help reduce the negative impacts of such temporary situations as the aftermath of natural and industrial disasters, public transport strikes, energy supply disruptions, and critical periods of air pollution. As in novel interventions, the survey researcher may face the double difficulty of assessing hypothetical responses under unfamiliar conditions, but the social and political contexts are very different. Emergency situations are sometimes the subject of contingency planning, a process to which SR surveys have contributed. In addition, actual emergencies may provide valuable opportunities for experimentation of a type that would normally be unthinkable, a point to be discussed later.

Scoping the Notion of Interactive Stated Response

Interactive methods are "generally taken to mean techniques which give explicit recognition to interaction between the interviewer and respondent(s) and attempt to use this positively" (3). In many cases, the interaction permits survey instruments to be modified or customized in the field on the basis of the characteristics, initial responses, or revealed behavior of respondents.

Predominant Uses of Interactive SR Methods in a Utility-Maximizing Framework

Most classifications of SP methods distinguish between surveys in which respondents rank or rate packages of attributes and those in which they are asked to choose between behavioral outcomes. Most of the SP literature takes for granted that these two main classes of data are to be specified and analyzed within a utility-maximizing framework. It is therefore to be expected that interactive SP methods are predominately proposed to improve the input to utility-based models. A detailed review of the relevant design issues is beyond the scope of this paper, but we should be aware of the growing contribution of interactive methods to answer three major concerns.

The first is that the quantification of preferences and choices will be invalid, or unreliable, if respondents are overburdened Respondents cannot reasonably be expected to consider, without fatigue, all possible combinations of packages. Because full-factorial experimental designs are feasible only for very limited problems (i.e., those with few attributes and few levels to be presented), much attention is given to the specification of fractional and hierarchical designs. There are numerous examples in the literature of the advantages of relaxing completeness or orthogonality in the interests of package realism or to tailor boundary values (*4*). Thus, much emphasis is now placed on what is generally called "adaptive" designs, and in particular the development of interviews using portable computers. A very useful discussion of the principles of such designs is given by Bradley (*5*). These may be programmed to generate preference or choice packages relevant to a "revealed" base, usually the respondent's situation or the attributes of the current journey. It is also possible to include screening questions about key values in the process. There are, however, some risks, including nonorthogonal estimation data, problems with respondents with extreme preferences, and possible bias from correlations between the levels of design variables and the unmeasured components of utility (*2*).

A second concern is that respondents may vary in their willingness and ability to cooperate with SP tasks Some trivialize the tasks presented. Even those who cooperate may, as Bates (*6*) puts it, "choose 'paths' through the task which do not correspond with the decision rules used by the analyst." It is also possible, in principle, to use computer-aided interactive interviews to detect poor cooperation and to use branching or interview termination in these cases. Obviously, we should then question how much sampling bias we are willing to introduce However, it may be even more important, as Bates points out, to use another interactive technique—debriefing of respondents—to investigate how they interpreted the instructions for the task and how they viewed the exercise. Regardless of the degree to which respondents apparently complied with the instructions, it is particularly important to find out how much they may have temporarily changed the way they make decisions to complete the exercise.

A third major concern is the degree to which a respondent has an understanding of the contexts of stated preferences that is largely shared by all other respondents and correctly interpreted by the researcher. This is particularly troublesome in that context-dependence may underlie a number of observed discrepancies in the valuation of attributes, notably the "package effect" (*2,6*). In this effect, SP analyses typically suggest lower valuations of secondary attributes (such as comfort) when they are presented as part of a package including primary variables (such as fare) than when they are treated independently in an experimental design. There is a potential role for interactive methods to examine the perception of contexts explicitly in a pilot phase of an SP survey. This is an important example of a data-collection strategy involving more than one type of SR, a development illustrated later.

To summarize, these three concerns from SP, as practiced within the utility-maximizing framework, have served to introduce a number of key elements of interactive response techniques.

- The establishment of a revealed behavior base for an interview (this may involve travel or activity diaries administered and processed ahead of the interview);
- The "calibration" of SR instruments to the revealed behavior base, and possibly to initial assessments of boundary values;

- The elicitation of perceptions of contexts; and
- The debriefing of respondents about what they believed they were doing when responding to tasks and exercises as part of an SR survey.

We will now consider some alternatives to utility theory that require, among other things, extension of these elements.

Alternative Theoretical Frameworks for Travel Behavior

There has been a long debate in the travel behavior literature over the adequacy of the utility-maximizing framework as a description of how travel choices are made. The present purpose is not to take sides in this debate but to review the relevance of ISR methods to the data requirements of some alternative frameworks.

By the end of the 1970s, the part of the debate concerning measurement issues had benefited from a burgeoning of experimentation in transport survey and modeling methods. One consequence was a growing recognition that measurement should vary according to the complexity of the travel decision context. Heggie and Jones (*7*) organized decision contexts into four main domains with distinct empirical relationships and hence different possibilities for both modeling and measurement. The four domains were defined according to the degree of linkage or dependence between decisions along two dimensions: interpersonal and spatiotemporal. The four domains were identified as (*a*) independent, (*b*) spatiotemporally linked, (*c*) interpersonally linked, and (*d*) fully interdependent on both dimensions. The last two domains were subdivided according to whether the linkages functioned predominately within or between households. Of importance to the present discussion is that utility-maximization approaches are of limited applicability to the first domain, the domain of independent decisions, and that few utility-maximization solutions are known for the interdependent decision domains (the second, third, and fourth).

