Integration of Longitudinal Data in Agent-Based Travel Demand Models

PD Dr. Martin Kagerbauer, KIT-Institute for Transport Studies

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mobitopp

- Agent- and activity-based travel demand model
- Used in several projects since 2006, many publications

Two separate modules:

Long-term module

Population synthesis, activity plan generation, mobility tool ownership assignment, fixed destination choice

Short-term module

Based on long-term module, simultaneous simulation of all agents from Monday to Sunday

More information and publications: mobitopp.ifv.kit.edu/english/

Features (selection):

Modelling period of one week

Household-level modeling

Vehicle-specific mode availability

Intermodal trips

Modern choice models, incl. ML, CNL

Change of activities due to working-from-home

Destination choice model

Estimated values for parameters of the binary logit model for the choice of a new destination for trip purpose „shopping for everyday needs“ during the course of one week

Analyses of Maximum-Likelihood-Estimation								
Parameter		DF	Estimate	Standard error	95% Confidence limits		Chi-Square	Pr > Chi Sq
Intercept		1	-1.5931	0.0855	-1.7606	-1.4256	347.41	<.0001
Tripno	2	1	1.6735	0.0824	1.5121	1.8350	412.74	<.0001
Tripno	3	1	0.9400	0.0853	0.7729	1.1071	121.59	<.0001
Tripno	4	1	0.6220	0.0922	0.4413	0.8027	45.51	<.0001
Tripno	5	1	0.4107	0.1056	0.2038	0.6176	15.14	<.0001
Tripno	6 and more	0	0.0000	.	.	.	.	.
Origin	Other	1	0.3201	0.0416	0.2385	0.4016	59.21	<.0001
Origin	Home/Work/ Education	0	0.0000	.	.	.	.	.
Community	City of Stuttgart	1	0.8287	0.0475	0.7356	0.9217	304.83	<.0001
Community	Major/medium regional center	1	0.2220	0.0507	0.1226	0.3215	19.14	<.0001
Community	Other community	0	0.0000	.	.	.	.	.

Source: Survey of Stuttgart Region, 2009

Mode choice model

Conditional logit-model for mode choice of the mode used for the first trip (left) and the second and consecutive trips the of the week starting on Monday

Conditional logit-model for mode choice of the mode used for the first trip of the week (on Monday) starting from home
Type-3-effect analysis

Effect	DF	Wald Chi-Square	Pr > ChiSq
mode	4	28.6370	<.0001
Travel time	1	33.2577	<.0001
Travel costs per km	1	137.7236	<.0001
mode*caravail	8	561.7754	<.0001
mode*transpas	4	1139.9950	<.0001
mode*purpose	28	732.6141	<.0001
mode*wdaytyp	8	4.0098	0.8562
mode*hhtyp	12	130.8115	<.0001
mode*pgroup	28	169.1050	<.0001
mode*parkpress	4	416.0658	<.0001
mode*dist	4	288.2756	<.0001
mode*comkm	4	22.1580	0.0002
mode*shorttrip	4	477.9181	<.0001

Conditional logit-model for mode choices of the second and consecutive trips starting Mon-day
Type-3-effect analysis

Effect	DF	Wald Chi-Square	Pr > ChiSq
mode	4	1390.9763	<.0001
Travel time	1	1047.4362	<.0001
Travel costs per km	1	2595.8491	<.0001
mode*modelast	16	81515.6516	<.0001
mode*caravail	8	2543.7086	<.0001
mode*transpas	4	4028.9460	<.0001
mode*purpose	32	12692.3094	<.0001
mode*wdaytyp	8	815.9866	<.0001
mode*hhtyp	12	596.0980	<.0001
mode*pgroup	28	874.4959	<.0001
mode*parkpress	4	4705.7832	<.0001
mode*dist	4	3618.5895	<.0001
mode*comkm	4	118.5816	<.0001
mode*shorttrip	4	9274.1202	<.0001

