Guest Editor’s Note

Innovative Travel Survey Methods and Behavior Modeling in the Era of Big Data

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1. INTRODUCTION

Travel survey and behavior modeling still take obviously important roles in a series of transportation planning, including problem identification, problem structuring, travel demand analysis, project/policy formulation, and project/policy evaluation. Classical large-scale travel surveys (e.g. paper-based questionnaire), which have been applied in many cities in the world, have faced challenging problems such as increased survey costs, decline in quality or reliability of the results, and less continuity. The scope of transportation planning at present has become more diverse and it would cover a variety of subjects including demand management, environment, health, gender, and evacuation. Moreover, there have been dramatic expansions in travel data collection with the rapid spread of information communication technology. These issues have motivated me to set up this special issue.

This special issue has welcomed papers that are related to all aspects of innovation in travel survey methods and corresponding travel behavior modeling that show innovations in approach, outcomes, and state-of-practice. Five papers have been selected for this special issue.

2. A BRIEF REVIEW OF SELECTED PAPERS

The first paper, by Sawada and Sasaki, developed a novel methodology of integrating and assimilating travel behavior models and big data in the context of activity-based simulation. One of the critical issues in activity-based modeling (ABM) is the practical difficulty in temporal and spatial transferability of the model parameters. As the authors argued, the data for estimating ABM are costly and rarely collected. On the other hand, the availability of passive transportation big data such as aggregate mobile phone location data has been increasingly receiving attentions for their applicability as travel behavior data. The paper by Sawada and Sasaki developed a method that incorporates the mobile-phone-based dynamic population data “Mobile Spatial Statistics” (Odawara et al., 2013) into the ABM-based simulation developed for the center of Tokyo Metropolitan Area, Japan, within the framework of data assimilation (e.g. Evansen, 2009). This study particularly focused on updating alternative specific constants in choice models and confirmed its effectiveness through case studies.

The second paper, by Hasegawa et al., explored a new methodology of collecting pedestrian behavior data for traffic safety analysis with a novel device of glass-like smart

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eyewear to investigate the head behavior of pedestrians. Such wearable device can precisely detect walking behavior characteristics from acceleration/gyro sensors incorporated into the device. Hesegawa et al. conducted a field experiment in Akita Prefecture, Japan, to collect the behavior data of students walking to their schools, and then analyzed characteristic features of walking behaviors. This study further performed a walk behavior discrimination model in the context of safety by employing random forest technique (Breiman, 2001) and successfully achieved a high discrimination ability and an overall accuracy.

The third paper, by Muromachi, would be quite novel among the papers in this special issue, in the sense that it examined the applicability of neuroscience in travel behavior analysis. Some psychological countermeasures are thought to be effective for promoting travel demand management and the psychological constructs “moral consciousness” are thought to be important for activating socially recommended travel behaviors (e.g. Bamberg et al. 2011). However, it is not easy to fully identify such psychological constructs to make policy measures more effective mainly because of the difficulty in data collection through typical paper-based questionnaires. Muromachi’s paper examined the applicability of brain function measurement with the functional magnetic resonance imaging (fMRI). The fMRI may have potentials of monitoring brain areas for simultaneous activation when the respondent receives a psychological or other type of stimuli. This study conducted an experiment to examine the relationship between moral consciousness and travel behaviors with fMRI in the context of illegal bike parking problem, and successfully extracted the brain areas in relation to sympathy or memory.

The fourth paper, by Yang et al., focused on one of the crucial traffic safety issues in some developed countries like Japan, that is, the elderly driver problem for their higher risk of severe traffic accidents. Particularly, this paper investigated the asymmetric psychological structure of elder driver intentions such as the intention for “continuing driving” and the intention for “surrendering driving licenses” through the data analysis of the survey conducted in Toyota, Japan. It indicated that many elder drivers are reluctant for returning driving licenses voluntarily while they also have the intention for ceasing driving in some regions where the public transportation alternatives are not available. In order to accommodate such rationally inconsistent but psychologically possible different attitudes in the same individual, the paper by Yang et al. explored the unified econometric framework with a trivariate ordered probit model to jointly examine anxiety about driving, the intention for continuing driving, and that for surrendering driving licenses. Since the estimation procedure is complicated, this paper also employed Bayesian estimation framework (e.g. Koop, 2003) to obtain parameters in the model.

The final paper, by Kato et al., conducted in-depth quantitative analysis on potential factors of success in a large-scale transportation survey by taking Metropolitan Transport Census conducted in the Tokyo Metropolitan Area as a case example. This census survey has a cooperative framework among central/local governments, private/public railway companies, and transportation academics/experts to jointly design the survey, collect data, and process and analyze the data. In their paper, Kato et al. called it “integrated travel survey system” and examined the critical factors of such survey system in which public, private and academic entities jointly develop a database of travel demand. This paper further argued that the above alignment would be mainly achieved through interactive communications among the stakeholders in the planning management process of the survey.
3. FUTURE DIRECTIONS

Although these five papers in this special issue, as briefly introduced, cover a broad range of topics in travel behavior model and data collection, the sphere of transportation research in each direction could be further extended. In particular, the issues of continuing large-scale travel survey in some developed countries, even though its importance is fully recognized in terms of making a better transportation master plan, would become difficult for huge survey costs, lack of appropriate knowledge transfer of survey technique and so on. We further encourage studies that describe future directions of travel surveys based on practical experiences in transportation planning. The guest editor fully expects further developments in innovative methods for travel survey and/or travel behavior modeling, new data collection, new modeling methodologies and their integrations, promoting the appropriate use of big data in transportation, and the sustainability of continuing travel survey.

REFERENCES


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