

Bevorzugter Zitierstil für diesen Vortrag

Axhausen, K.W. (2022) How did we get here? 24 Years of ETH Research, *NLS Colloquium «Transport Planning: Where do we go now?»*, ETH Zürich, December 2023.

How did we get here? 24 Years of ETH Research

KW Axhausen

IVT

ETH

Zürich

December 2023

 *Institut für Verkehrsplanung und Transportsysteme*
Institute for Transport Planning and Systems

ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Mission

The mission of the IVT is the:

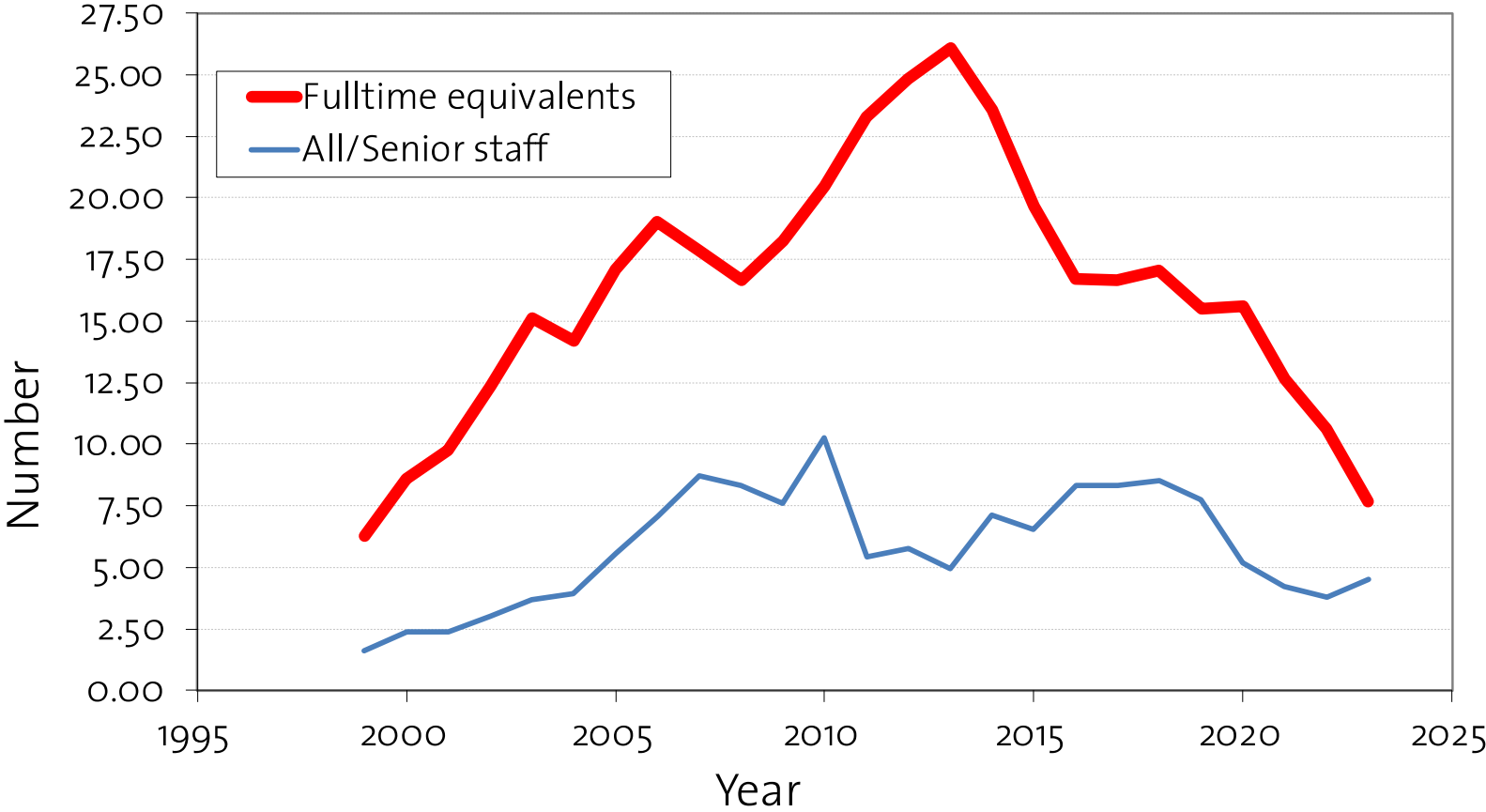
- Generation of new knowledge for the planning, design, operation, and maintenance of transport systems
- Transfer of this knowledge through teaching, further education, and applied research

and of the transport planning group, as was:

- Generation of new knowledge about the structures of spatial and, in particular, travel behaviour through the advancement of methods for its observation, measurement, description, and modelling on a micro and macro scale
- Transfer of this knowledge through teaching, further education, and applied research, particularly through work on large scale networks and demand models, and on the parameters of cost-benefit analysis.

