Accounting for route overlap in urban and suburban route choice decisions derived from GPS observations

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Abstract
Driver's route choice behaviour in an urban or suburban environment is influenced by a wide variety of factors. Among those factors, the similarity between route alternatives, established through route overlap, plays a prominent role due to the high density of urban and suburban street networks. Yet, how to account for similarities in dense networks is still an ongoing research issue, particularly considering the large set of alternatives the decision maker as well as the analyst is confronted with. Neither of them is able to evaluate the full set of alternatives, the universal choice set. The analyst has to consider this not only in the generation of the choice sets but also in the modelling of the similarity effects. The similarity of a route with other routes can have different behavioural implications: On the one hand, it can reduce the probability of the alternative to be chosen because it is less distinguishable from other alternatives or because it shares risks due to common bottlenecks. On the other hand, it can also increase this probability by offering rerouting alternatives in case of incidents or by making the route stand out as the best of a class of essentially similar alternatives. The relative effect of the four different mechanisms in any choice situation is unclear a-priori. Therefore, more empirical work is needed to identify which of these mechanisms is dominant in which choice situation.

The proposed paper aims to fill this gap for route choice in urban and suburban networks by analysing the car trips of a person-based GPS study, conducted with participants residing in the Swiss cities of Zurich, Winterthur and Geneva. Each of the 4882 survey participants carried an on-person GPS-receiver for 6.65 days on average resulting in more than 32'000 person-days. This data has been cleaned and subdivided into trips and activities. For each trip the respective mode-sequence has been established. However, for this analysis only the about 55'000 car trips will be employed. To derive the chosen routes, these car trips will be matched to the Swiss Navteq network, a fine-grained network covering all regions of Switzerland and containing 408636 nodes and 882120 unidirectional links. The same network will be used to generate the alternatives. Different choice set generation procedures, deterministic as well as stochastic ones, will be tested to evaluate their effect on the choice set composition, the resulting route choice models and the behavioural mechanisms with respect to route overlap described above. In the choice model, the impact of different route and decision maker attributes will be investigated. Since no socio-demographic information about the participants is available, statistics about their overall travel behaviour will be derived from the GPS data set exploiting the fact that for each participant all trips and activities within a complete week are known. The focus, however, will be put on the analysis of the similarity factors, which account for route overlap. Different formulations will be tested in order to evaluate which mechanisms are at work in car route choice in an urban or suburban context. Since the results of this analysis will afterwards be employed in a combined route and destination choice model, special attention will be paid to models that can be efficiently computed even for large sample sizes and large sets of alternatives.