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Modelling mobility transitions using the Actor-Option framework

The transport system needs to become more sustainable. Innovations are often seen as a cure for the problems inherent to the transport system, while many policy makers shy away from the uncertainty surrounding them. To understand the dynamics of the transport system and the role that innovations might play in the transition towards more sustainable functioning, modelling and simulation can be a powerful tool. Modelling aids human reasoning about complex phenomena and in answering policy questions.

There have been previous efforts to model mobility transitions. These models have a strong technology focus, often on one novel transport mode such as hydrogen cars, electric cars, or autonomous vehicles. This misses out on recent mobility phenomena that combine novel technologies with other novel or existing technologies, or the increasing interest in multi-modal trips. There is a need for a conceptualisation that considers the transport system as a whole, with any innovation being able to emerge and interact within it.

We propose an agent-based model based on the Actor-Option framework to simulate mobility transitions. The Actor-Option framework is a generic framework for modelling transitions. The main components of the framework are actors, options, and mechanisms. In the context of the transport system, we consider as actors the users (travellers), providers (e.g. public transport providers or shared services), regulators (government bodies), and opinion groups (e.g. lobbies or touring clubs). Options are all possible ways for users to fulfil the users' mobility needs. The mechanisms describe the ways in which change happens in the system.

The model is developed in an iterative process, using a stylised case. This means we use an artificial city and population in order to simplify. We start from the diffusion of one technology among users with the end goal of incorporating a multitude of transition dynamics. In the first iteration of the model, the only actor type present are users, who have habitual trips that each have a mode assigned. A new transport mode is introduced, and the users learn about it through word of mouth. If it is advantageous for one or more of their needs, they will adopt it. In the next iteration, transport providers are added and react to market developments to determine the properties of the offered modes. The step after includes the regulators who set policy plans that react to changes in the transport system. For each iteration of the model development, relevant mechanisms are added.

In principle, the Actor-Option framework allows us to apply this model to any mobility case study. It is flexible and can be adapted to many regional and policy-making contexts. We can let any innovation emerge within it as an option to see how it performs in the system. The structure also allows us to test many different policies. The development of the stylized model will be presented at the conference. It serves as a first test of the use of Actor-Option framework for mobility transitions. Following this, it will be applied to an actual case study of future urban mobility in The Netherlands.