Potential for mode shifts due to Mobility-as-a-Service: results from the Netherlands Mobility Panel

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Abstract The primary goal of this study is to quantify the expected effects of Mobility-as-a-Service on travel preferences and travel behaviour in the Netherlands. We do this by studying the expected changes in preferences and behaviour related to the following determinants of travel mode choice: travel time, travel costs, convenience and comfort, flexibility and freedom, willingness to share and certainty. We achieve this by collecting and analysing survey data, including a choice experiment. This allows to detect preferences and trade-offs that people would be willing to make for a system which still does not completely exist in reality. To make choice sets relevant for respondents (e.g. relating their choices to current travel behaviour), we select respondents from the Netherlands Mobility Panel (MPN), which is a household panel started in 2013 that maps the travel behaviour of a certain group of people and households over a period of consecutive years. Our research makes several contributions, including shedding light on the extent to which the promise of MaaS as a tool to assist in the shift towards more sustainable travel can be kept.

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1 Introduction

Mobility-as-a-Service (MaaS) is a new transport concept in which existing and new mobility services are integrated into one single digital platform, providing customised door-to-door transport. Instead of owning individual modes of transportation, customers buy mobility service packages tailored to their individual needs, offering customised trip planning and payment options.

Even though this concept is relatively new, a lot of studies, thought pieces and business cases related to MaaS appeared in the past couple of years. Indeed, multiple promises and challenges arise with the concept. When carefully designed, MaaS promises to be inclusive of all categories in the population and to be efficient travel demand management tools to assist in the shift towards more sustainable travel (Matyas & Kamargianni, 2017). The design question is thus essential (Karlsson, Sochor, & Strömberg, 2016) and intrinsically linked to potential MaaS users. As a matter of fact, MaaS is described in literature as a user-centric paradigm (Giesecke, Surakka, & Hakonen, 2016; Jittrapirom et al., 2017). Current literature focuses more on defining what MaaS is and on its organisational challenges (ecosystem, technologies, integration of modes), rather than on quantifying how it may impact travel preferences and behaviour with in-depth analysis (Matyas & Kamargianni, 2017). In general, empirical research on this topic remains limited (Ho, Hensher, Mulley, & Wong, 2017).

One of the core characteristics of Mobility-as-a-Service is that it integrates different transport modes. Firstly, it shows customers different options that can include different modes. Secondly, modes can be integrated in multi-modal trip chains. The second form of integration seems especially feasible in countries or regions like the Netherlands, where the combined use of modes (such as the bicycle and train) is a daily practice for many inhabitants. To illustrate: for around three million citizens who live in or frequent the (sub-)centres of the main Dutch urban agglomeration (‘Randstad’, including Amsterdam, Rotterdam, The Hague) cycling and transit together have surpassed the car system as the primary transportation system (Kager & Harms, 2017). In addition, the existence of a Dutch smart card data that can be used in all public transport modes (Van Oort, Brands, & De Romph, 2015) suggests that the Netherlands might be a good country to study if MaaS would have an added value and if it could work effectively.

The primary goal of this study is to quantify the expected effects of Mobility-as-a-Service on travel preferences (e.g. attitudes towards owning or using a private car) and travel behaviour in the Netherlands. More specifically, we hope to answer the question whether the Dutch are willing to accept MaaS as a new form of daily mobility and potentially make use of it based on changing preferences. We will do
this by means of collecting and analysing survey data. The survey includes a choice experiment, allowing to detect preferences and trade-offs that people would be willing to make for a system which still does not completely exist in reality. To make choice sets relevant for respondents (e.g. relating their choices to current travel behaviour), we select respondents from the Netherlands Mobility Panel (MPN), which is a household panel started in 2013 that maps the travel behaviour of a certain group of people and households over a period of consecutive years.

The extended abstract starts by introducing results from previous research on MaaS on travel behaviour, and presents factors influencing preferences that are relevant to take into account in this study (Section 2). Next, the methodology is presented (Section 3) and expected results are described (Section 4). This extended abstract finishes with the contributions of this research.

2 Background

2.1 Potential for shifts in behaviours

MaaS pilots around the world show that a modal shift can occur. Participants of the six-month MaaS pilot in Gothenburg (Sweden), Ubigo, reported a decrease in private car use and an increase in alternative mode use, especially car-sharing and bus/tram (Sochor, Karlsson, & Strömberg, 2016). Participants of the MaaS pilot smile in Vienna (Austria) were found make more multimodal trips and car use decreased by 21% (smile mobility, 2015). The smile pilot users matched the gender- and age distribution for early adopters. The focus of these pilots on urban areas and the fact that participation was on voluntary basis limit the transferability of results.

