



Estimating and implementing a Danish activity-based model in SimMobility

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Agenda

- Background and motivation
- Activity-based model structure
- Data
- Estimation status
- Preliminary results
- Next steps

Background and motivation

- To build a **laboratory** for testing new model formulations of **individual behavior** and support the research on **designing future mobility solutions**
- How will individuals' travel patterns be like in the (uncertain) future and what are the implications of it?
 - Changes in supply, new technologies, mobility policies
- Anticipate how individuals will react give us advantage
- Understanding and modeling individuals' behavior as close to reality as possible

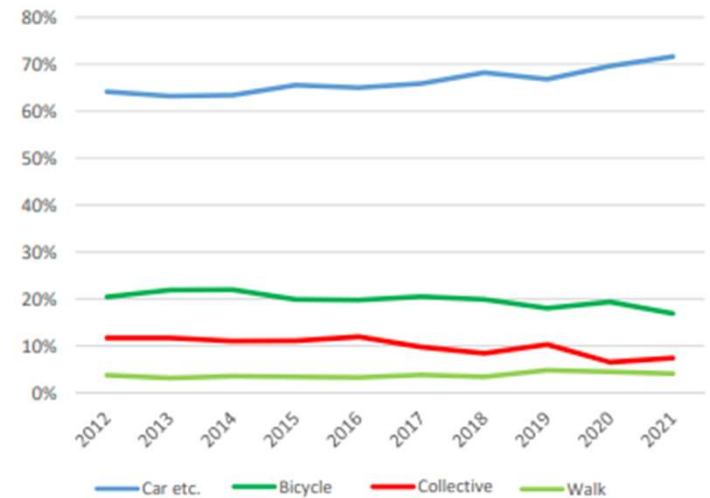


Figure 1: Danish modal split (commute)

Source: TU annual report Denmark 2021

SimMobility (1/2)

- Activity- and agent-based model simulator
- Started the development by MIT and SMART in 2012



- **Open-source** in 2019 (<https://github.com/smart-fm/simmobility-prod>)
- Current **developments**:
 - Singapore, GBA, Tel Aviv, Talin, SF-CA, Austin-TX, Baltimore, Washington DC, Santander, Copenhagen
- International **collaborative** team:
 - MIT, DTU, Telecom SudParis, Ariel Univ., A*STAR, UCLondon, JRC, Shenzhen IAT

SimMobility (2/2)

- **Integrated/modular**
- **Consistent** across levels (shared code and database)
- Mobility-sensitive **behavioral** dynamic plan/action models (activity-based)
- Local and city-wide multimodal **networks**
- Multiple spatial-temporal **scales**

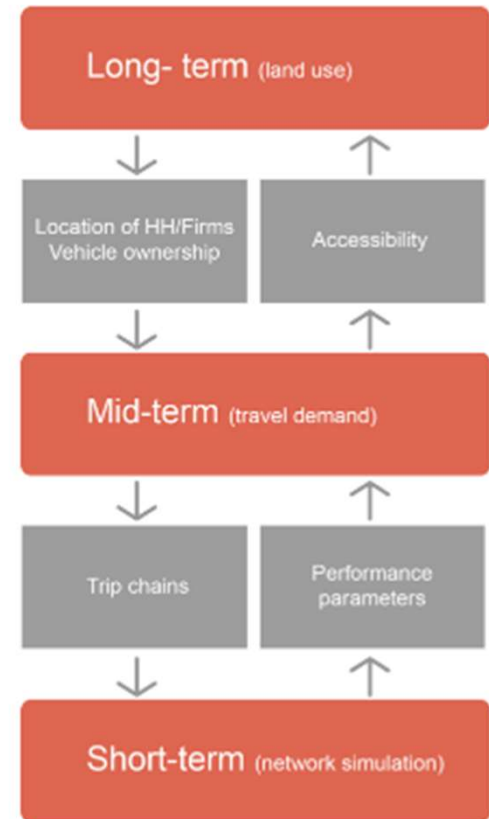


Figure 2: SimMobility general framework

SimMobility Mid-term

- **Activity-based** demand integrated with **dynamic multi-modal** assignment

- **Three components:**
 - Pre-day
 - Within-day
 - Supply (inc. controllers)