Source: Survey of Stuttgart Region, 2009

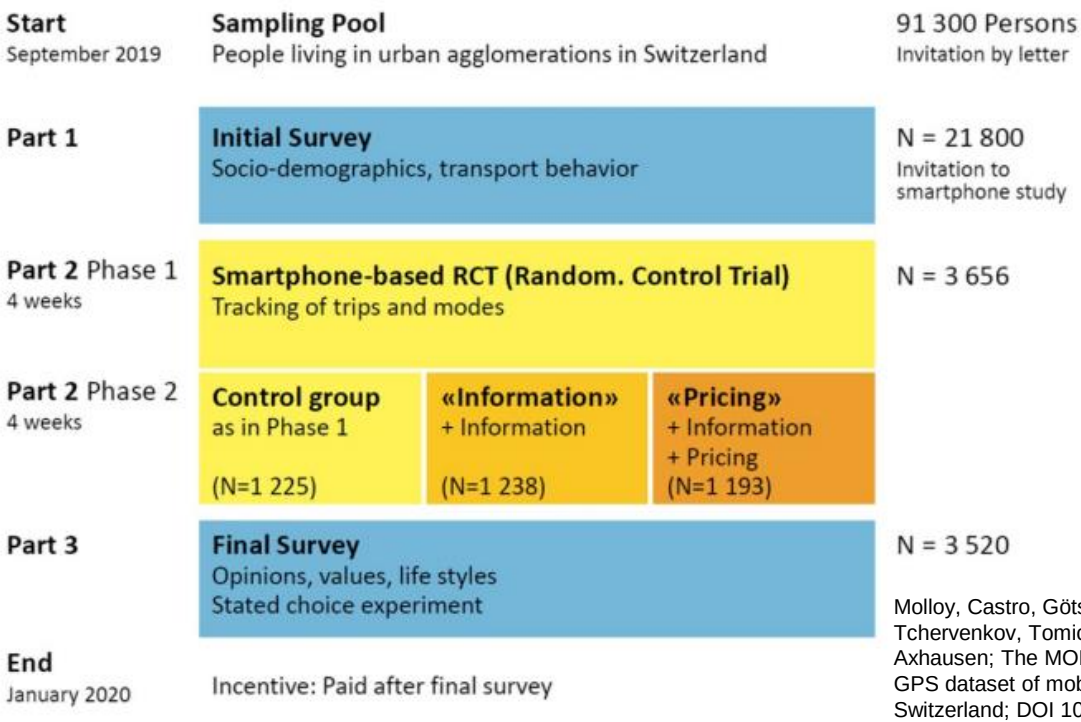
Motivation to update mobiTopp

- Stabile and variable behavior patterns in destination choice
  - Repeated trips (temporal and spacial)
  - Routines
- Modelling of these behavior patterns in ABM
  - Influences of changing circumstances or mesures on travel behavior