Three other illuminating reviews from this period, Brog and Erl (*8*), Dix (*9*), and Hanson and Burnett (*10*), lay out many of the measurement issues that are far from resolved a decade and a half later Brog and Erl had long been concerned that planners may focus on monitoring trips without regard to the evolution of underlying human activities. They argue that only interactive measurement can adequately relate current and future household travel decisions to the "situational" context out of which comes the factors determining the degree of flexibility enjoyed by household members. They caution about expecting socioeconomic variables to account for the situational context and suggest that a chain of "objective circumstances—personal perception—subjective situation—individual decision—behavior" must be reenacted to understand behavior Furthermore, this requires a comprehensive survey design using a variety of methods, some of which could observe the household members' efforts to reorganize their travel under hypothetical changes in transport supply and some of which should observe the household decision process in itself. Many emerging methods, such as gaming-simulation, offer worthwhile data, but no one method should be seen as "the" solution. They cite a number of applications of these ideas to understanding behavior without losing sight of the planner's need to estimate demand.

Dix contrasts the development of attribute-utility approaches and conjoint measurement (which was then emerging into utility-based SP) to other approaches such as attitude-based segmentation and activity-based interactive measures. He, too, draws attention to the notion of choice as a process rather than an event and lists the diversity of psychological concepts embraced by different travel behavior researchers during the 1970s: learning theory, habit formation, cognitive dissonance, satisficing, noncompensatory attribute-utility, arousal or curiosity seeking as a component of utility maximization, psychological response thresholds, and selective attention/information acquisition.

Hanson and Burnett focus on the measurement of travel as complex behavior in constrained situations, cover activity theory in much greater depth from a spatial perspective, and argue for "the flexible selection of methodological procedures for the problem at hand."

Both they and Dix elaborate on the critical insight that expressed choice is not the same thing as freedom to act, which gets to the heart of why the term "stated response" is more appropriate than "stated preference" for the class of survey methods that is the subject of this paper. If choice is a process, understanding behavioral outcomes under constraints requires dynamic measures of freedom to act. Hanson and Burnett thus emphasize that longitudinal panel data on activities are indispensable in the RP domain, whereas in the SR domain, both papers point to gaming-simulation as one promising new survey tool for exploring the dynamics of freedom to act under future conditions.

In the 14 years since the publication of these three papers, transport planning has continued, on the whole, to depend on surveys designed in the light of microeconomic theory and econometric methods At the same time, there has been a certain amount of development of transport survey methods built around behavioral concepts other than utility maximization, as well as considerable research on activity-based methods and decision processes, much of it in fields such as time-use research, organizational psychology, and consumer behavior. Some of these developments are discussed later, but to understand data requirements, the variety of behavioral concepts and assumptions that may be included in travel choice models must be introduced. Garling (*11*) provides a very useful review of alternative behavioral assumptions that places many of the concepts raised in the 1970s into the context of a wide range of recent behavioral research. In essence, these are the interdependency of "planned" decisions, information acquisition/representation/use and its relationship to planned behavior, the variety of heuristic and reason-based decision rules used by travelers, the potential for social factors to constrain egoism, and the process of implementing and maintaining choices.

Scope of Interactive SR Methods Under Alternative Theoretical Frameworks

At this point in the discussion, a transportation planner faced with writing a request for proposals to collect new data on potential changes in travel behavior might feel some despair over how to translate the plethora of behavioral concepts into methods applicable to policy analysis imperatives such as air quality and demand management. To the extent that travel choice is conceptualized as a dynamic and complex social-psychological process, much of the research needed to formalize the generalizability of our analyses may still be incomplete long after the current information requirements of the ISTEA and Clean Air Act regulations have been answered. After all, travel behavior modeling has made only limited progress in this direction in the past two decades.

Nevertheless, it would be a mistake to focus that part of new data collection concerning future behavior only on those attenuated problems compatible with current state-of-the-art, SP-based predictive models. Unless a foundation of data is built on which explanatory models of more complex behavior can be developed and that knowledge is used to validate the simplifying assumptions underlying most current SP, the credibility of all SR tools will be in doubt. Part of that validation will come from the simultaneous application of different instruments, and multi-instrument data collection strategies may offer more than the sum of the parts in travel behavior measurement. But criteria are needed for specifying a balance on the scales of specificity-comprehensiveness, prediction-explanation, and quantitativeness-qualitativeness to select the optimal set of survey methodologies in a particular policy environment. As a first step, in the next section of this paper, a schema for distinguishing four main types of SR survey is presented. However, the broad implications for survey methods of the major alternatives to the utility maximization framework must be examined To do this, Garling's five areas of alternative behavioral assumptions (*11*) are followed.

1. Interdependency of "planned" decisions: Garling puts the emphasis on problem-solving theories of decision making and suggests in particular the use of production-system models of how people plan Such models include metadecisions about how much to plan and under which guidelines. He argues that these metadecisions and external circumstances are more important than usually believed. In surveys of response to future contexts, this appears to require some sort of problem-solving exercise by respondents. Clearly, a key design pa-

rameter is the complexity of the interdependencies pertinent to the issue at hand. For this, a good point of departure is Heggie and Jones's domains of decision contexts (*7*). Such problem-solving exercises should also be interpreted in relation to previously used decision rules in contexts of comparable complexity (see Item 3).

2. Information acquisition/representation/use and its relationship to planned behavior. This area is mostly about the formation and imaging of choice sets. To explain choice, we need to know what kind of information respondents select and seek when a choice must be made and try to characterize the cognitive representation of that information. Part of this is "environmental" perception—of the location, nature, and usefulness of destinations. Another part is the perception of risks of various outcomes associated with a trip on a particular day, at a particular hour, and under a particular amount of time pressure, such as car accidents or arriving late for work.

