Taking the detour - Travellers' compliance with system-beneficial route advice in a real-world context.

Mariska van Essen, Tom Thomas, Eric van Berkum, Caspar Chorus

Travel information is expected by many scholars and practitioners alike to be successful in reducing traffic congestion and thereby improving road network efficiency. Yet, traditional (personalized) travel information aims at generating benefits to individual travellers, stimulating their personal optimization of their own route choices; it is well-known that this may lead to an inefficient user equilibrium. Examples on network efficiency, such as Pigou's example (Pigou, as pointed out by Roughgarden, 2006) and Braess' Paradox (Braess, Nagurney, & Wakolbinger, 2005), have shown that in order to achieve system optimal network conditions, at least some travellers need to cooperate and choose route alternatives possibly at their own expense (i.e. they might need to take a detour). Until now, only a few studies have considered cooperative routing and these mainly focussed on network effects by building upon theoretical assumptions about individual behaviour rather than empirically validated findings (e.g. Jahn, Möhring, Schulz, & Stier-Moses, 2005; Çolak, Lima, & González, 2016). A crucial and unanswered question in this regard is whether travellers are willing to comply with received route advice when the advised route implies a personal travel time sacrifice for the benefit of other users of the road network. Our study sheds light on (which factors determine) travellers' compliance with system-beneficial route advice in a daily life context using a unique, real-world experiment. As such, our study's perspective complements existing studies on the topic of cooperative routing.

We conducted a real-world experiment in the Twente region, in the Netherlands, during 5 consecutive weeks (January 16th till February 17th, 2017). Participants (29 employees of the Business and Science Park and/or the University of Twente) commuted at least 3 times per week during the morning peak hour. It was ensured that their usual route to work passed certain predefined locations covering the main inbound routes to the destination area, guaranteeing the existence of an acceptable and realistic detour for their commute trip. Participants were randomly assigned to one of two information strategies; i.e. a 'Recommend'-strategy or an 'Educate'-strategy. The 'Recommend'-strategy has low information content and capitalizes on aspects of bounded rationality such as limited mental resources and decision time *('In order to alleviate congestion, please use this route today')*, while the 'Educate'-strategy has high information content and focusses on creating awareness and changing attitudes towards cooperative behaviour. This strategy consisted of three elements: 1) explain importance of cooperative behaviour, 2) provide a map with both the usual and cooperative alternative and inform on estimated travel times for both alternatives, 3) provide route advice for that day. For two days every working week the cooperative route alternative was advised to each participant, while on the remaining days of the working week their usual route was advised.

Participants installed the smartphone application 'SMART Mobility' on their smartphone which automatically collected trip-data, i.e. origin, destination, departure time, arrival time, route and mode (-chain) for each trip. On working days, this application sent the tailored information messages containing route advice for the morning commute to the users. After a commute trip was made, users received two questions about the main reason for choosing a particular route and the role that the information message played in that decision. In order to assess to what extent certain personality traits influenced their actual behavioural responses, participants filled out a short questionnaire once at the beginning of the experiment; information related to the participants' decision styles and their attitude towards cooperative behaviour were measured, as well as the extent to which their route choices were made in a deliberate or habit-driven fashion. This was done using validated questionnaires and scales from the field of social psychology. Moreover, actual travel times on both the usual and cooperative route alternatives were collected from Google Maps at a 5-minute interval during the experiment in order to monitor the road network and quantify the actual travel time sacrifices that have been made by the participants.

Currently, data collection is completed and we are in the process of analysing the data. First, observed compliance rates are assessed; we make a distinction between weak and strong compliance, depending on whether the usual route or the alternative, cooperative route was advised and taken. In addition, we then estimate mixed logit models (acknowledging the panel structure of our data) to identify which factors determine strong compliance and as such we obtain insights into the role of information strategies, the magnitude of the travel time sacrifice, personality traits and route characteristics. We compare these findings with results from a prior study on cooperative route choices using a stated choice experiment in which the same principles were applied, but then in a hypothetical context containing a larger sample (211 respondents). Finally, responses to the questions sent by the smartphone application allow for qualitative analysis of motivations to comply with the received route advice. Preliminary results are promising in the sense that they are both intuitive and interpretable in terms of psychological theories of cooperative behaviour.

Our next step is to translate the observed behavioural response to the network level in order to check whether the network state actually gets closer to a system optimum. Overall, with this work we can identify the potential of applying travel information as a travel demand management measure in order to improve network efficiency.

Keywords: *cooperative route choice behaviour, travel information, smartphone application*

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