

An agent-based model for modal shift in public transport

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Special Session: Exploration and validation of spatial simulation models

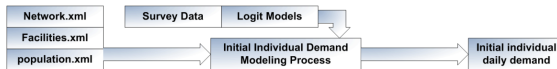
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[Zhuge et al., 2019]

MATSim model: heterogenous data and integration of many sub-models



(a) scenario creation: transport network / locations, capacities and opentimes for activities / synthetic population



(b) initial individual demand modeling: complete daily demand for each individual of the scenario



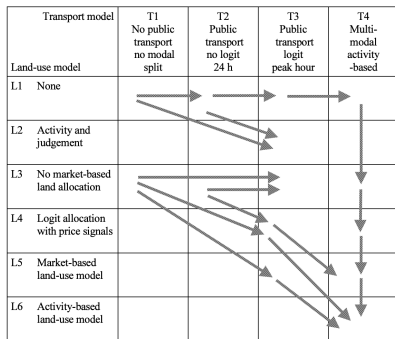
(c) demand optimization: systematic relaxation process to optimize user specified parts of the daily demand, i.e. route, departure time and activity duration choice



(d) statistical analysis: dynamic traffic volumes / work place occupation density / spider analysis / winner-looser statistics / dynamic traffic visualization / counts comparison / etc.

Source: [Balmer et al., 2009]

Land-use transport models as a progressive complexification through coupling of detailed sub-models



Models	Speed of change							
	Very slow		Slow		Fast		Immediate	
	Networks	Land use	Work-places	Housing	Employment	Population	Goods transport	Travel
BOYCE	+				+	+		+
CUFM		+	+	+	+	+		
DELTA/START	+	+	+	+	+	+	+	+
HUDS				+	+	+		
IMREL	+	+	+	+	+	+		+
IRPUD	+	+	+	+	+	+		+
ITLUP	+	+			+	+		+
KIM	+				+	+	+	+
LILT	+	+	+	+	+	+		+
MEPLAN	+	+	+	+	+	+	+	+
METROSIM	+	+	+	+	+	+		+
MUSSA	+	+			+	+		+
POLIS		+			+	+		+
RURBAN		+			+	+		+
STASA	+	+	+	+	+	+	+	+
TRANUS	+	+	+	+	+	+	+	+
URBANSIM		+	+	+	+	+		+

Source: [?]

Case study: *Construct a modular four-step multimodal transportation model using open source projects and data*

Integrated models:

- MATSim model (MATSim Community) for the transportation system
<https://www.matsim.org/> [?]
- SPENSER model (University of Leeds) for the synthetic population
<https://github.com/nismod/microsimulation>
- QUANT model (CASA, University College London) for spatial interactions to generate home-work plans
<http://quant.casa.ucl.ac.uk/> [?]
- spatialdata library (OpenMOLE community) for data processing
<https://github.com/openmole/spatialdata> [?]

Data:

Generic for any Functional Urban Area (GHSL [?]) or any arbitrary area in the UK: NOMIS census, OrdnanceSurvey roads, Traveline National Dataset for public transport

Workflow systems:

- DAFNI facility funded by UKCRIC <https://dafni.ac.uk>
- OpenMOLE software <https://openmole.org/> [?]

Implementation

Currently integrated into the DAFNI platform:

- synthetic SPENSER population with uniform job locations
- QUANT model to generate home-work commuting flows
- network and plans prepared into MATSim xml files and fed into a one-mode MATSim (multimodal version still tested locally)
- models integrated as Docker containers

→ Road network preprocessing: implemented into the `spatialdata` scala library [?]

`figures/road_data.png`

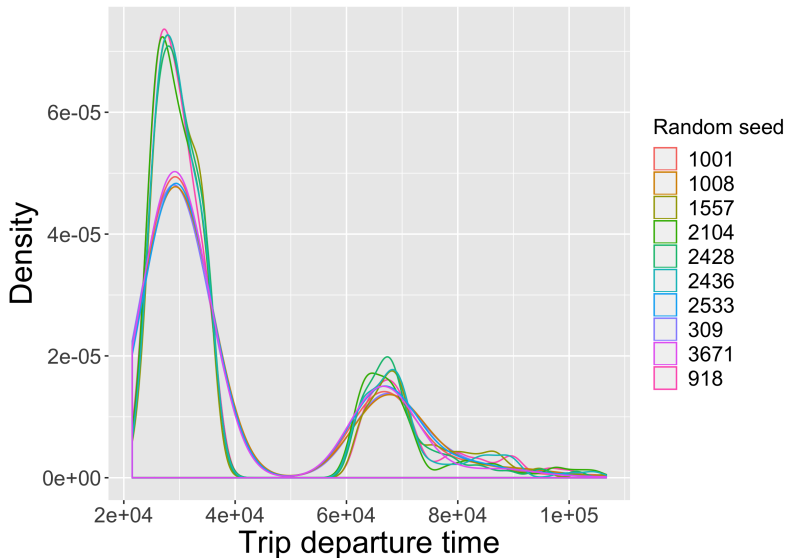
OpenMOLE model exploration open source software [?]



Enables seamlessly (i) model embedding; (ii) access to HPC resources; (iii) exploration and optimization algorithms

<https://openmole.org/>

FUA: Taunton



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Open repositories

<https://github.com/JusteRaimbault/UrbanDynamics/Models/Matsim>
for containers and workflows

<https://github.com/openmole/spatialdata> for data processing

Acknowledgements

DAFNI platform/Champions program; Urban Dynamics Lab Grant EP-SRC EP/M023583/1

-  Balmer, M., Rieser, M., Meister, K., Charypar, D., Lefebvre, N., and Nagel, K. (2009).
Matsim-t: Architecture and simulation times.
In Multi-agent systems for traffic and transportation engineering, pages 57–78. IGI Global.
-  Zhuge, C., Shao, C., Wang, S., and Hu, Y. (2019).
Sensitivity analysis of integrated activity-based model: Using matsim as an example.
Transportation Letters, 11(2):93–103.