Garling points out that risk and uncertainty are mostly ignored in travel choice modeling. Part of our work at Université Laval on exposure to accident risk concerns how car drivers form, image, and test travel choice sets in the face of perceived risk, external constraints, and dysfunctional conditions. This follows up a proposed conceptual model of opportunity sets known as the operating envelope, which has guided a variety of SR survey methodology experiments with car drivers (*12–14*). According to this model, data collection should focus on the circumstances under which individuals seek information on options that are outside their day-to-day experience and on the learning brought about by both intended and unintended novel behavior.

The importance of the time horizon of anticipated travel changes in the specification of appropriate SR survey techniques was noted earlier. This issue is central to information and learning processes. For example, evaluating travel options following a commitment to a new home location should have different information requirements from coping with a 1-day strike at the day-care center, and it is to be expected that there is much more for an individual to learn, including about interdependencies, in the former case. Focusing on learning and information processes associated with long-term decisions is also one response to the concerns, such as those expressed by Polak and Jones (*2*), about the temporal stability of findings from SP methods.

3. The variety of heuristic and reason-based decision rules used by travelers: Garling cites a number of theories supporting the use of different and perhaps multiple decision-making rules and suggests that the choice of rule may vary with demands such as time pressure, information overload, and desired precision. Examples include satisficing (conjunctive decision rule), choosing on the basis of a dominant attribute (lexicographic decision rule), elimination by aspects, frequency of good and bad features, expected utility, additive utility, and weighted additive utility. Utility maximization is thus a necessary but not sufficient source of rules. Decision theorists have categorized rules in a number of ways helpful to the design of data collection. For example, Payne et al. (*15*) distinguish between compensatory rules involving trade-offs (including trade-offs of utilities) and noncompensatory rules such as satisficing. Note that the term "rules" is also applied in a much more narrow sense to such decisions as, "If I anticipate having to carry heavy shopping, then I will take the car." These are also the type of rules that are captured in knowledge-based systems (KBS).

Even though the manifestation of noncompensatory rules (notably the lexicographic rule) is often noted in SP studies, it is not conventional to make the observation of selected decision rules an objective of data collection. The elicitation of rules presents substantial methodological challenges. However, the notion of plans (see Item 1) includes metadecisions about which decision rules are applied in given circumstances. This suggests that we should at least try to infer some "rules for the use of rules" from surveys that track and then characterize respondents' actions, both in recent "revealed" behavior and in simulations of new choices. In the case of relatively narrow decision contexts, it may be possible to build up an understanding after eliciting detailed if-then rules, perhaps using KBS methods.

A number of relevant survey methods based on simulation games collect data on revealed behavior over a reasonable period using travel-activity diaries and use these to tailor and calibrate a problem-solving exercise. "Calibration" in such methodologies refers not to model

calibration, but to establishing shared meaning between respondents and interviewers concerning the nature and quantity of resources available to solve problems, in some cases setting limits analogous to boundary values in the utility framework. A particularly promising variant involves such tracking and debriefing during a period of field experimentation, such as a trial high-occupancy vehicle lane or a "natural experiment" created by emergency conditions such as a transit strike or the aftermath of an earthquake. As suggested in Item 1, when interpreting simulated metadecisions in the light of rules observed from a period of revealed behavior, it is important to ensure not only that the calibration is realistic but also that the complexity (i.e., the degree of interdependence) of the decision domains is comparable.

4. The potential for social factors to constrain egoism: We need to take into account the possibility that people are influenced by the collective consequences, or the individual outcomes of the collective consequences, of their decisions. Garling suggests that we explore social dilemmas in transport, and he has developed instruments to study the "commons dilemma" around the environmental impacts of personal car use (*16*)

It is particularly important in this area to use highly interactive methods to test the credibility of stated responses, because respondents may offer inaccurate views of their intentions when presented with hypothetical opportunities for altruism. For practical purposes, data are mostly collected from simulations of social dilemmas or situations in which a change in individual travel behavior would contribute to a common benefit such as reduced air pollution. Relevant examples include game-based surveys of potential voluntary responses to energy shortages (*17*) and the adoption of low-polluting vehicles (*18*).

5 The process of implementing and maintaining choices: The last of Garling's categories of alternative behavioral assumptions concerns the propensity to act in accordance with decisions and to persist in that behavior. Here we are not concerned with expressed preferences versus freedom to act, but with the potential for a realistic choice to fail in its execution. The data we should seek here concern the limits of the context within which the individual considers a given behavioral response to be tolerable. This is the inverse of the pro forma question behind much of SR· How would you act in the following situation? Interviews are highly desirable for such explorations of the limits of contexts for carrying out intentions.

Maintaining a choice may involve other mechanisms. "Automatization" may explain why some behaviors persist without a deliberate decision to continue, or even beyond a time when the behavior has come into conflict with the individual's attitudes. Automatization implies that more advantageous alternatives are not evident or salient enough to be evaluated, and so the mechanisms for changing persistent habits are closely related to information acquisition, representation, and use. Data needs around persistence are thus substantially the same as those discussed in Item 2.

In concluding this rather cursory discussion of data needs for understanding travel choice under alternative conceptual frameworks, the following conclusions can be drawn·

- Interactive measures methods promise to play a dominant role in all of the areas of alternative behavioral assumptions.
- A broadly defined activity base is essential wherever the interdependence of decisions is high.
- The importance of processes rather than states implies the need for tracking, gaming-simulation, and experimentation.
- There is a need for some SR methods to elicit and not to simply hold constant many factors related to decisions.

The last point leads directly to the taxonomy presented in the following section.

