Sharing is saving

How collaborative mobility can reduce the impact of energy consumption for transportation

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How collaborative mobility can reduce the impact of energy consumption for transportation

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1 Abstract

Shared mobility systems are said to contribute to a more efficient and less energy consuming transport system. The high expectations contrast with limited knowledge about their impact once they exist at large scale. Contributions of this research are:

- Better understanding of the energetic impact of large-scale integrated shared-mobility systems.
- Examine future shared mobility scenarios with a simulation approach.
- Allow policy makers to define desirable scenarios and highlight effective measures to reach them.

2 Background

First systems of shared mobility date back to the mid-20th century. However, only recent technological advancements allowed them to increasingly unlock their potential.
Currently, some of the most widespread systems are car-sharing, bike-sharing, car-pooling and shared taxis. As presented in Table 1, those four systems cover a broad range of market segments and can therefore be seen as cornerstones of shared mobility. Due to their different nature, they serve different customer groups and have specific environmental impacts.
In particular, positive environmental impacts have only been proven for car-pooling[1] and station-based car-sharing[2]. There is more uncertainty about the impact of newer, more flexible forms of shared mobility (i.e. shared taxis or free-floating car-sharing[3]) Bike-sharing has been found to reduce private vehicle travel. However, relocations of bikes may eat up a substantial part of the related energy savings.[4]

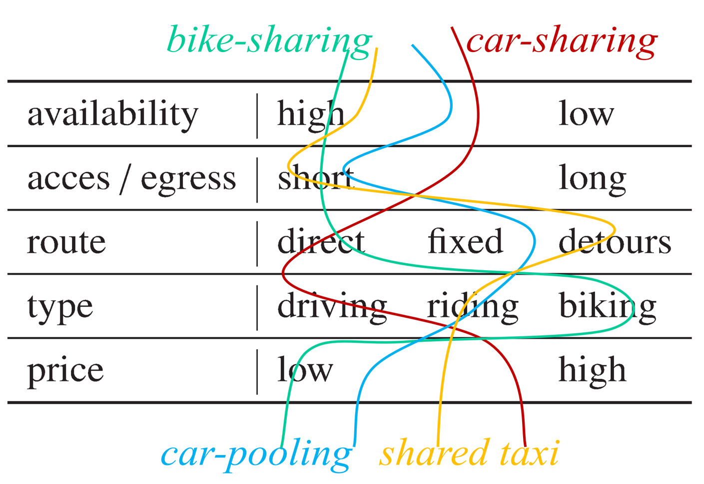


Table 1 Market segmentation of shared mobility systems

Apart from very few exceptions, none of the shared mobility systems has achieved a substantial market penetration yet. Even in Switzerland, which is the only country to see a seamless, nationwide car-sharing system, only 2.5% licence holders are car-sharing members. It is therefore still unclear, how the different systems would interact and what the environmental impact of large-scale shared mobility systems would be.

3 Methods

Simulations - Environmental Potential
Following a qualitative evaluation of the different shared mobility systems and possible supporting policies, a set of scenarios is generated combining different shared mobility systems, service levels, integrations and policies, optimising their expected energy efficiency, usage and revenues. In particular, the economic success and environmental impact of some shared mobility systems may depend on the presence or absence of other systems or regulations. To allow a quantitative assessment of such complex scenarios, a simulation approach has been chosen for this research.

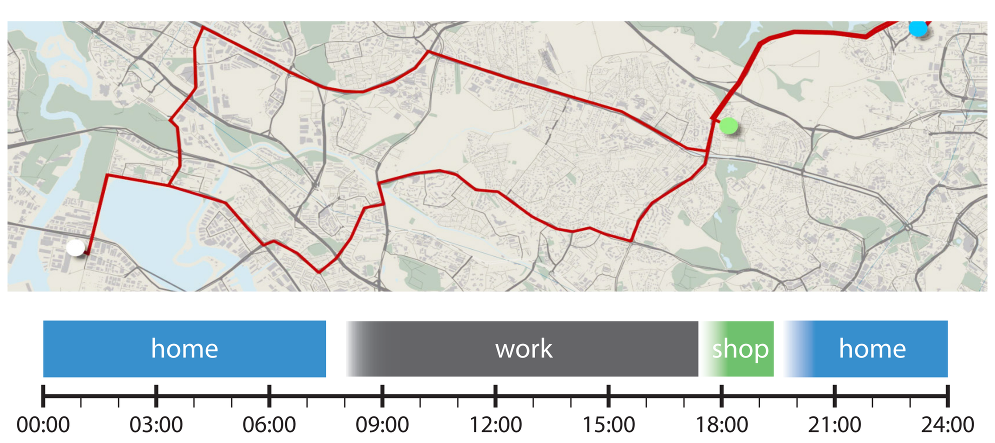


Fig. 1 Agent-based simulations to identify energy-efficient scenarios.

