Robo-Taxi Service Design, Modeling and Simulation

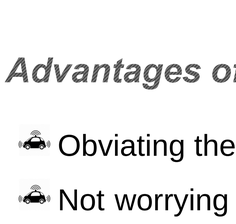
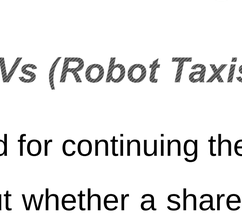
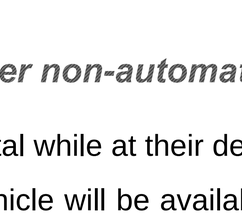
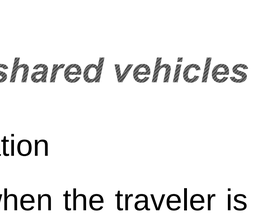
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Context

Bike-sharing
Car-sharing
Ride-sharing
Scooter-sharing
Ride-hailing
…

SHARED-USE VEHICLE SYSTEMS
shifting the private mobility from *ownership* to *service use*

Shared-use vehicle systems evolution

Round trip Car-sharing	One-way station-based Car-sharing	Free-floating Car-sharing	Shared Autonomous Vehicles(SAVs)
			
• Pick-up and drop-off at same point • No destination choices • Rent of vehicle in non-use times • No park space problem • No rebalancing problem • Can not solve last mile problem	• Limited pick-up and drop-off points • High limitation in destination choices • Park space problem • Rebalancing problem • Low potential for solving last mile problem	• Pick-up anywhere available and drop-off anywhere authorized • More destination choices • Rebalancing problem • More potential for solving last mile problem	• Pick-up and drop-off anywhere • No limitation for destination choices • No parking problem • No rebalancing problem • High potential for solving last mile problem
1990	*2007*	*2012*	*2021*



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Advantages of SAVs (Robot Taxis)over non-automated shared vehicles

- Obviating the need for continuing the rental while at their destination
- Not worrying about whether a shared vehicle will be available when the traveler is ready to departing.
- Anticipate future demand and relocate in advance to better match vehicle supply and travel demand.

Objectives

Two major research axes:

► Develop a design methodology for Robot Taxis systems

► Conduct sensitivity analysis by using multi-modal traffic simulation environment

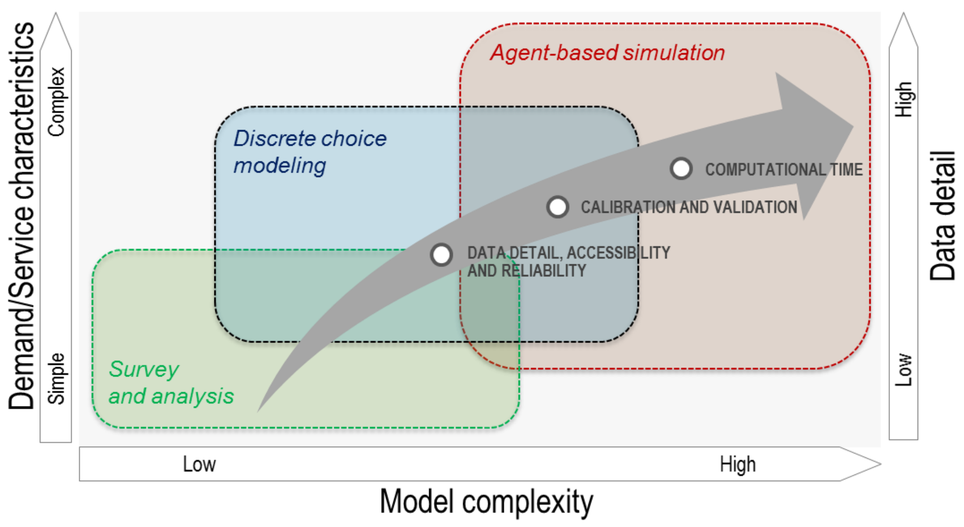
Current studies

- Predicting the usefulness of autonomous vehicles
- Estimating the number of shared autonomous vehicles needed to serve an existing demand

Expected results

- How the new travel mode would interact with existing travel options?
- How customer preferences influence the mode choice?

Approaches



Challenges

DATA DETAIL
Travel should be modeled at the individual level with explicit modeling of the modal choice.
It requires *individual socio-demographic data*.