Resources and impact

Staffing

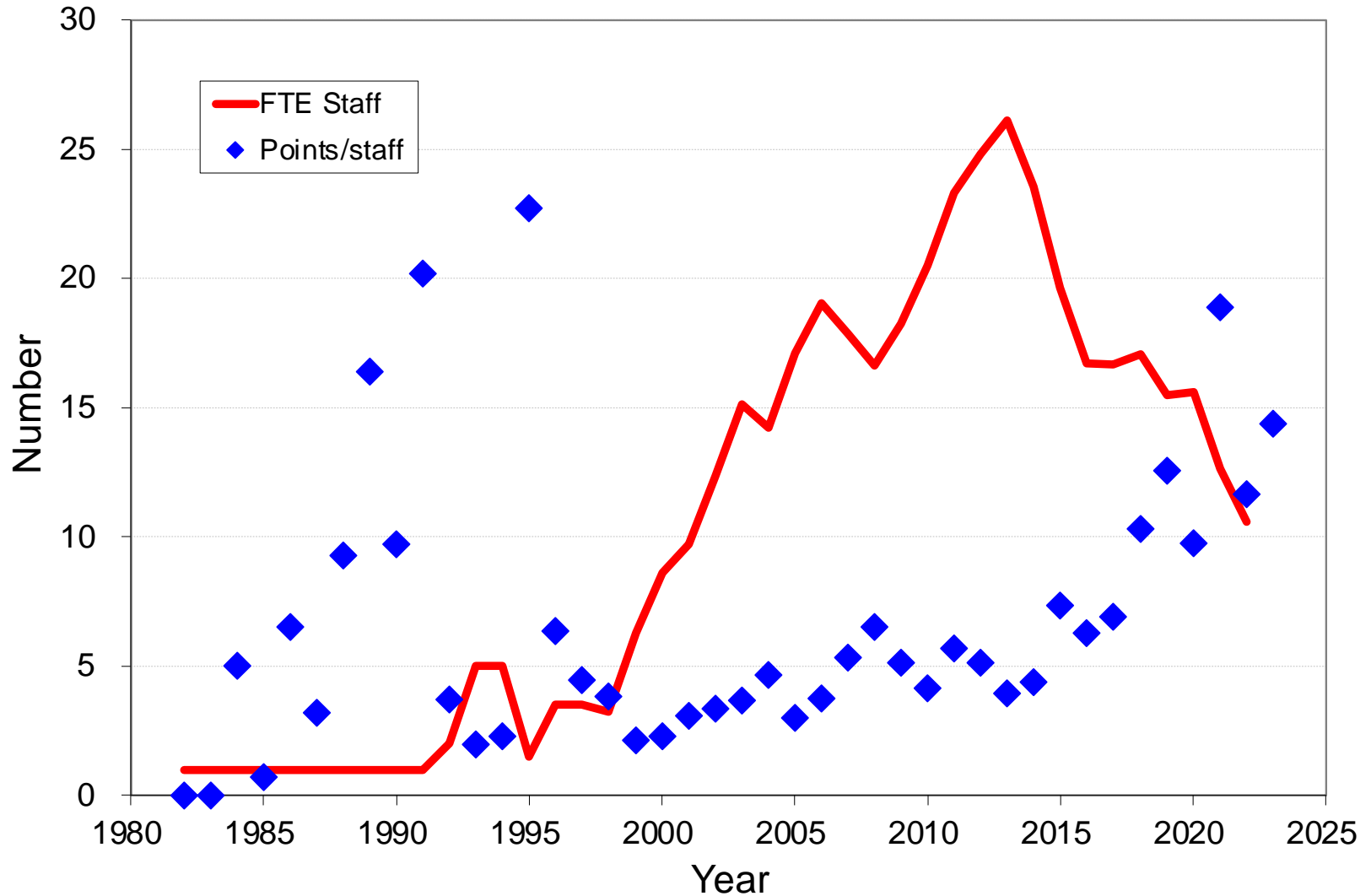


Students and staff at IC, Innsbruck and FCL Singapore



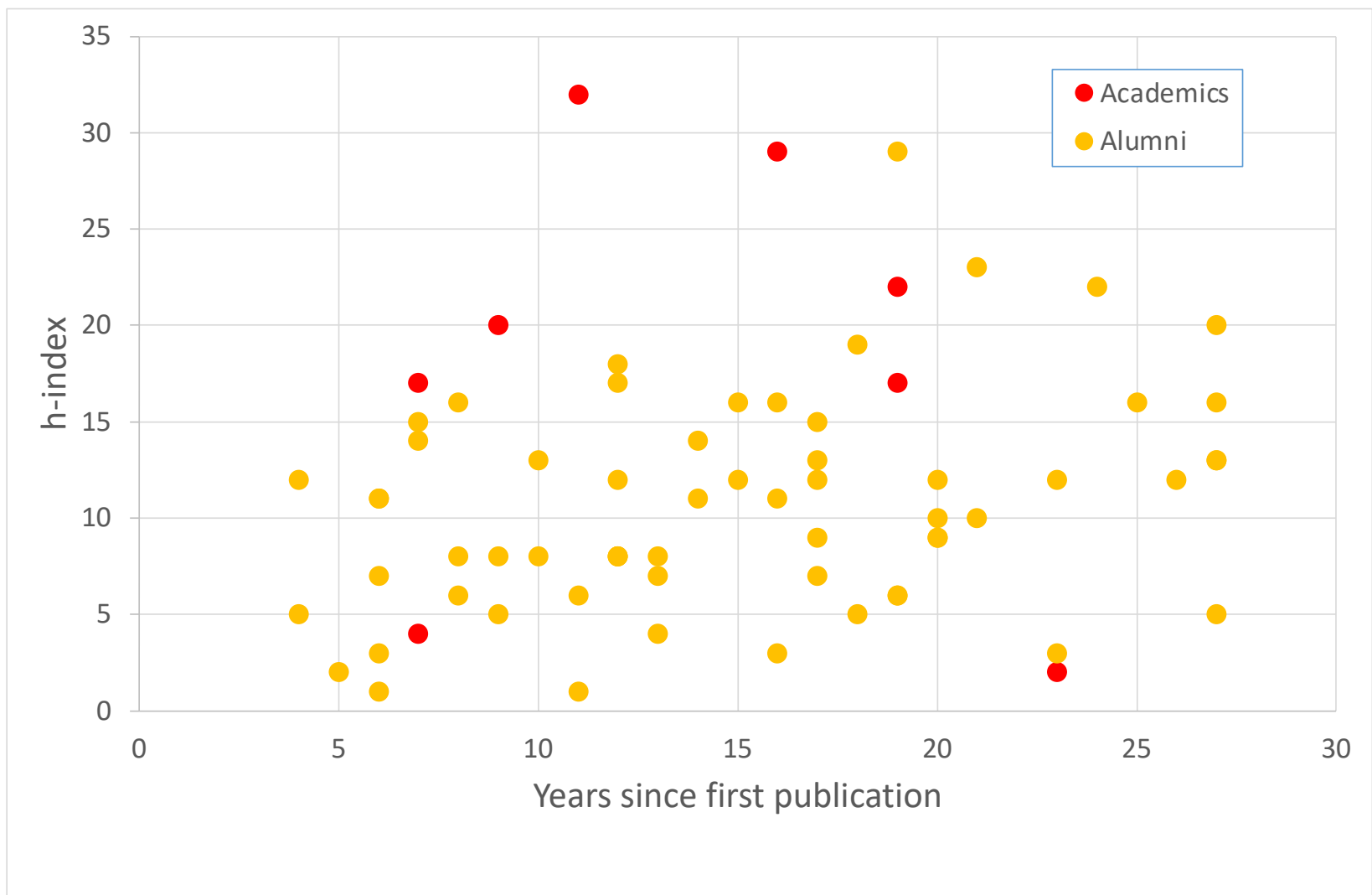
Publications (including 2023 preliminary)

Productivity since 1982 (including 2023 preliminary)



Impact

Impact: h-index of the group's alumni (2023)



Wider impact

Firms of alumni

senozon AG
Transoptima
UrbanDataLab

Simunto cynkra
TransSol
Odyssee

Open-source software packages

MATSim [AmoDEUS]
equaSim
CTAP and JTAP
mixl
SNMan
[FALc]
[Swiss NPVM]

Shared data, e.g.