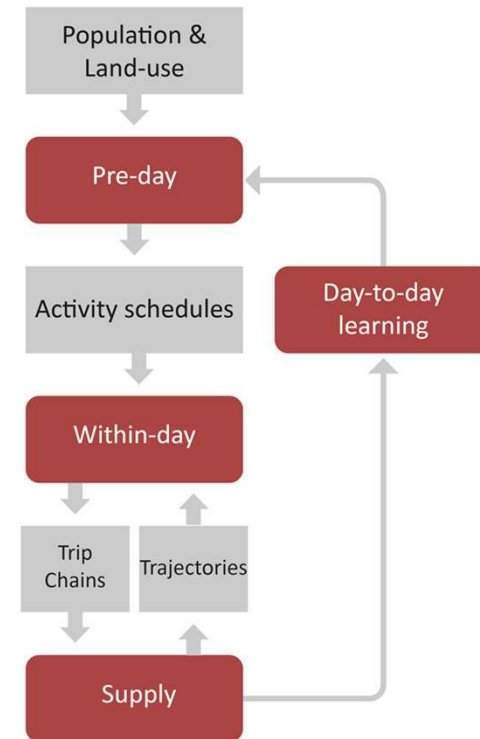


Figure 3: SimMobility Mid-term framework

SimMobility Pre-day Output

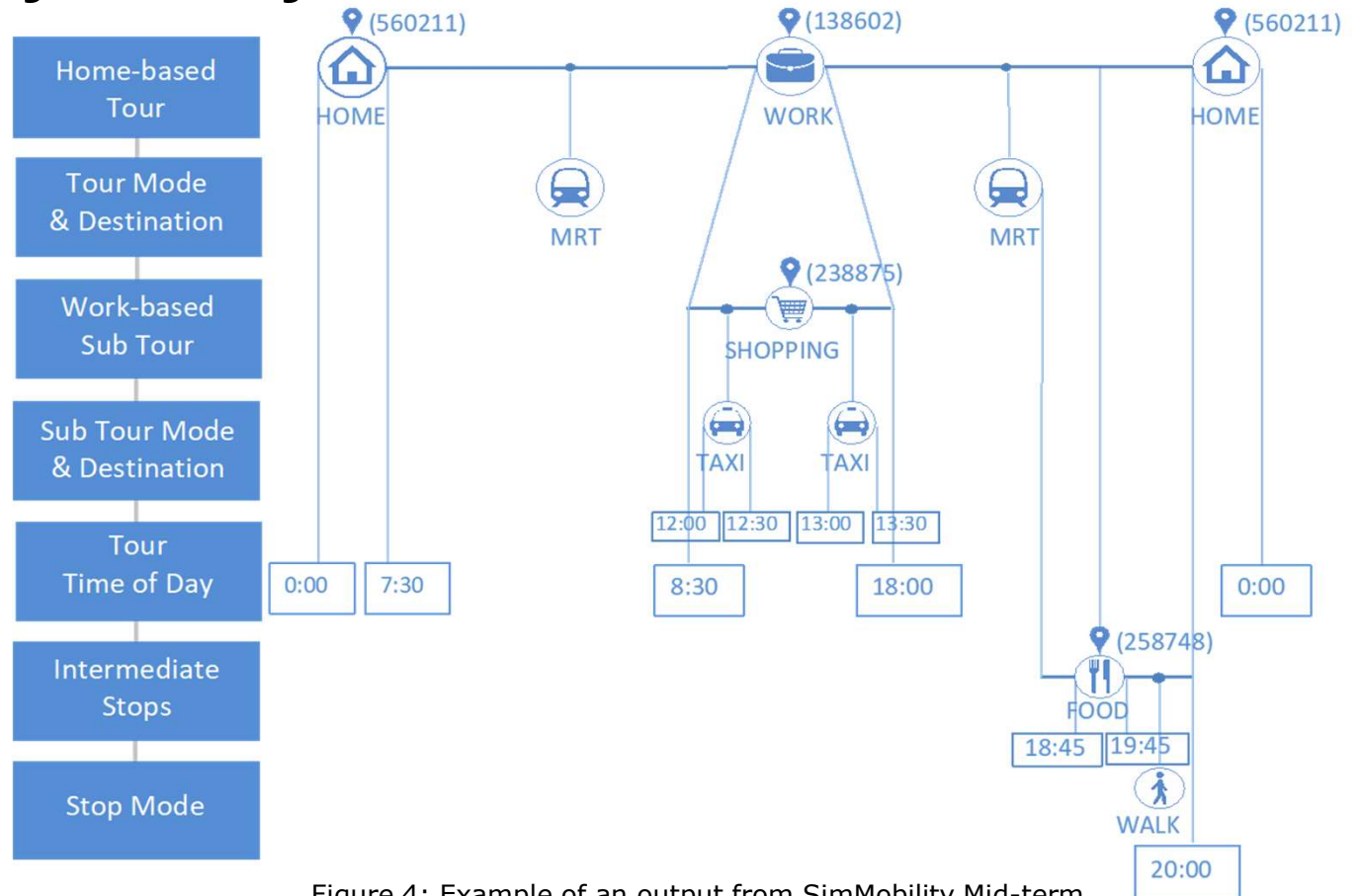


Figure 4: Example of an output from SimMobility Mid-term

Pre-day model structure

- **Day pattern level:** models whether the individual will travel during the day, and if traveling, for which combination of primary activities
- **Tour level:** models the mode, destination and time when each primary activity and WB sub-tour happens
- **Intermediate stop level:** models the secondary activities, as well as the mode, destination and time when each secondary activity takes place