Empirical studies show that frequent car users (using the car more than four days a week) performing few or no public transport trips were amongst the least likely to adopt MaaS, and thus to change their travel behaviour (Alonso-González, Van Oort, Cats, & Hoogendoorn, 2017; Ho et al., 2017). Such results could suggest that public transport users and multimodal people in general are the most likely MaaS adopters. Ho et al. (2017) found that the group of non-car and frequent public transport users is unlikely to adopt MaaS if prices are not lower. Furthermore, Kamargianni, Matyas, and Weibo (2017) found that 29% of regular public transport users in London would most likely substitute part of their public transport usage with taxi, which could potentially mean busier roads in an already crowded city. Therefore, it is necessary to understand what influences changes - or the absence thereof - in travel behaviour with MaaS.
2.2 Factors influencing travel mode choice

Changes in travel mode choices are both determined and influenced by preferences and more objective criteria such as the monetary costs and travel time (KiM, 2017; Olde Kalter, Harms, & Geurs, 2015a). Clauss and Döppe (2016) made a state-of-the-art summary of such subjective and objective determinants of travel mode choice. The most prominent determinants turned out to be travel costs, time-efficiency (includes trip planning and travel time) and flexibility, followed by convenience and (traffic) safety. Affective determinants were also found to play an important role. These are inherently linked to individual preferences and include perceptions about travel modes, like privacy, independence, stress and comfort. According to an earlier Dutch study, six factors besides costs can play a role in determining travel preferences and thus travel behaviour: travel time, comfort, how relaxing and enjoyable a trip is, safety and flexibility (Olde Kalter, Harms, & Geurs, 2015b).

Given that many determinants overlap and that some are not necessarily relevant or measurable in relation to MaaS, we decided to include six main factors in our research: travel time, travel costs, convenience and comfort, flexibility and freedom, willingness to share and certainty (e.g. being sure that there is a connection). We will examine how each of these factors may influence travel mode preferences and behaviour and what this implies for the acceptance and the use of MaaS.

3 Methodology

3.1 Survey

We use a survey consisting of two parts to collect the necessary data to fulfil our research goals. The first part of the survey will focus on general questions relating to preferences and current travel behaviour while the second part is a choice experiment.

The survey starts with multiple questions. First, some questions about smartphone use and journey planning are used to get an idea of the potential compatibility of each respondent with MaaS. Second, respondents are shown questions and statements about each of the six factors presented above. These tackle the personal meaning of convenience and comfort, of flexibility and freedom, the attitude towards sharing, risk aversion and potential barriers to a MaaS subscription.

The second part of the survey consists of a stated choice experiment. This allows to detect preferences and trade-offs that people would be willing to make for a
system which still does not completely exist in reality. Still, it remains important to make choice sets relevant for respondents, for instance by taking into account the degree of urbanisation of respondents. To this end, respondents from the Netherlands Mobility Panel (MPN) are approached. It is a household panel started in 2013 that maps the travel behaviour of a certain group of people and households over a period of consecutive years (Berveling, Olde Kalter, & Harms, 2017). Approaching these people also offers advantages for the analysis of the survey results (see paragraph below).

3.2 Modelling approach

We will use discrete choice modelling to analyse results. The idea is to start with a Random Utility Maximisation (RUM) -based multinomial logit (MNL) model. However, we believe that nests of alternatives might exist (similar unobserved attributes, for instance between on-demand modes) and it might be relevant to take into account the correlation between choices made by the same individual (panel effects). It might also be worth capturing taste heterogeneity across the population. For these reasons, multiple mixed multinomial logit (ML) models could also be estimated. We will also investigate the presence of latent classes based on current mobility behaviour, taking into account panel data from the MPN. This way, we should be able to make a connection between the observed past and present behaviour of respondents, and their stated preferences towards MaaS.

4 Expected results

Based on our research findings, we hope to shed light on the potential effects of MaaS on travel preferences and travel behaviour in the Netherlands. We do this by studying the expected changes in preferences and behaviour related to the following determinants of travel mode choice: travel time, travel costs, convenience and comfort, flexibility and freedom, willingness to share and certainty. In addition, we will consider travel time and monetary costs; for each of the four determinants, considerations will therefore be made on both of these factors.

**Convenience and comfort**: MaaS is supposed to make trips more convenient and more comfortable, from the planning phase until the arrival at the end destination, including the payment. If everything is centralised onto one platform, booking a trip would be much easier. How attractive is this to people? How would this influence the perceived travel time of people? Are people willing to pay more for such a service?
**Flexibility and freedom**: Would people feel “trapped” with a system such as MaaS, for instance when needing to make a trip instantly, when needing a quick rescheduling of their trip or when wanting to modify a suggested trip? This may be particularly relevant for car captives. In addition, to what extent is the diversity of options important? To what extent are people willing to pay for more flexibility and freedom?

**Willingness to share**: Most MaaS schemes include shared modes, from the usual public transport offer to demand-responsive transport options, car sharing and ride sharing. How do these modes influence the potential use of MaaS? To what extent are people ready to share a ride, to use a borrowed car or bicycle within a MaaS scheme? Which influence do such modes have on perceived travel time and the willingness to pay?

**Certainty**: Since MaaS aims at providing door-to-door solutions, suggested trips will most likely include transfers between modes. Transfers are known to create uncertainty (Van Hagen, 2011). Besides, capacity will always remain limited in general (the amount of shared bikes, the amount of seats in the train or in any other vehicle), and unpunctuality will still exist, introducing further uncertainty. To what extent is certainty important in MaaS? To what extent are people ready to pay for more certainty in a MaaS-like system?

5 **Contribution**

Our research will make several scientific and practical contributions. First, from a research perspective, more knowledge on the demand side of MaaS would allow to build better models of MaaS. Second, from a business perspective, it would allow to design offers that better align with passengers’ expectations. And last but not least, from a policy perspective, it is necessary to understand the extent to which the promises of MaaS – to be inclusive of all categories in the population and to be an efficient travel demand management tool to assist in the shift towards more sustainable travel – can be kept.

**References**


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