A structural equations model of intrapersonal variability in leisure activity-travel patterns

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Abstract
Most models of activity-travel behavior employ cross-sectional data to capture variability in activity and travel at one point in time across various segments of population. However, determinants from such studies are unable to exhibit habitual activity-travel pattern on a daily and weekly basis. Therefore, multiple-day data is valuable to provide an insightful portrait of an individual's rhythm in activities and travels and to examine how their behavioral pattern changes from day to day and week to week.

This study focuses on leisure travel to investigate the nature of its variability upon a weekly basis. Leisure, defined as a non-obligatory activity, has dominated daily urban traffic and used a greater proportion of total time expenditure over the past several decades. The consequences of new types of leisure evolving and lifestyle changes of urban residents have made leisure activity to become a crucial role in shaping overall activity-travel patterns. Evidence exists to confirm those speculations. Most notable are: new types of leisure activity are emerging that become more specific and diverse; traditional leisure schedules are changing from mostly weekend to weekday travels as well; and built-environment improvements that could increase attraction of the areas to create more leisure trips. Therefore, new forms of leisure type, schedule flexibility and lifestyle change have emerged and affect new formations of variability of leisure activity and travel patterns, shifting traditional leisure trends. As a result, increasing interest by urban and transport modelers on investigating the nature of leisure activity-travel behavior has arisen as a way to seek possible effective policies. It is believed that gaining more knowledge on this issue leads to substantial contributions on how to mitigate negative impacts contributed by leisure traffic such as congestion, environmental emissions, and energy consumption.

Intra-personal variability of activity properties such as number of activity participation and time budget, as well as travel properties such as travel time, distance travelled and average speed, seems likely to vary across one another. For example, over a given period of time, one person could obtain quite a stable pattern in terms of trip generation and time budget, but have a variable pattern for travel time, average speed and distance travelled. On the other hand, one person could consistently have variable activity-travel patterns for all identified properties. How these variability properties change over time and the complex relationships across properties of variability in activity and travel pattern work are still not clear yet. Therefore, the influence of all of variability properties will be investigated with respect to each other.

The hypothesis underlying this study is that variability of activity and travel properties are not independent, but tend to relate to each other. Hence the aim of this study is to investigate these questions: In the context of leisure activity and travel, does variability of travel time and distance travelled lead to the change of variability of trip generation and time budget? Or are variability trip generation and time budget the first to appear, and then these influence the change of variability in distance travelled and travel time. As well, how do all of the behavioral properties relate to socio-demographic and spatial characteristics?

The policy implications are obvious. If the findings is that the variability of travel time distance travelled and average speed influence variability of activity participation and time budget, then the study directs
policy makers to the case that urban traffic management, infrastructure and built-environment improvements supported by better accessibility can change behavioral rhythm of individual's leisure activities. On the other hand, if the case is that variability of activity participation and time budget influence variability of travel time, distance travelled and average speed, then controlling leisure traffic can be effectively performed if the change of individual's needs and desires on leisure activity and time budget allocated is first identified.

As an attempt to answer the hypothesis, a structural equation modelling is performed to examine the complex relationships underlying activity and travel properties using a continuous six-week travel survey collected from Karlsruhe and Halle of Germany in spring 1999. The dataset fits with the study's aim as the survey was motivated to capture the rhythm of mobility pattern over a span of time.