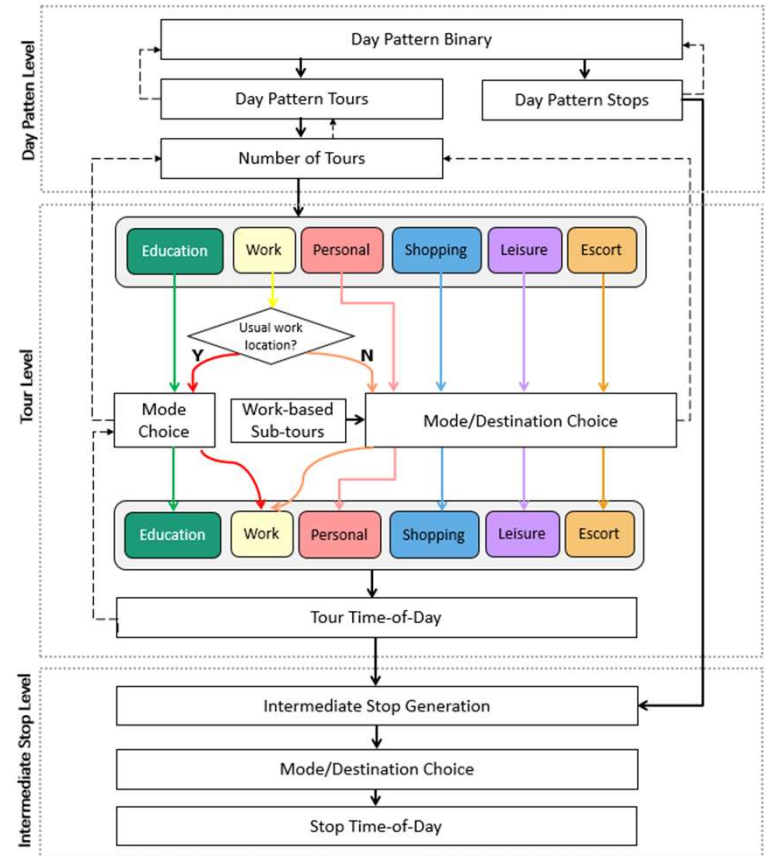


Figure 5: Activity-based model framework

SimDanmark Pre-day Estimation Data

- Danish National Travel Survey (TU survey)
 - Trip diary
 - Socioeconomic information
- Landstrafikmodellen (LTM)
 - Level of service (2020)
 - Travel times
 - Travel costs
- Pandas Biogeme: <https://biogeme.epfl.ch/>

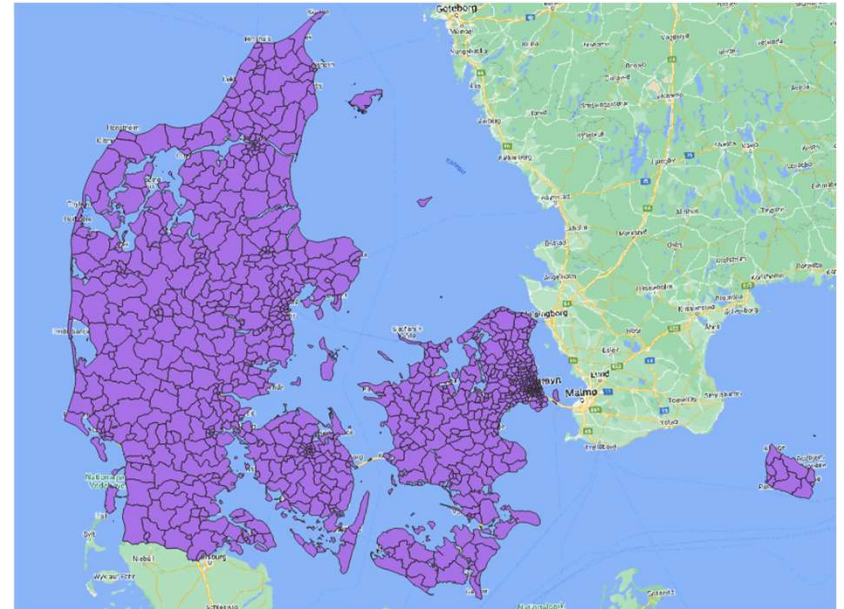


Figure 6: Danish zone system (L2 – 907 zones)

