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## Data challenges: more behavioural and (relatively) less statistical – a think piece

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### Abstract

The study of traveller behaviour has blossomed into a multi-disciplinary array of theories, methods and data paradigms aimed at improving our understanding of drivers of passenger and freight movement. While progress continues unabated, there remains the challenge of extracting more behavioural richness out of the way in which we work to understand the nuances of preference revelation and hence choice making. In this paper we discuss a number of ways of gaining an increased understanding of behavioural response. The paper is a thought piece in line with the role played as a plenary presentation at the Travel Survey Methods Conference.

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### 1. Introduction

The most complex element of travel behaviour studies is the human being. While we may never be in a position to fully explain the next response that each individual might make to a changing set of circumstances designed to influence trip making, in the short, medium and long term, we now have a growing body of theoretical and empirical evidence that is suggestive of possible paths of response and what are some of the key drivers of change and/or reinforcement of habitual behaviour. The existing literature recognises a growing number of areas of fruitful

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research endeavour that have not been given enough attention in travel behaviour studies and in travel survey design, and which should move from what one might describe as fringe interests to a central role in the toolkit used by travel survey methods specialists.

This paper, as an interpretation of a plenary address, summarises a number of such themes that should be highlighted for serious consideration in the design of travel surveys. The selection of themes includes uncertainty and subjective probability and a return to a greater role for revealed preference data compared to the growing influence of stated choice data, the complexity of choice experiments contrasted with the relevance of information, herding behaviour, behavioural insights and nudging, and the appeal of supplementary response variables in choice studies such as awareness, familiarity, and acceptability of alternatives.

## 2. The process of modeling decisions under uncertainty

The great majority of travel choice studies and aligned data sets are snapshot interpretations of choice making activity that typically assume that all decisions taken are associated with risk neutrality. Although it is common to assume that individuals are, on balance, substantially risk averse, with some exceptions under risk taking, the recognition and hence testing for risk attitude should be encouraged, especially where there is a growing relevance attached to circumstances that question the real behavioural value of simplistic assumptions such as certainty of travel times on the road network (i.e., trip time variability<sup>†</sup>) and getting a seat on public transport (i.e., the crowding variability effect).

Recognising risk is one thing, but extending the data collection exercise and modelling opportunity to accommodate uncertainty is quite different. Specifically, risk is associated with a known or assumed occurrence (probability) distribution, whereas uncertainty relates to an unknown distribution that is guided by sources of ambiguity aversion (also known as source preference – see Fox and Tversky 1998). Fundamentally, risk is *conditioned by* uncertainty. In seeking out ways to incorporate uncertainty into choice modelling, we begin by asking the question: what sort of data might we need to be able to do this? Central to the answer is evidence on subjective probability associated with the occurrence of attribute levels such as travel times and getting a seat. The most common response is to build this into a stated choice experiment; however given the subjective (or perceived) nature of such information, this may not be possible. Choice experiments impose levels on attributes in general (hence this is objective data), although such experiments are able to establish revealed levels for an experienced (status quo or reference) alternative but not for the designed alternatives. Fundamentally, uncertainty (linked to subjective probability) is difficult to measure and hence capture (maybe impossible?) in a choice experiment. Taking travel time variability as an example which requires data on travel times (Attributes (A)) and the associated occurrence of each travel time (Probabilities (P)), these two items can be measured as objective or subjective constructs as summarised in Table 1 (from Hensher *et al.* 2015). As objective constructs they are imposed within the design and respondents are asked to assess the given levels. Given that choice experiments impose attribute levels through a designed structure, it appears not possible to see respondent perceptions on levels of attributes, and thus only level *i* is permissible. Whether objective (O) levels designed into choice experiments can be used as proxies for subjective (S) levels, offering the ability to treat the choice experiment as a source of data to accommodate the role of risk and uncertainty is an empirical issue that has, as far as I am aware, not been systematically investigated.

**Table 1 Four levels of subjectivity and objectivity of data**

Level <i>i</i>	FO	= OPs+OAs
Level <i>ii</i>	PS(1)	= OPs+SAs
Level <i>iii</i>	PS(2)	= SPs+OAs
Level <i>iv</i>	FS	= SPs+SAs

**Notes:** FO: fully objective, PS(1): Partially subjective; PS(2): Partially subjective, FS: fully subjective; SPs: Subjective probabilities, SAs: Subjective attributes; OPs : Objective probabilities, OAs: Objective attributes. Source preference = sources of uncertainty ambiguity

<sup>†</sup> On two days that I drafted this paper my journey work was 35 mins and 2 hours – the latter due to an accident on the Sydney harbour bridge).

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