Taxonomy of Stated Response Approaches

It is evident that the SR tool kit includes a wide range of existing and potential techniques. The selection of suitable SR methods in any given policy context is, of course, dependent on

many situational factors such as budget, political sensitivities, and desired levels of representativeness and accuracy. Nevertheless, transport planners must also make judgments about the pertinence of different approaches to measuring traveler responses to new situations, and it is time to adopt a nomenclature that is in pace with methodological developments In particular, after barely a decade of its inclusion in the language of transport, there is much variation in what "stated preference" is assumed to encompass. A simple schema that assigns the term SP to only one of four classes of SR survey approaches is proposed here This is a classification of the content of measures, not of method. Each approach can be implemented by a variety of methods, although there are prevalent methods associated with particular classes.

Defining the Basis for Classification: Degree of Open-Endedness of Behavioral Outcomes and Constraints

In developing SR techniques, a central design issue is the degree to which responses to predetermined choice vectors and packages are sought. There are two main groups of variables to consider: the behavioral outcomes and the constraints on behavior. The term "behavioral outcomes" refers to what travelers might do, such as changing departure times, modes, vehicles, destinations, and so forth. These can persist within a single trip for the short or long term. Constraints may be made up of many attributes, most of which are external or environmental, but some of which are internal or personal The composition of external constraints includes transport supply attributes (such as price and level-of-service variables, which may vary by time of day and day of week), resources, temporal-spatial attributes of destinations, intra- and interhousehold schedule linkages, obligations, contracts, social and religious norms, traffic laws and regulations, and many others. Internal constraints include but are not limited to functional abilities, propensities to transient disorders, addictions, perceptions of risks, fundamental values, ethics, and adherence to taboos Constraints can also be viewed as the components of decision contexts.

The classification of SR suggested here depends on whether behavioral outcomes or constraints, or both, are mostly elicited (i.e., measured in an open-ended manner) or mostly given in the course of data collection. Hanson and Burnett (*10*) argue for new techniques eliciting both at once. Elicitation may be undesirable (e.g., in factorial SP designs) or desirable (e.g., in gaming-simulation), but it results in very different types of measurement. Eliciting constraints is less familiar than eliciting behavioral outcomes in transport surveys, but it has a long history as a design choice in applications of simulation-gaming that are intended to explore processes Also, in the main tradition of travel behavior modeling, outcomes are viewed as dependent variables and constraints as independent variables. From that perspective, eliciting constraints is more radical than eliciting outcomes, and eliciting both makes causal inferences more difficult to test.

Taxonomy

Figure 1 summarizes the four approaches. Although names have been given to each of the cells, elicitation is not a binary choice but a matter of degree, and therefore the categories are tendencies with areas of overlap on both dimensions. Also, it is expected that more than one of the four approaches will be used in some instrument packages, and this is desirable. In each cell the focus of measurement and a "template" or prototype question to clarify the type of information sought are shown. Of course, these are not the actual wordings of questions but rather the essence of the approaches.

The foci of measurement are believed to be best suited to the four quadrants, related to the increasing open-endedness of responses and constraints moving toward the bottom and the right. The number and variety of responses per respondent also increase in these directions, and thus smaller (but higher-quality) samples are appropriate Nevertheless, as survey and analysis techniques develop, it is possible that some types of information will be found in

BEHAVIOURAL OUTCOMES	CONSTRAINTS (expressed as attributes: personal/household/social/spatial/supply, etc) — *Mostly given*	CONSTRAINTS (expressed as attributes: personal/household/social/spatial/supply, etc) — *Mostly elicited*
Mostly given	**STATED PREFERENCE** (focus = tradeoffs, utility) *"Given the levels of attributes in these alternatives, which would you prefer: [A]. .? [B] . . . . ? etc ....."*	**STATED TOLERANCE** (focus = limits of acceptability, and thresholds for change) *"Under what circumstances could you imagine yourself doing: [r1].....? [r2].....? etc . . . ."*
Mostly elicited	**STATED ADAPTATION** (focus = reactive and trial behaviour; problem-solving, rules) *"What would you do differently if you were faced with the following specific constraints· [... .detailed scenario]"*	**STATED PROSPECT** (focus = learning processes, information seeking, the imaging, formation and testing of choice-sets, metadecisions) *"Under what circumstances would you be likely to change your travel behaviour and how would you go about it [..broad context]*

FIGURE 1 A taxonomy of stated response survey approaches, showing "template" questions.

more than one quadrant. In the following discussion, existing examples of the four classes of SR are given, but this is as much a framework for developing new methodology as a way of cataloging available techniques.

Stated Preference

This term is reserved for approaches involving forced choices or trade-offs between predetermined options, whether those options are expressed in terms of packages of attributes or as behavioral alternatives in the face of given sets of constraints. Thus defined, SP surveys typically focus on a specific trip or on a repeated trip such as the journey to work. This use of the SP label is in keeping with most published definitions of SP (*19*) and is consistent with the predominant interpretation of the term. Stated preference surveys are the most important but not the exclusive source of future choice data for utility models. These approaches have made significant advances in the past decade and have gained increasing acceptance by policy makers. Current issues in this quadrant are discussed elsewhere (*2*).

Stated Tolerance

Moving to the right-hand column of Figure 1, respondents are no longer asked to respond to given levels or specifications of attributes, but rather to identify the nature and level of constraints comprising the limits of acceptability of behavioral outcomes. In this cell, the term "tolerance" is used to emphasize these limits for a set of particular, given outcomes.

Most applications of transfer prices, the forerunner of much SP work in transport (*20*), and of willingness to pay (WTP) belong in this quadrant. Transfer price data were also used in early applications of microsimulation to travel choice modeling, such as Bonsall's work (*21*) on organized car sharing.