Modelling individual networks in mobiTopp

Modelling individual networks in mobiTopp

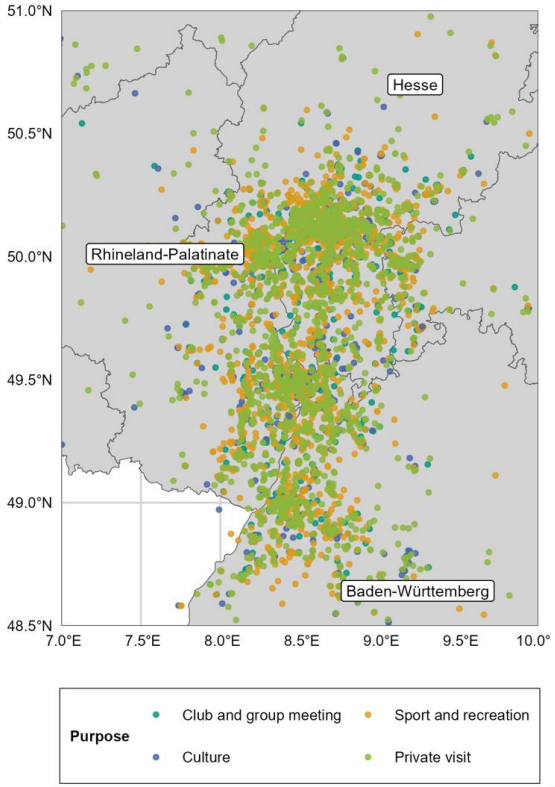
- Database MOBIS

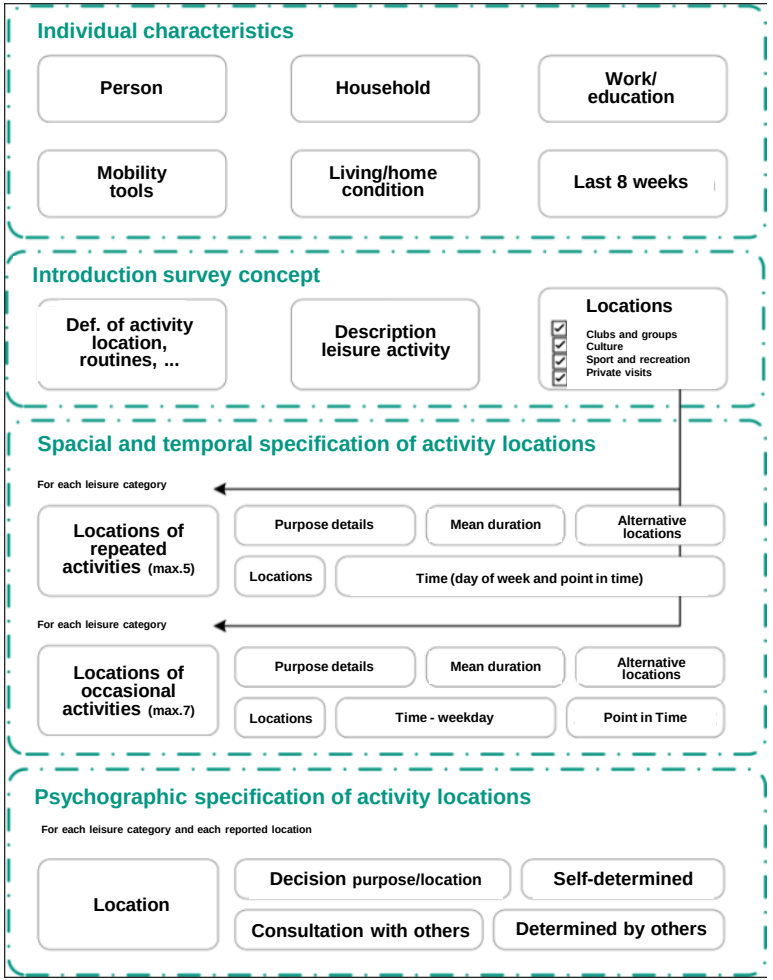


Molloy, Castro, Götschi, Schoeman, Tchervenkov, Tomic, Hintermann, Axhausen; The MOBIS dataset: a large GPS dataset of mobility behaviour in Switzerland; DOI 10.1007/s11116-022-10299-4

Modelling individual networks

- Database for ongoing work





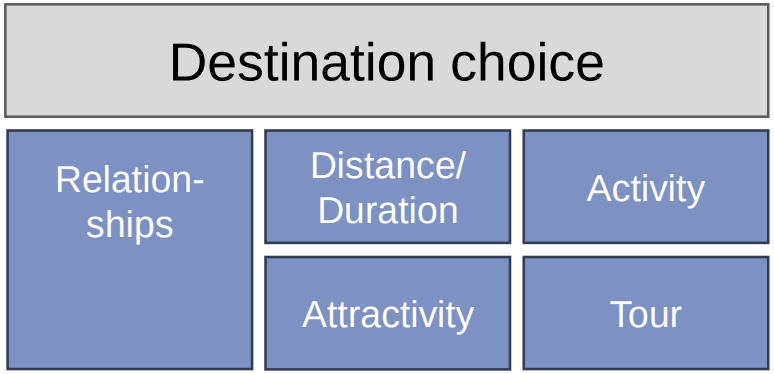
Relationships of agents & destination choice