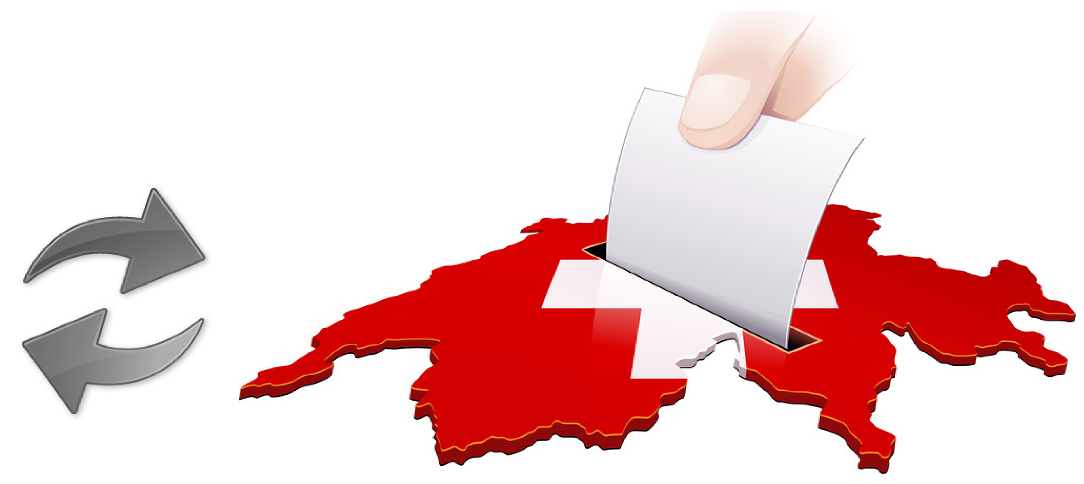
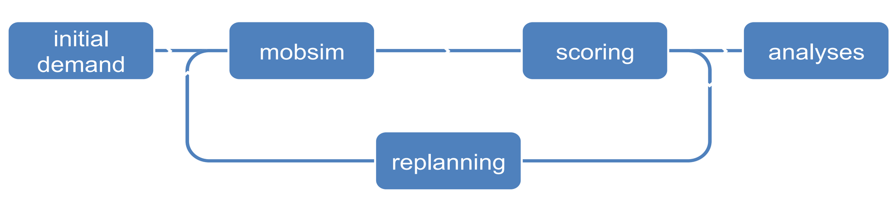


Fig. 2 Stated preference survey to ensure selecting viable scenarios.

Stated Preference - Public Acceptance
The most promising scenarios with respect to their impact on energy consumption are selected for a deeper study of their public acceptance. This step is important to ensure, that the scenarios are not only well-performing in terms of a reduced energy consumption, but are also likely to be implemented. For this purpose, a stated-preference survey is planned, in which participants are presented a set of future scenarios to choose from. This allows to measure the public support for the different shared modes and proposed policies and regulations. The framing of these experiments will test both a personal and a civic (referendum-style) perspective.

4 MATSim

MATSim is a fast, dynamic, agent- and activity-based transport simulation. The basic idea is to let a synthetic population of agents act in a virtual copy of the real world. The synthetic population matches census records while the virtual world reflects the infrastructure such as road network, land use and the available transport services and activity opportunities. Each agent has a daily plan, which consists of the chain of activities which it is supposed to perform during the simulated day. In a realistic, artificial world, agents compete for capacities in space-time trying to use the day as efficient as possible. This way, MATSim allows to simulate systemic behaviour from assumptions on the individual level only.



5 Expected Results

This research is supposed to shed light on the question, if, how and how much shared mobility can contribute to a more (energy) efficient transport system. The innovative holistic approach allows to define future systems of large-scale, integrated shared-mobility services including a quantitative analysis of their impact on energy consumption. It shows how integrated large-scale shared mobility systems will affect the transport system and what impact and efficiency one can expect of specific political measures.
This research allows policy makers and planners to define a desired future state and shows them which policy tools can help them to reach their objectives.
In turn, operators can use the insights from this research to identify promising new business models.

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