SimDanmark Pre-day Estimation Data

- 2017-2019: 19,588 individuals
- 16,507 of them performed 24,644 tours



Figure 7: Modes modelled

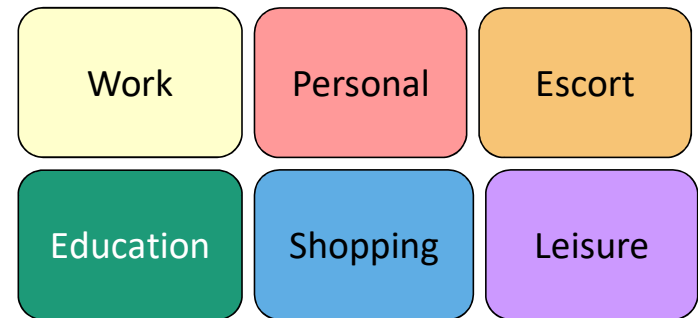


Figure 8: Activities purposes modelled

Estimation status

Already estimated

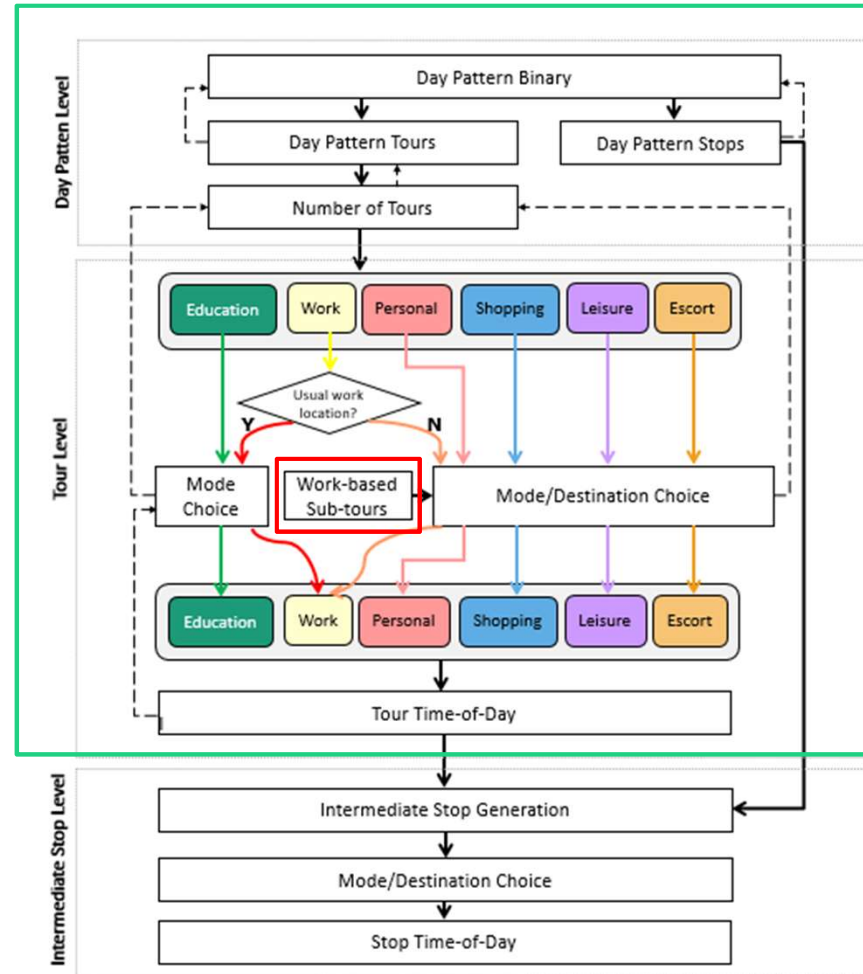


Figure 9: Activity-based model estimation status

Preliminary results

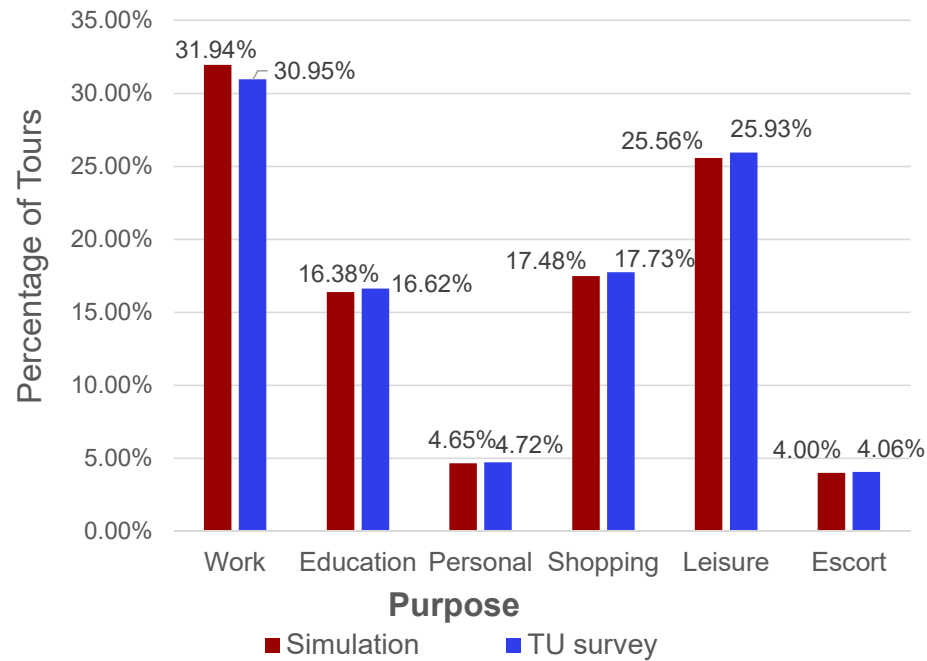


Figure 10: Tours by purpose

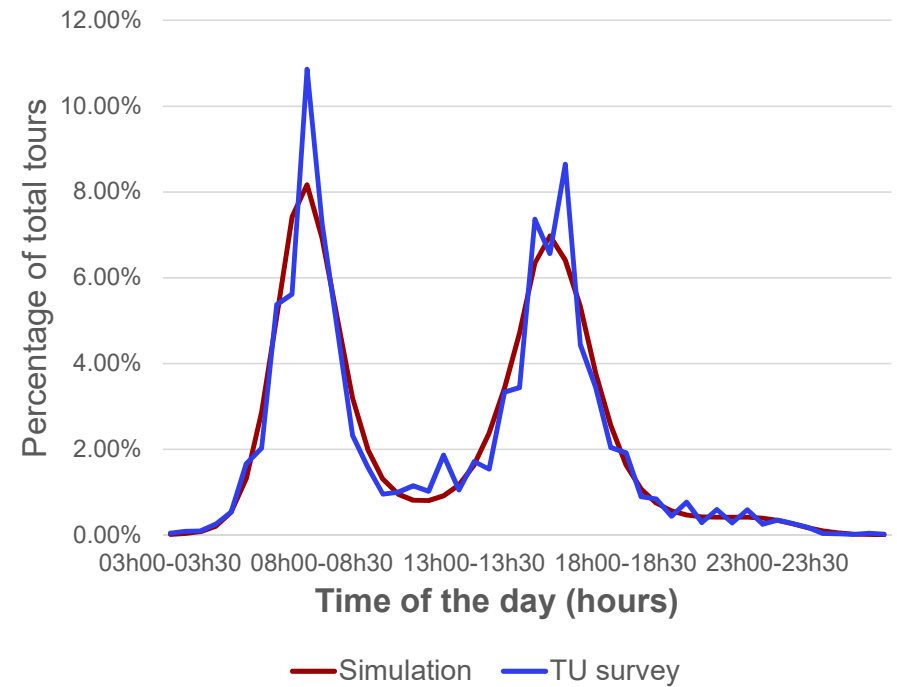


Figure 11: Work tours by time of the day

Next steps (1/2)

- Pre-day
 - Finish initial estimation of the models
 - Simulate the models to obtain logsums (inclusive values from lower levels)
 - Re-estimate the higher level models with the estimated logsums
 - Calibration to match observed statistics (e.g., mode share, flow counts, speed)
 - Supply data:
 - Rejsekort
 - Connected cars
 - Mastra

Next steps (2/2)

eMOTIONAL Cities project (Horizon2020 - <https://emotionalcities-h2020.eu/>)



- Investigate how the **built environment affects an individual's health and well-being**;
- **Incorporate data from land-use and emotions** into the demand models to examine how they affect or are affected by daily activities and travels;
- Support the design of land-use policies guidelines to **improve citizens well-being**

Sorted Mobility (JPI Urban Europe/IFD - <https://jpi-urbaneurope.eu/project/sortedmobility/>)



- Focus on **self-organizing management of public transport**;
- Model mobility decisions under current and future highly dynamic/self-organized rail operations (uncertainty);
- Support the **planning of future rail public transport**



Thank you!

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