Relationship synthesis

Persons/Agents …

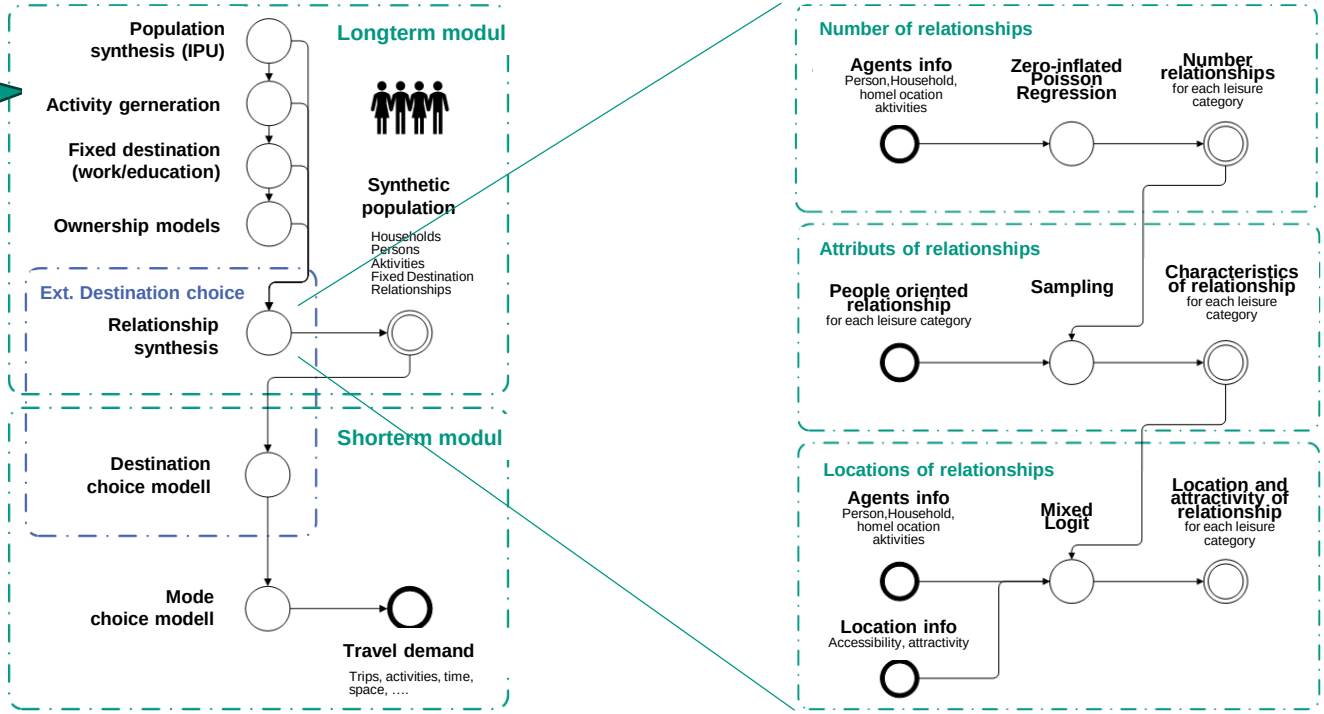
- … are part of a houshold
- … have fixed destinations for work and education
- … have access to car, PT, carsharing etc.
- … have a specific amount of destinations for the different activities with characteristics (e.g., time)