MobiDrive/Thurgau
MOBIS/COVID
EBIS
TimeUse+
Social network snowball survey
Post-car-world
SVI Neuverkehr
UTD19 (MFD data)

Where are we now ?

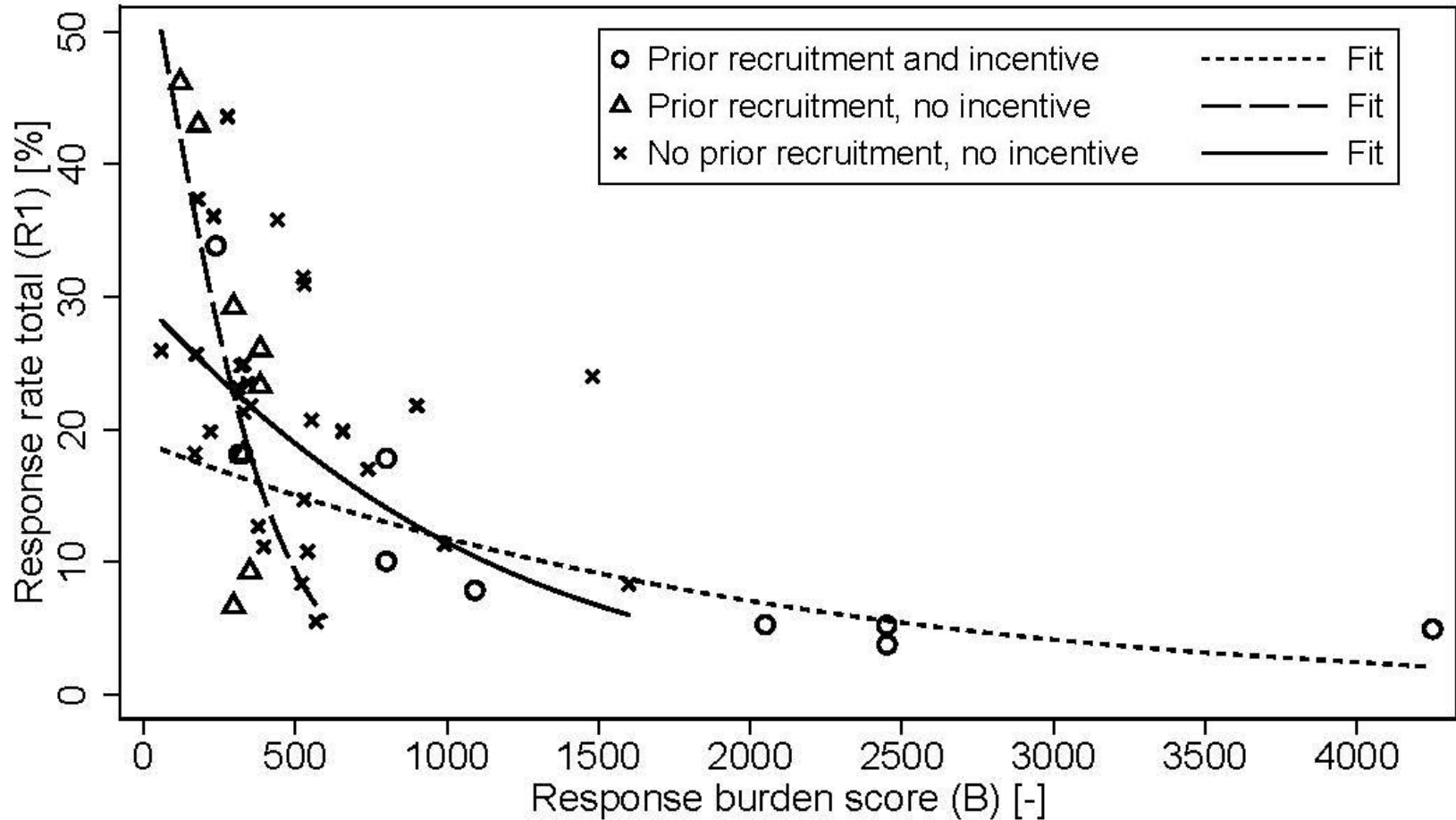
Where are we now ? But what did we miss ?