Surveys limited to transfer prices or WTP are to the left of the stated tolerance (ST) quadrant, because it is possible to elicit many other types of constraint. Respondents may be asked to identify both the categories of constraint and the levels to which they are sensitive. In policy analysis terms, this is to suggest that ST can investigate a wide range of perceived barriers to and incentives for the adoption of specific behaviors. It is thus particularly relevant to the issues concerning the implementation of choices discussed earlier. The template question can also be phrased negatively, that is, "Under what circumstances could you imagine yourself no longer doing . . ." Whether approached positively or negatively, the purpose is to dis-

cover the ranges of constraints within which a particular behavior is likely to be tolerated, or threshold conditions for a shift to or from the behavior.

A related development with lessons for ST is the contingent valuation (CV) method. This has been used to assess preferences for environmental goods as well as to estimate—although not without controversy—appropriate compensation in the case of environmental disasters. In addition to its potential application to the environmental impacts of transport, an important disparity is revealed by CV studies. In general, the monetary compensation implied in a respondent's willingness to accept (WTA) a given loss in environmental quality is typically several times higher than the amount of the same respondent's WTP for an equivalent level of environmental improvement Moreover, this difference, according to Payne et al. (*15*), "appears much larger than can be accounted for by wealth effects " These authors raise a number of broader questions, including the role played by the provision of information to respondents and indeed "the extent to which any assessment technique such as CV creates values as much as it reveals them." These lessons suggest that it is much more valuable to explore sets of constraints associated with particular behavioral responses than to reduce everything to monetary values, but in doing this we need a design for the consistent provision of information during the survey

The potential of the ST quadrant to explore constraints other than price appears to have been neglected in transport surveys. Appropriate methods involve personal or telephoned interviews. Written instruments are feasible only for very limited constraint sets.

Stated Adaptation

In the bottom row, respondents are allowed to imagine for themselves how they would behave in the new situation of interest Stated adaptation (SA) is the inverse of ST and uses the much more familiar "what if" type of question. In this quadrant, the constraints are laid out in sufficient detail that, it is hoped, the range of adaptations—the behavioral outcomes—that respondents would be able and willing to carry out in such circumstances can be understood. As in ST, the number of categories of constraints can vary.

The definition of this quadrant technically includes the open-ended version of what was generally known in the 1970s as a stated intentions survey, consisting of elicited reactions to given changes in supply attributes. However, this has never been a very credible basis for assessing choice in future contexts, and the term "adaptation" in this quadrant has been adopted to imply techniques that also bring about the imaginary or experimental validation of reactive behaviors This requires simulated or actual trial behavior and the observation of the knock-on effects of behaviors—especially on established linkages. Ideally, data are collected on approaches to problem solving, the rules used, and the outcomes retained by the respondents. These are intensive techniques involving small, high-quality samples.

The best-known example of a simulation-based technique in this quadrant is HATS (*22*). For each participating household member, HATS uses a revealed travel-activity base from a 1-day diary, displayed on both a scheduling board and a map New constraints such as a change in school hours are given, and household members attempt to accommodate this into their schedules. Any modifications are validated against each individual's set of other salient constraints, including linkages to other household members in the new situation.

Two recent surveys involving this type of simulated problem-solving concern the impact on household travel of limited-range battery electric vehicles (BEVs) Both of these surveys (*18,23*) used a survey package to observe the impacts of the range and charging requirements of BEVs on the way multivehicle households managed their cars over a simulated 7-day period under a variety of scenarios. The work was carried out in California and the Rhône-Alps region of France, respectively, using derivatives of the Car Use Patterns Interview Game (CUPIG) (discussed later). Once again, a gaming interview is built around displays summarizing recently revealed behavior, and simulated choices are debated by household members affected and carefully validated for feasibility. In the California case, the SA survey (N = 51) was backed up by other surveys: semistructured interviews of people after test driving a BEV, interviews of very early adopters of BEV technology, and a medium-sized mailed

questionnaire survey about car use patterns and desired attributes in new vehicles, which was designed using insights from the SR survey.

Parallel SP/ST work in the United States to establish the utility or disutility of the BEV's range and charging requirements has suggested, in general, that cars would need to be sold at extremely discounted prices before people would buy them, even though a high percentage of the daily duty-cycles of automobiles fall within the currently feasible BEV range. It was hence assumed by some market analysts that only extremely "green" (ideologically ecological) market segments would be interested in changing their "second" car for a BEV. The SA surveys, however, provide clues to the manner in which adaptations to BEVs might be anticipated. It appears that in California the ideological green market is less significant than a market segment that would exploit the BEV as a complementary technology and not as a straight substitute for one of the household cars. The SA work in California also showed that the notion of a second car is not even a contemporary reality in most multicar households. Respondents in France, who were not facing California's regulation-driven market for low-emission vehicles, had their own views of how the BEV might fit into their future. The differences are interesting but beyond the scope of this discussion.

The key point is that the focus of SA on problem-solving provided important insights into how the market might develop on the basis of the uses imagined by respondents. It was not possible to quantify estimates of market penetration with this work, which is why SP/ST work on the attributes of BEVs was also undertaken. In California, the evidence from the SA work is different and more favorable to the eventual success of the BEV than the evidence from most of the SP work. The policy maker must weigh the evidence and avoid extreme interpretations that might arise from an ideological attachment to one approach or the other.

Another recent example of SA concerned hypothetical temporary citywide car-restraint scenarios, as well as permanent urban road pricing scenarios with and without the introduction of a new type of public transport service (*24*). This survey (N = 16) was in greater Lyon, France, and used some of the same visual aids to display the revealed base that the French BEV survey cited. Here the primary intention was to inform the design of a later SP survey on these two areas of policy. The interaction between the two policies was too complex for a one-stage SR design. The breadth of given contexts puts this study to the right of the SA quadrant, but its focus was clearly stated to be the observation of adaptations.