Destination Choice



Modell framework

Data of
6 weeks



Effekts of working from home

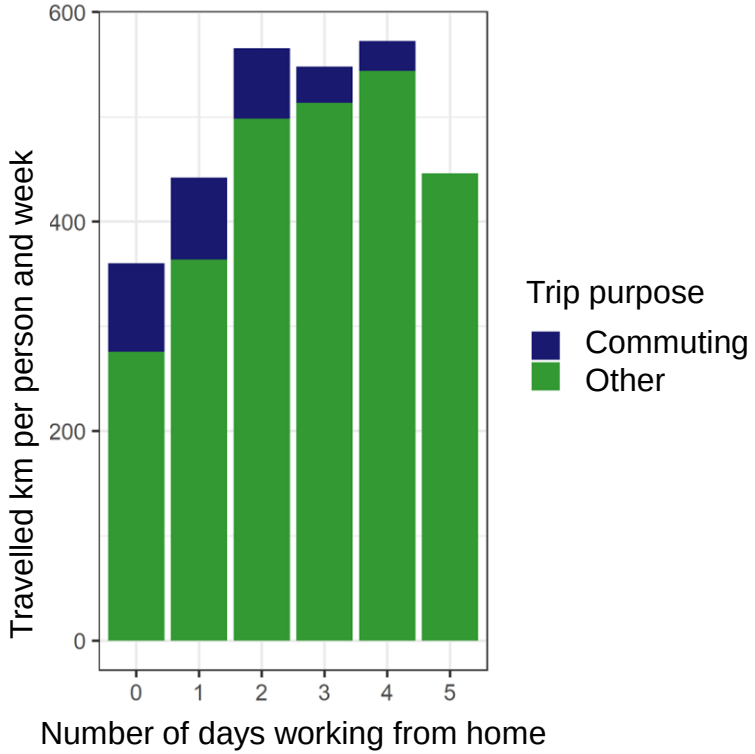
- **Survey Stuttgart Region: Oct. to Dez. 2021:**
  - 9.959 Persons/5.477 Households

- ➢ 50% of people are able to work from home
- ➢ 20% work from home 1-3 days a week
  17% work from home 4-5 days a week
- ➢ WFH almost always the whole day

- **German Mobility Panel MOP**:
  - since 2012 WFH-Data
  - MOP (2021): 3.247 Persons/1.840 Households

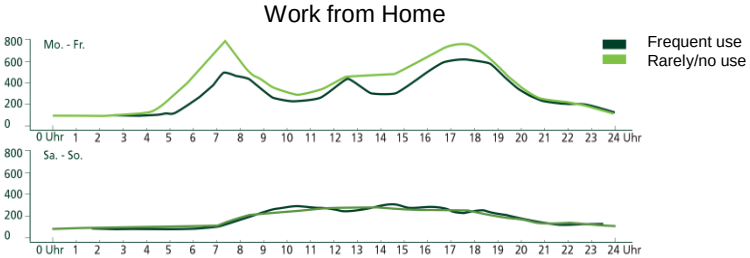
- ➢ People WFH are more mobil (more trips and distances)

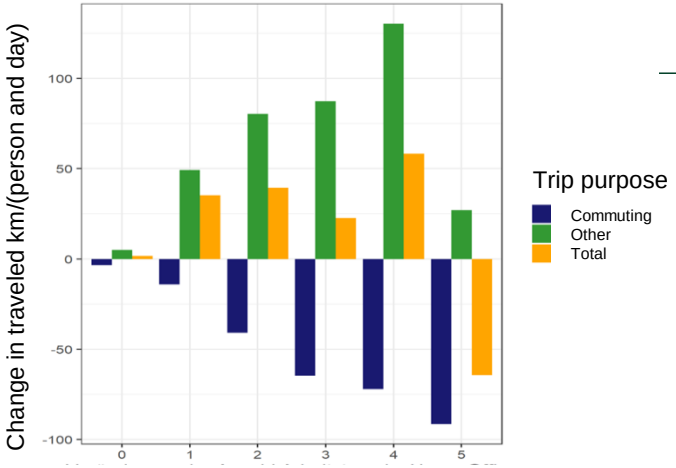
MOP 2021



Effects of working from home (WFH)

WFH is accompanied by a significant shift in the timing of traffic participation. This leads to a reduction in peak loads.





Change in the number of working days from home

Change in WFH frequency also changes travel behavior: With more WFH days, other trips increase. This increase exceeds/equalizes the savings effect of the eliminated work trips (rebound). This increase in other journeys is particularly noticeable among people with a shorter distance to work

Thank you!