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Information gain, novelty seeking and travel: a model of dynamic activity-travel behavior under conditions of uncertainty

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Abstract

When making a trip, individuals make observations that may increase their knowledge about their environment. In this paper, we develop a measure of expected information gain based on a Bayesian model of mental maps and belief updating. We argue that expected information gain is an element of the utility function of trip choice alternatives under conditions of limited information and learning. Theory and models are developed. The simulations conducted illustrate that expected information gain tends to favor longer trips and variety seeking in terms of both route and destination choice. We argue, therefore, that individuals may perceive a positive utility of travel through environments with which they are less familiar.

Keywords: Mental map; Bayesian learning; Information search; Novelty seeking; Uncertainty; Travel utility; Microsimulation

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1. Introduction

Models of activity-travel choice typically assume that travel involves a disutility. Travel is conceptualized as a means of reaching a destination to conduct a particular activity. In this paper, we will further develop a model of dynamic activity-travel behavior under conditions of uncertainty. In contributing to the topic of this special issue, we will argue that individuals may derive a positive utility from travel as a means to gain information about their urban and transport environment reducing their uncertainty about their environment and/or to seek variety or novelty. It will be shown theoretically that the involvement in travel may reduce environmental uncertainty, and that therefore travel will have a positive utility in a model of strategic behavior.

Variety or novelty seeking behavior has not received much attention in the transportation literature to date. It is often operationalised as the choice of different destinations at successive choice occasions. That seems straightforward but actually variety-seeking is a highly complex phenomenon in the sense that it may be motivated by different reasons. To explain variation in behavior, it is useful to differentiate between derived and intentional varied behavior. The distinction reflects to the difference between intrinsic versus extrinsic motivations for variation in behavior (McAlister, 1982). *Derived varied behavior* relates to extrinsically motivated variation, whereas *intentional varied behavior* relates to intrinsically motivated variation. Variation in behavior is intrinsically motivated if the consumer engages in this behavior for the value inherent in the process of switching between alternatives per se. The switching behavior is thus a goal in itself. Variation in behavior is extrinsically motivated when the goal of behavior is extrinsic to the choice process. In these cases, variation is not the goal in itself, but serves as a means in achieving some further goal. Reasons beyond the explicit desire to seek variety that explain the observed patterns of varied behavior may be situational (e.g., season, congestion, non-availability of particular alternatives, due to for instance, opening hours or opening seasons). Such behavior can be modeled if proper account of such situational factors is given. *Idiosyncratic reasons* for derived varied behavior are caused more by forces internal to the individual, rather than imposed by factors and constraints beyond an individual's control. For example, dissatisfaction with the previous alternative may relate to variety-seeking behavior. *Intentional varied behavior* is conceptualized to reflect variation in behavior that is sought or avoided for its own sake. Intentional varied behavior is positively valued by consumers for its contribution to the underlying processes of relief of boredom with the choice task, relief of attribute satiation and satisfaction of curiosity or novelty. Timmermans (1990) listed various psychological theories to explain intentional variation in behavior, including cognitive consistency theory and arousal theory. Another review is given in McAlister and Pessemier (1982). In the present paper, we develop one additional reason for seeking variety: reducing uncertainty.

This means that in addition to positioning the paper in light of the topic of this special issue, it can also be positioned in the context of the development of models of travel behavior under conditions of uncertainty. The first dynamic models in transportation research typically considered learning in non-stationary environments without explicitly taking into account the uncertainty of perception. Most of this research can be interpreted in terms of reinforcement learning theories and assume that the value or perception of a transport variable (often travel time) is updated according to some weighted function of habit strength and an individual's most recent experience. Examples include Ben-Akiva et al. (1991), Koutsopoulos and Xu (1993), Axhausen et al. (1995)