Some applications of Hoinville's priority evaluator (PE) technique (*25*) are SA approaches. In PE surveys, levels of predefined attributes are priced in a currency. Respondents are given an imaginary budget of this currency and asked to allocate it to the attributes and levels of their choice Ideally, the budget is calibrated (scaled) to the value of existing choices on the same attributes, and then the respondent is asked to adapt to a different budget. Although originally used to study trade-offs between amenity investments, budget allocation principles can be used to elicit behavioral outcomes and to study the use of rules For example, in the rationing stage of a game-based household interview about coping with a fuel shortage, Lee-Gosselin (*13*) used an accounting board to keep track of a fuel budget by activity category as actions were taken to reduce car use. In this case the budget was a percentage of the fuel actually used during a recent 7-day period for which activity patterns were recorded.

As mentioned in the discussion of alternative frameworks, actual trials of innovative supply constraints or various kinds of emergency may provide excellent opportunities to observe how travelers adapt to changes in constraints in situations that would otherwise only be feasible in simulations. An example of adaptation through telecommuting after an earthquake is described by Pratt (*26*).

Two more recent examples concern congestion pricing. An empirical SA approach was proposed in 1994 for a survey concerning the Bay Bridge (Oakland–San Francisco). The survey involved a trial visible only to respondents, who would be given scrip to pay for tolls under a variety of congestion-pricing schemes and whose choices would be tracked and then discussed in a series of telephone interviews (Applied Management and Planning Group, unpublished proposal to MTC for surveys in connection with the Bay Bridge Congestion Pricing Demonstration Program, 1994). Respondents would have to add some of their own money to maintain their previous levels of peak-hour crossings. A more sophisticated exam-

ple of this type of trial was implemented starting in late 1994 in Stuttgart, Germany (*27*). Using a prepaid debit card ("MobilPASS"), which is valid both for congestion pricing charges and for a combined transit and park-and-ride alternative, an automated record is kept of a user's choices and is subsequently analyzed relative to a peak-hour travel diary kept during a multimonth period. For the trial, the card is paid at the start of each month by the respondent in cash on the basis of the previous month's trip pattern. At the end of the month this amount is refunded, but any unused credits resulting from congestion avoidance accumulate and are paid out at the end of the trial. The payoff in the designs of both these pricing experiments is conducive to participation in the tracking survey.

The potential exists in all SR to validate simulated choices against actual choices on a disaggregate basis provided that it is possible to recontact respondents. This is particularly appropriate in SA simulations in view of the elicited outcomes and the recorded detail about how the adaptation came about. The interest is not just in the rate of adoption of the new behavior, but also the extent to which the observed relationship between activity patterns and the new behavior corresponds to that recorded in the simulation. Such validation is rare but can occur when a new transport service is introduced. For example, Bonnel (*28*) was able to compare respondents' simulated adaptations to a planned new tramway in Grenoble with their actual behavior 9 months after its introduction. On both occasions the use or nonuse of the tramway was examined in the light of data collected on activity patterns immediately preceding the interview day.

Finally, adaptive designs for SP may involve an SA stage. A well-known example is the Adelaide Travel-Activity Questioner (ATAQ), a computer-aided interview (*29*). The initial stage of ATAQ involved validating the feasibility of elicited behavioral outcomes against the activity patterns of the household. Outcomes that survived validation then became givens in an SP ranking exercise.

Before moving to the lower right quadrant, which is also the domain of much simulated and novel behavior, it is important to recognize that not all simulations of travel behavior have been conceived as SR surveys (i.e., the measurement of responses to future situations) As Mahmassani and Herman (*30*) point out, there is a hierarchy of strategies for the study of interactive dynamic systems, ranging from analytical models of idealized situations through simulation models, laboratory experiments, field surveys, and field experiments Various kinds of simulation, including HATS, have been used to better understand decision rules under prevailing day-to-day conditions and to observe adaptive behavior under changed constraints. The former use of simulation serves to develop insights and theories that should be applied to SR data collection. Mahmassani et al. (*31*) provide an excellent example of this. To track commuters' adaptations to congestion, they used a two-stage survey designed around insights into the mechanisms governing day-to-day switching of route and departure time previously obtained in laboratory experiments where commuters interacted with a simulated traffic system (*30*). The objective of SR surveys is ultimately to generalize about the aspects of future choice to which the success of policies is sensitive—in the case of SA, methods of problem solving and coping, decision rules, and the elicited behavioral outcomes.

Stated Prospect

It is possible but not easy to devise measurement methods that record how respondents, in effect, invent future contexts for their travel behavior and explore alternative outcomes Simulation gaming techniques are used here by necessity, although as Brog and Erl (*32*) point out, they must be embedded in a larger design. Neither the list of possible behavioral outcomes nor a detailed constraint scenario is predetermined. Nevertheless, approaches in this quadrant normally use a general scenario (such as an energy shortage) as the broad context, or possibly as a pretext, to initiate the process of learning about alternative outcomes. The term "stated prospect" (SPro) is used to symbolize not only the comprehensive future orientation of this quadrant, but also the centrality of information-seeking and the imaging, formation, and validation of choice sets. To understand these processes and to discover the metadecisions governing the selection and use of decision rules, it is inevitable that SPro involves ob-

serving how solutions are invented and by whom and relating this to previous efforts to reorganize activities and travel. It is also essential to debrief respondents about their operating assumptions during the game stage of the survey.