But what did we miss ? Did not do enough of?

- Historical network reconstruction and analysis
- Land-use-transport interaction models
- Social network integration into MATSim
- Direct demand models
- “Standard” aggregate models
- Freight-transport
- Environmental assessment
- Policy acceptance
- Communication methods for policy acceptance

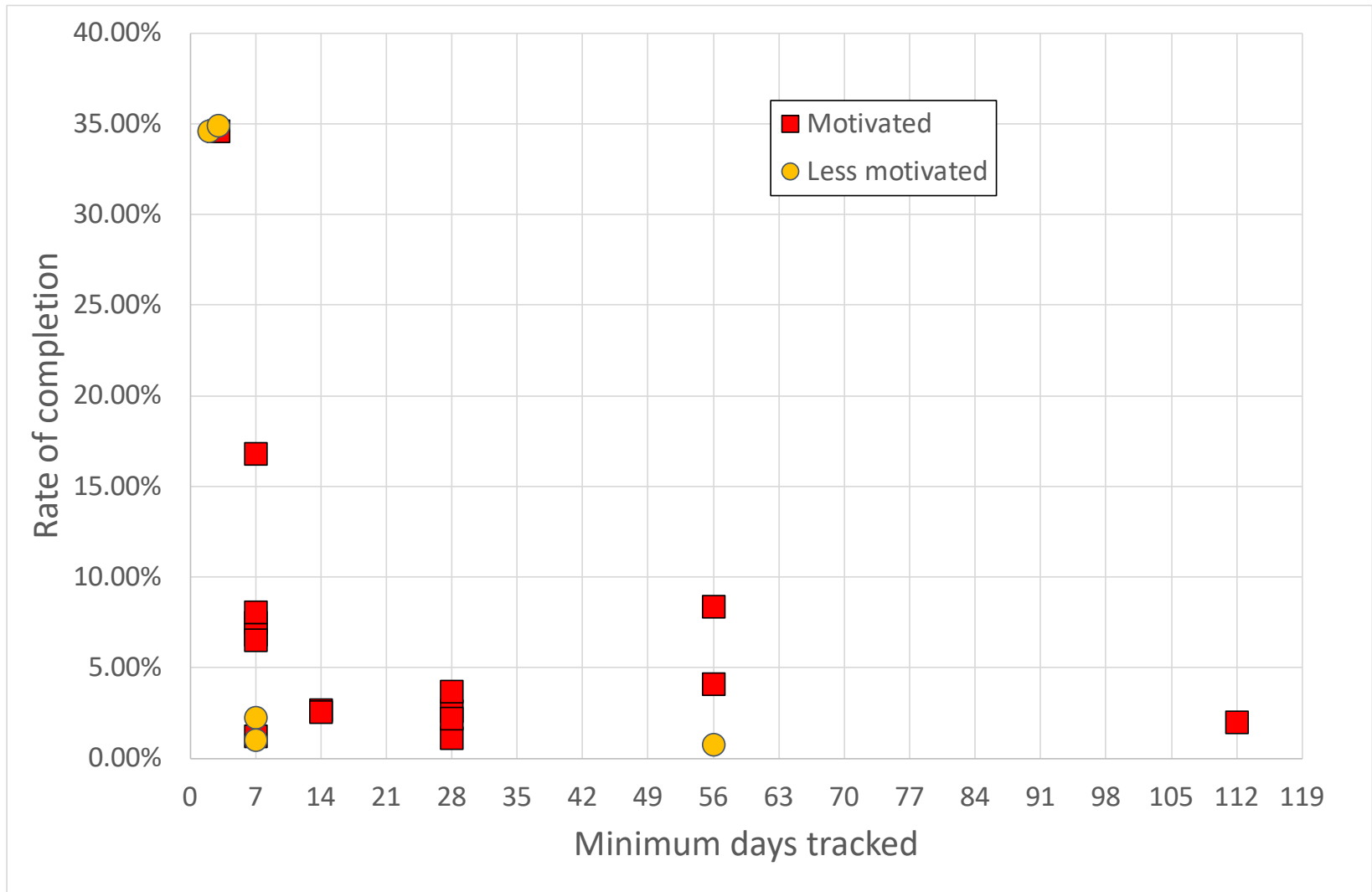
Advances: Response rates better understood

