*Extended Abstract for hEART 2018*

**Sizing a fleet of automated taxis: A demand-responsive case study for Zurich**

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Automated vehicle technology has reached a point where fleet services can be expected to be opened to the public in just a few years. Companies like nuTonomy (Reuters, 2018) and Navya (Navya, 2017) are already running trials in cities around the world including Switzerland (Postbus, 2017) and show that their vehicles can cope with the complex situations that arise in everyday traffic.

While technology is maturing quickly, questions remain about how a large-scale deployment of automated vehicles will change the transport system. There are a couple of positive anticipated effects, such as higher access to mobility for young people, for the elderly, as well as disabled people. Furthermore, it is expected that the effective capacities of the roads will increase because of vehicle-to-vehicle communication, shorter reaction times, and intelligently managed intersections. However, it is likely that the cost of mobility will drop drastically since drivers fall out of the calculation. Very low prices and easy access to mobility may lead to induced travel demand and have the potential to increase individualization of travels. This may lead to even more congestion than we see today (Meyer et al., 2017). Hence, it is a crucial task to assess how much travel by automated vehicles one can expect under certain scenario conditions. The main difficulty in this task is that the usage of a fleet of automated vehicles depends on the tradeoff that people make between the offered service levels and prices not only of the automated vehicles, but also of all other available modes.

Over the course of the past two years research activities around fleets of automated vehicles have been conducted in the Swiss context. First, a thorough assessment of costs and prices of automated vehicles (Bösch et al., 2018) has been undertaken, including numerous factors from fuel to maintenance, dispatching and cleaning of the vehicles. Second, a stated choice survey has been conducted (Becker and Axhausen, 2017) which explores how people in the canton of Zurich, Switzerland would change their travel behaviour once a fleet of automated vehicles becomes available.

With the data basis at hand, a high-fidelity transport simulation of the city of Zurich and its surroundings has been set up in the activity- and agent-based transport simulation framework MATSim (Horni et al., 2016). In this simulation, thousands of interacting travellers are simulated in the capacitated transport system at the same time. Based on a package that allows for the simulation of highly configurable fleets of automated taxis (Hörl, 2017), the paper will describe in detail how an integrated simulation environment has been set up that allows to answer the question of optimal fleet sizes under responsive demand conditions:

- The cost calculation from (Bösch et al., 2018) has been integrated into the simulation, such that customer prices are calculated based on the actual utilization of the fleet.
- A discrete choice model derived from (Becker and Axhausen, 2017) has been integrated into the simulation and the underlying scenario data has been calibrated

against the estimated choice model. For that purpose a novel component for the integration of discrete choice models into MATSim (Hörl et al., 2018) has been used.
- A framework has been set up to measure experienced waiting times and travel times for the automated taxi mode to be fed back into the choice process of the agents.

Simulation results are presented that show that the interplay between the distinct components works: When automated taxis are introduced into the system, the accepted prices and waiting times produce a plausible picture and respond reasonably to changes in fleet sizes and policy measures.

The main result of the paper will be to show how the demand for automated taxis increases due to better service levels caused by higher fleet sizes, but also how it declines once the prices increase too much due to a fleet size that is to large. This way we arrive at an optimal fleet size for the proposed scenario with which the maximum number of customer trips are served. Note that this fleet optimum is then based on a demand that is created by responsive travel decision makers. To the knowledge of the authors such a methodology, in the context of automated vehicles, has not been conducted before. Further possible objectives will be to assess how different profit margins, subsidies or taxes will affect the optimal fleet size from the operator perspective and how levels of congestion and empty mileage change in different scenario setups.

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