The template question shown in this quadrant is posed as the further development of the existing context, which itself is characterized from a household's revealed activity travel base. As in SA, SPro normally uses data from travel-activity diaries for a very recent period to prepare visual aids for use in an interview. However, the insights sought are more about classes of behavioral outcomes and constraints than about particular instances of either. For this reason, a revealed travel-activity base over a period of at least 7 days is highly desirable. For longer periods, it may be feasible only to use retrospective instruments In the case of car use studies there are new possibilities thanks to recent developments in inexpensive electronic monitoring devices, which permit monitoring of useful samples of vehicles for weeks or months (*33*). Several Canadian studies use these devices, including the previously cited current project at Université Laval on choice set formation and the perception of accident risk.

One of the challenges of SR is to distinguish between the influence of tastes or attitudes and that of evolving constraints in the longer term. In the context of travel time, Polak and Jones (*2*) note evidence that travelers show greater sensitivity to losses than to gains in the short term, analogous to the WTA/WTP disparity noted earlier. However, they suggest that more symmetrical values of time might be expected in the longer term. Such asymmetries may not be confined to values of time. As noted earlier, if the evolving constraints take respondents into an unfamiliar future, the challenge is even greater Faced with this, one strategy is to confine a sample to respondents with relevant experience. Polak and Jones cite the advice of Hensher to adopt such a strategy for SP work on traffic calming A more compelling strategy is to find out about the learning processes involved, perhaps using previous experience as a segmentation variable.

The design of SPro surveys has much in common with that of "process-intensive" games, in which conditions of uncertainty and ambiguity are created to accelerate and observe the seeking of information, the imaging of options, and the discovery of interested parties. Such games are thus distinguished from "content-intensive" simulations, in which systems such as traffic or the urban land market are simulated explicitly under given rules and every effort is made to replicate the observable aspects of those systems in the real world.

There are important and growing implications from activity-scheduling experiments, such as those by Ettema et al. (*34*), for SR measurement in this quadrant. Their computerized simulation methods can be used to investigate decision making both under prevailing conditions and under hypothetical new situations. For the moment, this type of research is focused more on the former. However, these authors offer a conceptual framework for SPro (and SA) data collection under a production system model where long-term memory contains perceptions of activity attributes and short-term memory is the "scratch space" for processing decisions according to a rule base

A largely manual SPro simulation method that has its roots in the 1970s was applied with promising results to federal and provincial energy contingency planning in Canadian surveys of 1984 and 1988 Canada was one of the few IEA member countries in the early 1980s willing to use policy instruments other than rationing to deal with the perturbations of market mechanisms in a supply shortfall, and no conventional survey technique had been identified to explore the advantages and pitfalls of voluntary restraint measures The method selected, CUPIG, uses a revealed behavioral base from 7-day trip-activity diaries for each of the vehicles in a selected household (*13,17,35*). Visual presentation and tracking of prospective changes are achieved using a scheduling chart inspired by part of the HATS materials and a priority evaluator type of accounting grid for a fuel budget already described in the discussion of SA A detailed interview log records the origin, timing, characteristics, validation, and a judgment of likelihood of each candidate decision to change travel behavior

In the energy contingency planning application, this method was SPro in the voluntary demand restraint phase of an imaginary gasoline shortage but (as mentioned earlier) shifted to an SA approach for a subsequent rationing phase in the same interviews. This was because

the elicited constraints in the voluntary phase became givens for the rationing phase, at which time the budget reduction became explicit rather than ambiguous.

Of particular interest from the voluntary phase was the discovery of the levels of reductions in car use above which households ceased to seek information and to imagine new options for change. In terms of the "operating envelope" model, this amounted to a resetting of the perceived comfortable boundary around what would likely be "automatized" in day-to-day behavior Moreover, for certain groups it was observed that the decision context was restructured after entering the mandatory phase, whereas for others it was "more of the same" heuristic process. All of these insights, although not immediately generalizable as quantitative estimates of user response, provided valuable input to the design of policies that would support voluntary demand restraint.

There is a key methodological finding from a number of the process-intensive simulation methods concerning the devices, such as scenarios or budgets, that are used to initiate the formulation of choices in novel situations Even when these devices are seen by respondents as unrealistic or improbable, the gaming methods still function and the processes observed appear to be a plausible representation of how household and individual decisions evolve (*14,24*).

This completes the quick tour of the SR taxonomy. This was intended to provide a better nomenclature for SR techniques and to clarify design questions, not to provide watertight categories Many emerging methods will use sequences of instruments coming from more than one quadrant. In addition, there are many possible variants of techniques that are otherwise low on elicitation but in which additional outcomes or constraints can be "written in" by respondents.

Recommended Principles for Selection of Interactive SR Techniques

We have seen that the interactive part of the SR tool kit is substantial. Using the definitions in Figure 1, all SPro, most ST and SA, and some SP approaches use interactive methods. Three principles addressed to those needing to go beyond SP (i.e., those whose problems cannot be expressed in terms of preferences for levels of a limited number of predefined attributes and behavioral outcomes) are offered The principles summarize the selection process in terms of the direction of movement within the presented matrix, recalling that the axes are spectra and not dichotomies:

1. The more you need to know about enabling specific behaviors and testing their limits of acceptability, the more you must move right (toward ST and SPro).
2 The more complex the linkages between constraints, the more it is necessary to observe which behaviors are used to accommodate and adapt to changes in constraints and the more you move down (toward SA and SPro).
3. The longer the horizon, the more you need to know about learning processes and choice-set formation to distinguish between (*a*) the limits of taste and tolerance and (*b*) adaptation to constraints, and the more you need to move both right and down (to SPro)

