Will car users change their mobility patterns with Mobility as a Service (MaaS) and microtransit? – A latent class cluster analysis

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1. Introduction

Mobility as a Service (MaaS) offers tailored integrated mobility solutions to users. MaaS services, which are still in their early stage, aim at the integration of information, payment and usage of all available modes of transport. On the one hand, transport authorities see in MaaS the answer to congestion, since it 1) regards public transport as the backbone of the transport system and 2) is expected to reduce car ownership. On the other hand, different companies are jumping into the mobility business since MaaS market is forecasted to amount to 9,500 billion US dollars by 2035 (Statista, 2018). However, MaaS results only in little profit based on individuals' usage of public transport (Sochor et al., 2015b); the real profit comes from usage of third party on-demand services leading to conflicting interests.

The most often used on-demand services (i.e., car-sharing, bike-sharing and ride-sourcing) offer individual transportation, and the car-like nature of both car-sharing and ride-sourcing are of little help in reducing congestion. On the contrary, collective flexible on-demand services, such as microtransit, can indeed increase vehicle occupancy while providing flexible mobility. As a result, microtransit services can be a key player in balancing governmental and businesses' interests in the context of MaaS.

The impact of MaaS and microtransit in future mobility will depend on the characteristics of the individuals who adopt these services. Who are the individuals interested in MaaS and in microtransit? Are they the same? And what are their current mobility patterns? Are they current car addicts or traditional public transit users that would eventually adopt these services?

Even if individuals with very different mobility patterns find benefits in MaaS (Sochor et al., 2015a), MaaS adoption has been found to be affected by car usage, age and household composition (Ho et al., 2017). Similarly, Jain et al. (2017) found that usage of microtransit is related to the socioeconomic characteristics and car availability. However, it remains unknown whether there is a link between the attitudes towards these two mobility services.

To analyse simultaneously the characteristics of MaaS and microtransit that can be of interest for different groups in the population, we perform an attitudinal questionnaire among urban individuals in the Netherlands. Respondents are presented with a series of attitudinal Likert-scale statements related to MaaS, microtransit and general mobility attitudes. A factor analysis is then performed to

extract a series of latent variables from the observed indicators. The scores on these latent variables are then used to cluster respondents using the latent class cluster analysis method. Current mobility patterns and socioeconomic characteristics are accounted for in the model. The rest of this extended abstract highlights the data and methodology used in this research, as well as provides an outlook concerning the expected results and implications.

2. Methodology

2.1. Data collection and sample

Respondents are recruited from the Netherlands Mobility Panel (MPN). The MPN yearly collects mobility information of respondents, including a 3-day travel diary (Hoogendoorn-Lanser et al., 2015). The MPN also includes a household and a personal questionnaires. Thus, a lot of socio-economic characteristics of the panel respondents are already available prior to the attitudinal questionnaire.

MPN respondents participating in this additional attitudinal survey are eighteen years old or older, and representative of the Dutch population in age distribution and gender. The sample is limited to individuals living in urban areas due to the larger expected importance of new mobility services in these areas. The questionnaire will be distributed in April 2018. A net sample size of 1000 individual is expected.

2.2. Latent class cluster analysis

There are different methods to cluster individuals. One of these is latent class cluster analysis (LCCA). LCCA models, also referred to as finite mixture models, group individuals according to an unobserved (latent) class variable that underlies their responses on a set of observed indicators (Molin et al., 2016). LCCA differs from traditional clustering methods such as K-means in several aspects. We want to highlight three of them: first, it uses a probability-based classification; second, it uses statistical indicators to identify the number of clusters, and last, it can directly classify the nature of the subgroups simultaneously to the clustering (by including covariates) (Magidson & Vermunt, 2002). On these grounds, we use LCCA for our analysis.

A total of 36 5-point Likert-scale attitudinal indicators are included in the questionnaire and analysis. Ten of these are directly related to MaaS, ten others directly related to microtransit and the sixteen remaining to general mobility attitudes (innovation, sharing, transferring and reliability). A factor analysis is performed previous to the LCCA to find latent unobserved factors while reducing the number of study variables. The analysis is performed using the LatentGOLD software tool.

2.3. Model conceptualization

Previous research has used LCCA to cluster mobility patterns of individuals. However, due to the novelty of the services under consideration in this study, behaviour towards MaaS and microtransit cannot be observed in order to cluster respondents. That is why initial attitudes towards these services are measured and analysed. The graphical representation of the initial model that we analyse is represented in Figure 1. MaaS and microtransit are latent variables and represent the indicators to explain the latent classes of the model (measurement model). The boxes below are the covariates of the model. First, the model is analysed with the latent variables only (posterior to the

factor analysis to analyse if any additional factors can be extracted from the attitudinal questions). Subsequently, covariates are added to the model to predict class membership (active covariates) or to further profile the latent classes (passive covariates).

