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Car-lite impacts on housing market and vehicle ownership

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Keywords: Type your keywords here, separated by semicolons ;

1. Problem Statement

Transportation and city planners around the world have been showing increasing interest in reducing the number of motorized vehicles and pursuing "car-lite" neighborhood designs. In Singapore in particular, as a small island-nation with one of the world's highest population densities, the government's recent rhetoric has pushed a car-lite vision (GovTech, 2017; MCI, 2017; URA, 2017). In fact, a people-centered and car-lite neighborhood is one of the three main pillars that shape the Urban Redevelopment Authority's vision for future neighborhoods. To manage the number of cars, the government has implemented road taxes and restricted the number of certificates of entitlement to register a car. Several efforts have also been made to promote alternative transportation options, such as active mobility modes, and to explore autonomous vehicles (AVs) for mobility services. With the current pace of technology development, the technological feasibility of such policies to reduce cars seems inevitable. However, will such a transportation scenario be welcomed by the people? When accessibility is improved, by using, for example, AVs for first mile/last mile connection, will people give up their cars? Will urban designs that enable better connectivity to amenities be attractive enough to change households' preferences for housing locations? Answering these questions is fundamental to understanding whether AVs can help realize the 'car-lite' vision.

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2. Research Objectives

In this paper, we examine the sensitivity of housing market behaviors and identify the key factors and market forces that result from the adoption of car-lite neighborhoods. In particular, we seek to answer the following questions:

- How will households' perception of transportation system performance change due to car-lite policies such as AV implementation?
- How will households' long-term decisions change (e.g. residential location and vehicle ownership)?
- How will the urban form change in response to the changes of agents' attitudes/preferences regarding AV services?

3. Methods

3.1. Simulation platform

To attempt to answer the research questions, we use an integrated microsimulation model, SimMobility. SimMobility is a system of mobility-sensitive behavioral models integrated in a multi-scale activity-based simulation platform, which considers land-use, transport, and communication interactions (Adnan et al., 2016; Lu et al., 2015). In SimMobility, agent behaviors are modelled at multiple levels and in various timescales, which correspond to three integrated simulators: Long-term (LT), Mid-term (MT), and Short-term (ST). The LT simulator of SimMobility models the behaviors of agents in the housing market, and, ultimately, the commercial real estate market and the job market, in order to simulate the yearly and longer term impacts of alternative future mobility scenarios on residential and workplace locations; vehicle ownership; the density, land use distribution, and value of the built environment (Zhu, Diao, Ferreira, & Zegras, 2017).

3.2. The study area and data

The area selected for the study is located in the center of Singapore as shown on Figure 1. The area covers 7.2km^2, with a population of 131,893 in 2012. The area is one of the oldest residential towns in Singapore and includes a good mix of land uses (Figure 2).

Figure 1: Location of the study area

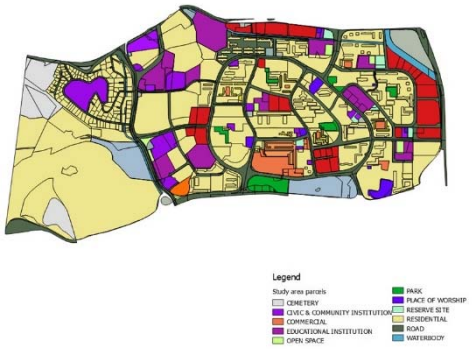

Figure 2: The study area's land use

Data used in the study were extracted from a synthetic population of households, individuals (Zhu & Ferreira, 2014), and firms (Le, Cernicchiaro, Zegras, & Ferreira, 2016). The population provides the baseline for SimMobility simulation and reflects the reality of Singapore in 2012 (consistent with the transportation network and building data used).

3.3. Scenario description

For the purpose of this study, we define "car-lite scenario" as the situation where significant accessibility improvement is possible through first mile/ last mile transport connection and neighborhood redesign. The expected changes in the transportation performance and accessibility are then incorporated into the housing market models and vehicle ownership choice model.

4. Expected results

The results simulate households' responses to car-lite policies with regards to choices of residential location and vehicle ownership. Improved accessibility and effective marketing campaigns can make housing units in car-lite neighborhood more attractive. However, car-lite impacts can also affect housing market price and the timing, density, and type of development. It is also expected that households in car-lite neighborhoods may give up their vehicles, whereas households that neither live nor work in car-lite neighborhoods may relocate to these neighborhoods and re-evaluate their vehicle ownership. Scenario simulations, and various tests of the sensitivity of results to behavioral assumptions, enable estimation of the net effects of car-lite plans that address neighborhood redesign, account for transportation regulation and transit service, and allow for the introduction of disruptive transportation technologies.

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