Two other guidelines can be safely offered. First, it is wise to reduce the risk of misinterpretation of SR data by using coordinated multi-instrument strategies. For example, insights from small-sample SPro approaches should help in focusing SA, ST, or SP instruments for use with larger samples. Second, in sensitive "future" public policy areas such as road pricing, face-validity—using observations of real-world or laboratory trials if necessary—may be more compelling to policy makers than mathematical tractability

It is inevitable that the further you move down or right, the more difficult it will be to use the data in elegant predictive models, and the more you must be prepared to construct complex explanatory models to generalize your findings. This is not to say that only qualitative analysis is appropriate, as useful as such techniques have proved in transport policy analysis. For example, research on activity scheduling (*34*) and knowledge-based systems for travel

choice (*36*) promise a wide range of new approaches to formalizing decision rules. These developments are much aided by recent advances in computing, but the direction of this work was anticipated much earlier, as in the decision domains of Heggie and Jones (*7*) and the situational groups of Brog and Erl (*32*). It is also to be expected that SR data will play an increasing role in microsimulation models.

Concluding Methodological Caveats

Approaches to SR data collection have been reviewed It has not been possible to cover the design principles of the numerous methodologies applying these approaches. Some comment should, however, be made about methodological pitfalls common to most or all ISR approaches.

First, all the ISR surveys cited used small, purposive (quota) samples Because this type of survey uses expensive techniques that have high respondent burdens, those who implement them will not be willing to waste resources on hostile or resistant respondents. It takes considerable courage and intellectual honesty to face the biases inherent in respondent selection and the effect of those biases on patterns of elicited responses. In essence, this amounts to understanding the difference between a representative sample and sample of representative variety. Also, Bradley (*5*) reminds us of the inherent biases in choice-based samples used, for example, to limit interviews to a relevant subpopulation, such as those who are current users of a transport service that is mooted for upgrading.

A related problem is that the linkages between household members are sufficiently central to most of ISR that whole households and not individuals are normally required as respondents, and many use group discussions. The scheduling of all mobile household members for a group interview is often a challenge in itself. Recruitment is very difficult without significant incentives. Compensation of $100 to $150 has been offered to households in California for multiple 7-day diaries and a 3-hr household discussion. The MobilPASS trial pays DM100, plus up to DM200 of accumulated payoffs from avoiding congestion, for a multimonth involvement These payments do not appear excessive given that some focus group participations pay $50 to $100, but the jury is still out on the nature of any selection bias associated with such payments, especially if they are varied to provide an incentive for complete and accurate reporting of the activity base and for full participation in the interview tasks.

Second, all interactive techniques suffer from potential effects of observation on the respondent There are important challenges to simulations that not only synthesize a revealed travel-activity base, thus providing more succinct "overview" information about interdependence than travelers may normally have at their disposal, but also accelerate the use of this information in a succession of future scenarios. Thus, the utmost care is needed in designing the consistent presentation of such feedback and successive unfolding of new information to the household. On top of this, interpersonal observer effects are potentially serious because the interviewer cannot avoid a central role in setting expectations about how to respond to such simulations. Very high-quality field staff are thus required.

A third point, related to the second, is that there are ethical considerations when mirroring back to respondents how they have made decisions in the past and indicating how they may make decisions in the future. The concern is not about affecting actual transport choices, but that in extreme cases relationships between household members could be affected by what is exposed in the interview: who really controls the use of the family's cars may sometimes be better ignored. Fortunately, problems of this kind are rare and can be minimized by sensible debriefing and adequate pilot testing of interviews on familiar ground.

Fourth, all these techniques are prone to framing effects. Payne et al. (*15*) point to the lack of theory in this area but cite some classic experiments in which identical outcomes in hypothetical situations are presented alternately as gains or as losses, leading to reversals in majority preferences. The WTA/WTP disparity is probably related to this phenomenon. One of the advantages of eliciting behavioral responses is that less framing of questions is necessary,

and there is robustness in the validation of actions that is part of SA and SPro, but these approaches can also suffer from framing bias in the presentation of scenarios.

Finally, more can be said about data preparation and analysis techniques, although these are necessarily varied. With SPro and SA, interview data reduction can often be accelerated by building inventories of simulated decisions, which are defined here as choices to act, or rejecting a potential action, after discussion. Structured interview logs, which may be manual or computer assisted, are designed, from which sequences of problem solving and analyses of behavioral outcomes can be reconstructed. A wide range of attributes of decisions (such as who initiated them, who is affected and how, what would make them tolerable, and so forth) can be precoded to speed up the work of an observer, who is generally not the interviewer. Decision inventories are particularly useful for developing classifications of respondents and adaptation strategies. Other summary data from interviews and analyses of preinterview activity patterns are, of course, critical additional inputs to such classifications.

Conclusion: Recommendations for Research

Much of what has been presented is an appeal to balance out methodological research on stated response. Most effort has thus far been invested in the upper left-hand quadrant. There is a constant theme of building SR around a better theoretical understanding of the revealed activity base. It is assumed that predictive and explanatory models will continue to exist side by side, but they need to be linked more fully. The observation and categorization of decision rules appears to be a common thread in many of the recent interactive approaches discussed, a development anticipated 7 years ago by Bradley (*5*). In particular, it is desirable to fund survey methods research that applies those approaches to situations in which travel behavior is in the process of rapid change, including those created by congestion, regulation, new technologies, or crisis.

Interactive stated response survey approaches have begun to make an important contribution to transport policy analysis To a greater or lesser extent, they allow people to invent their own future Therefore, they should help us avoid characterizing the future only in terms of what we can easily measure or building policy on an overly literal interpretation of the attenuated models of behavior that have driven much previous data collection about future choices in transport.

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