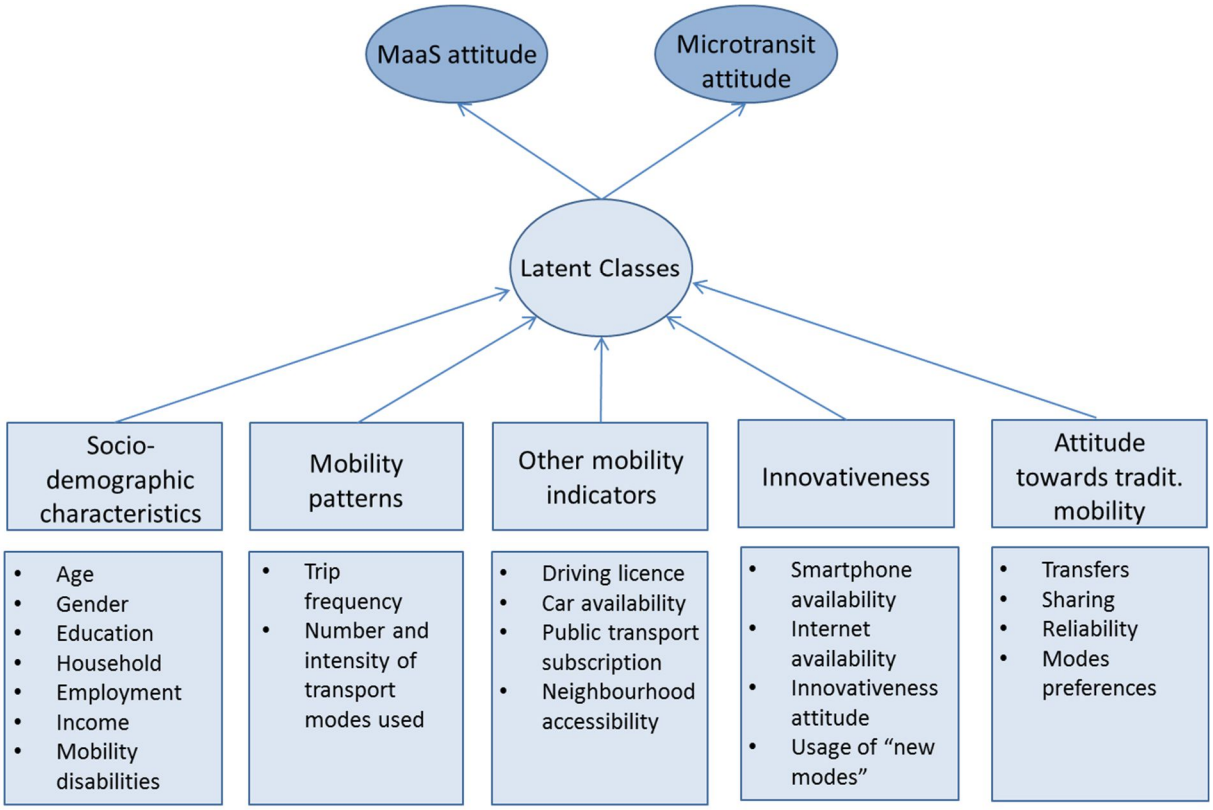

Figure 1: Graphical representation of the initial latent class model to be analysed

Two strategies will be followed to increase the model fit, as suggested by Magidson & Vermunt (2004): 1) variable reduction (deleting one or more variables) and 2) increase dimensionality (increase the number of latent variables).

3. Expected results and outlook

This study tackles three aspects:

1) It clusters respondents according to their attitudes towards MaaS and microtransit.

2) It explains the role of mobility patterns and socioeconomic characteristics in explaining variability in attitudes towards novel mobility services.

3) It analyses the characteristics of the respondents with a positive attitude towards these new mobility services and discusses the consequences of a possible modal shift from those segments.

The model estimation results will be presented and discussed. The results will allow examining if car users have a positive attitude towards these new mobility services or if, on the contrary, it is public transport users that are more likely to adopt these new services. Better understanding the attitudes of different segments can also support customizing MaaS and microtransit to fit the needs and

desires of different segments. It will also help better forecast the modal shifts that these services can induce in urban areas.

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