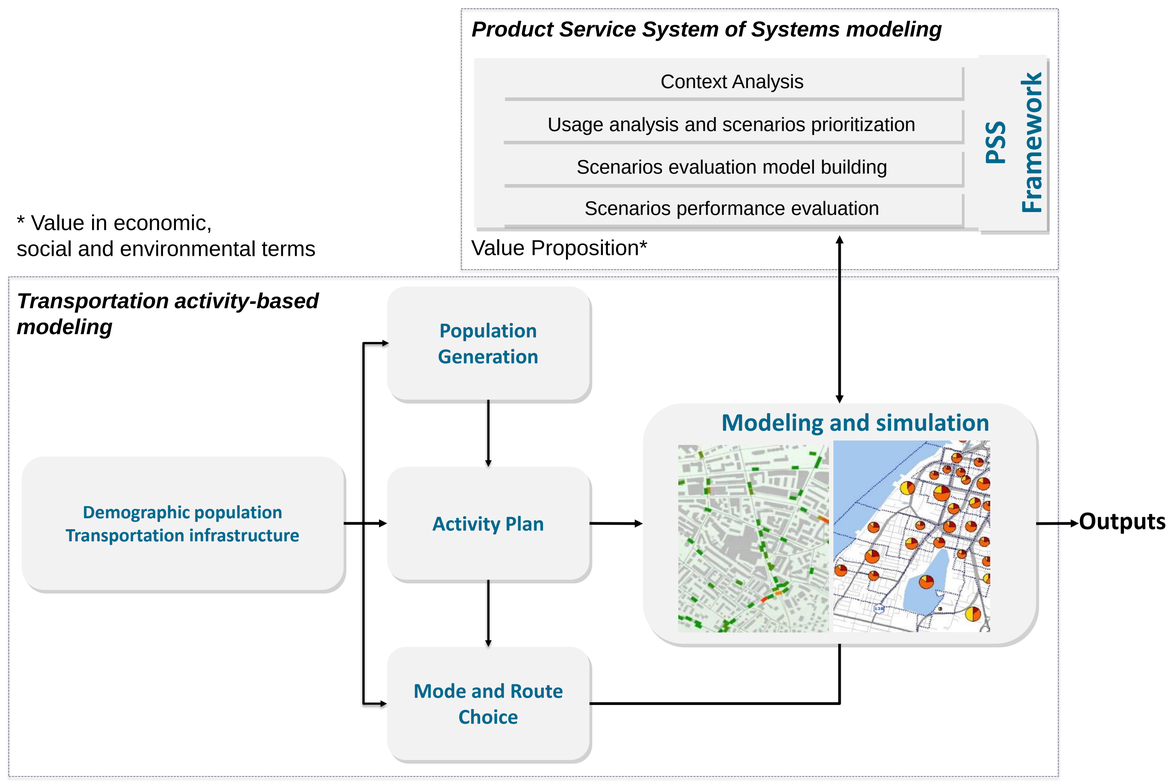
DATA RELIABILITY
These systems are not in operation yet so a stated preferences (SP) survey would be needed. It could be *costly* and *not necessarily result in reliable and complete model*

MACROSCOPIC MODELING WITH MICROSCOPIC DETAILS
Model should be sensitive to short-distance trips so *extremely fine-grained spatial information at the parcel level is needed*

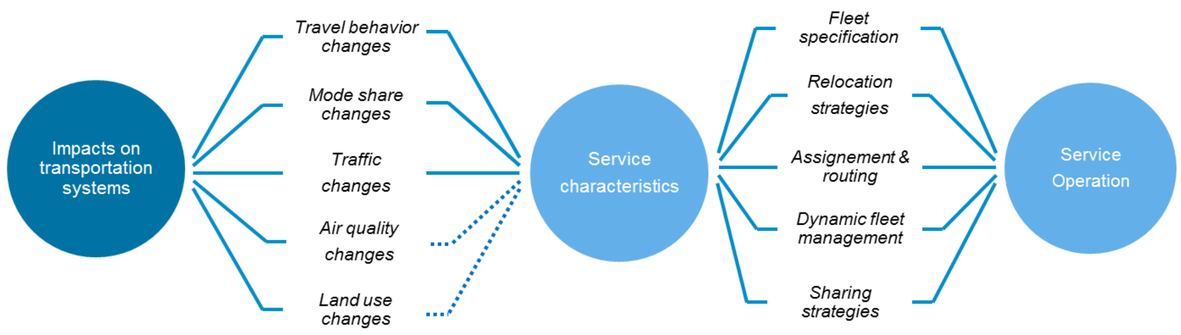
HIGH COMPUTATIONAL TIME
Model computes probabilities for a large number of alternatives at the individual level. Simulation procedures for real size networks would result in *very long computation times*

CALIBRATION AND VALIDATION
For SAVs services there are no real data at hands.
It would be difficult to validate if *the model run correctly or not*

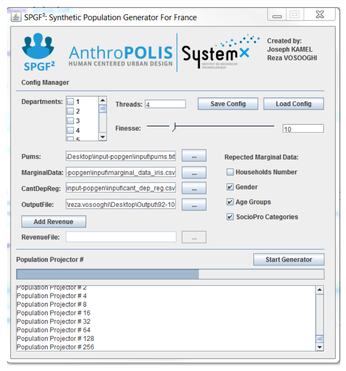
Design and Modeling Framework



Expected Results



Contributions





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