Estimating the parameters of a dynamic need-based activity generation model

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Abstract
Although progress in activity-based models has been formidable and these models are now slowly but gradually moving to practice, there is still ample room for improvement. One of the issues requiring elaboration and further attention concerns the classification of activities. Most existing activity-based models are based on a simple classification of mandatory and discretionary activities (maintenance and social/leisure). Empirical results however indicate that these models are performing better for work and shopping activities than for social, recreational and leisure activities. In part, this may be because the motivators underlying these activities are more varied and because the choice options are both larger in number and more diverse, and hence more difficult to predict. However, relatively poor results may also be caused because these activities are partly substitutable because they satisfy underlying common needs. For example, both shopping and socializing mean a break from house-keeping duties. Shopping will also contain an element of meeting other people and hence will partly satisfy some general social needs.

Doherty (2005) and Doherty & Mohammadian (2007) also discussed the issue of classification of activities, albeit from a different perspective. Examining planning horizons, they found evidence that the process of planning activities is not congruent with commonly assumed hierarchical processes underlying activity-based models. They applied an ordered probit model to analyze the influence of a series of factors.

To incorporate possible substitutions between activities, Arentze and Timmermans (2008) developed a needs-based model. They defined the utility of an activity in terms of its contribution to dynamically changing needs. So-called potentials describe the relationship between activities and needs. Potentials depend on the nature of the activity and on attributes such as duration, location, time-of-day, etc. The model predicts the timing and duration of activities in a dynamic longitudinal framework taking into account time budget constraints and both household-level and person-level needs.

The results of numerical simulations supported the face validity of the suggested theoretical framework and modeling approach, demonstrating the possibility of incorporating substitution effects between activities and complex dynamic interactions between activities in general.

The goal of the research project underlying this current abstract is to test the suggested approach empirically. More specifically, the paper will describe the results of an experiment, designed to predict the timing of duration of activities with respect to underlying needs. The experiment described in the paper will focus on social and leisure activities. Factors varied in the experiment include contextual variables (e.g., levels of current needs), activity history variables (e.g., time elapsed since last performance of specific activities), available time for discretionary activities and spatial factors (e.g., locations). The survey was held among a large sample of individuals through a web-based questionnaire. The sample is stratified on characteristics of the dwelling (e.g., free standing with garden or apartment) and neighborhood of the dwelling (e.g., urban or green environment). A mixed logit model was used to estimate subjective preferences for conducting and substituting activities. The results will indicate to
what extent particular activities are (partly) substitutable, which dimensions of needs are involved and what this means for the classification of activities.

The contribution of the paper to the state-of-the-art is twofold. First, it represents the next step developing the needs-based model. This approach may find wider explanation in both cross-sectional activity-based models and in the further development of dynamic activity-based models. Secondly, it provides evidence of the relationship between activities and underlying needs, increasing the complexity of previous analyses and models of activity timing choice and duration.

References

