Mark Bradley

Bio

Mark is an independent consultant based in Santa Barbara, California. He has a B.S. in Operations Research from Cornell University, an M.S. in Systems Simulation Modeling from Dartmouth College, and an M.S. in Mythological Studies and Depth Psychology from Pacifica Graduate Institute. For more than twenty years, he has carried out consulting projects to apply state-of-the-art travel demand modeling methods. He spent ten years working in Europe with Oxford University and Hague Consulting Group before returning to the United States in 1995. Since then, he has helped to create activity-based travel demand model systems for use in Portland, San Francisco, Sacramento, Columbus, and Atlanta.

Position Statement

The position statements by Goulias and Pendyala contain an overview of various issues and topics in GPS for activity-based travel demand modeling. Since my consulting focus is on designing and creating activity-based models for immediate implementation by regional MPOs, I will limit my focus to specific issues related to improving activity-based models in the near term.

Data Collection

The most common use of GPS data collection in travel surveys to date has been to validate and adjust diary-based surveys. This is NOT a very good use of GPS data, and the analyses I have done suggest to me that it would be much better to move to GPS as the *primary* data collection method, using diary-based methods only to provide additional details. This approach is being adopted for the upcoming Oregon Statewide Travel Survey. The key features planned for that survey include:

- A statewide sample of about 3000 households per year, with about 1000 in a longitudinal panel and the rest interviewed just once (a repeated cross-section).

- Seven day vehicle-based GPS data collection for every vehicle.

- Additional diary-based data collection for one or two days, in order to get additional trip details, especially for walk and transit trips.

- Use of the retrieval telephone call to validate and correct GPS trace data in real time (identify missing stops, extra stops, etc.)

- Later use of person-based wearable GPS devices when the technology improves sufficiently. (The pilot study indicated too much missing data with the current technology.)

Data Analysis

Activity-based models systems attempt to simultaneously predict several dimensions of travel behavior, including:

- Activity purpose and frequency
- Trip chaining
- Activity duration
- Departure time choice
- Destination choice
- Mode choice
- Route choice

Clearly, these choices are all interrelated, but it is not feasible to treat a day's activity pattern as one complex simultaneous choice. Thus, the main practical challenge in activity-based modeling is to derive a statistically tractable yet behaviorally realistic way of defining a hierarchy across these choices. GPS data can be vary valuable in this research. Some of the key questions to be answered are:

Which choice dimensions are most stable and "fixed" over time? Which activities affect the characteristics of other activities carried out by the same person?: One might assume that activities that are always done at the same place and at the same time of day have higher priority in activity decisions than those activities that are more flexible. Conversely, if we find that regular activities are done at different times and/or locations when another specific activity is present, then we can assume that the second activity has priority. For example, someone may always arrive and leave work at the same time, except for Thursdays when they pick their child up from school. The activity of picking up the child would have priority in a scheduling sense. Similarly, someone might always do grocery shopping at a certain store, except when combined with other personal business and entertainment activities, in which case they choose a supermarket towards the city center. In that case, shopping would have a lower priority in terms of location choice. A long-term GPS data set such as that collected in Atlanta can be very useful in looking at distinctions of this type.

What is the extent of variability observed over time? With a longer term GPS data set, we can measure variability in both the "exogenous" variables in our model systems (e.g. what is the variability in travel time between home and work at a certain time of day?). We can also measure the variability in the endogenous behavioral variables. For example, on days when a person performs the same sequence of activity types, how much variation is there in the times and places that those activities are performed. Also, how much variety is there in the routes that a person drives between the same set of locations?

So, we need to look at both regularity and variability in the activity patterns carried out by the same individuals over time. These are two sides of the same coin and can be analyzed at the same time, but will each provide unique information to inform future model development.