Response rates better understood: IVT surveys



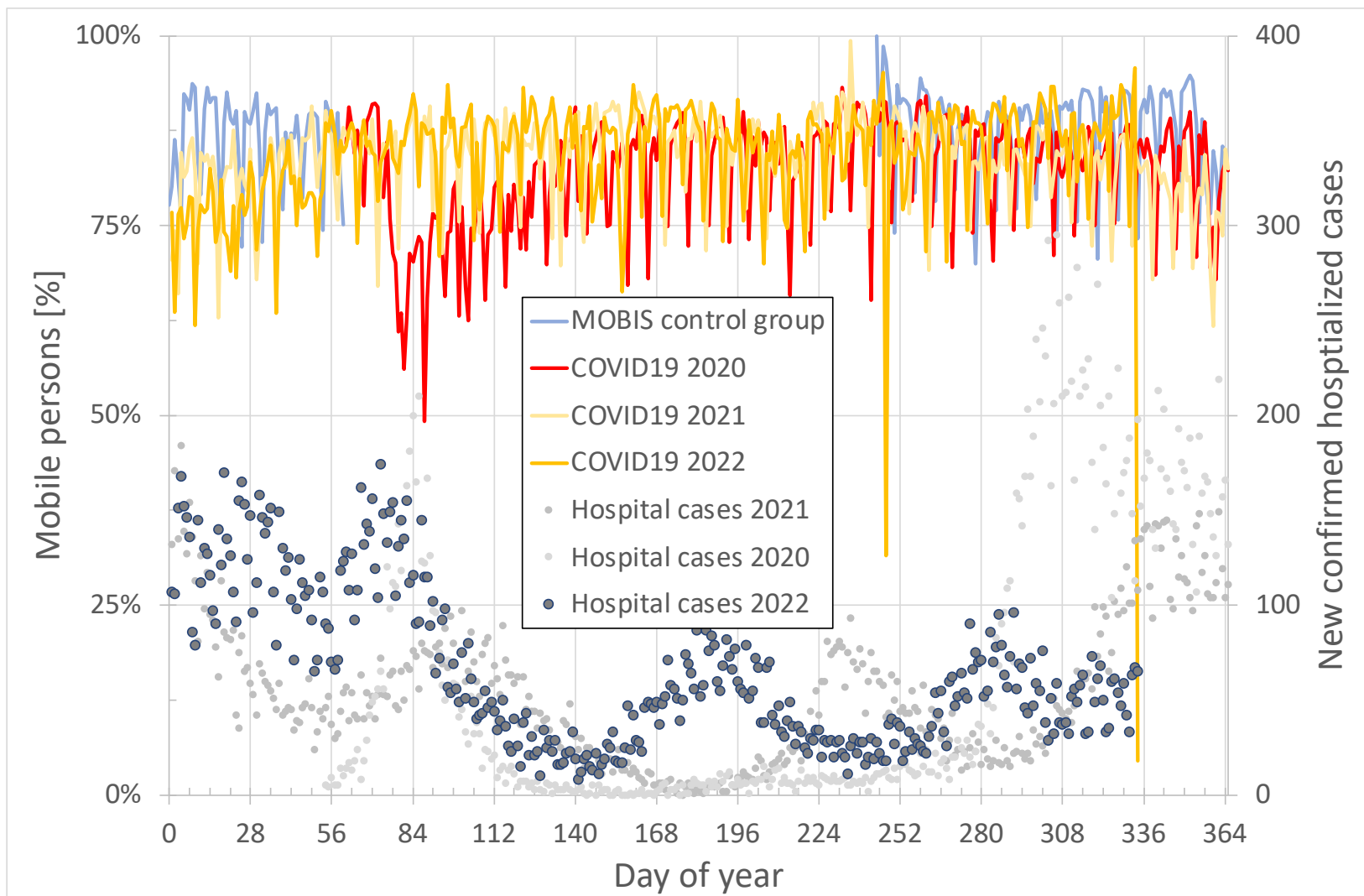
Source: Schmid and Axhausen, 2019

Completion rates better understood: GPS tracking studies



Advances: Long-duration diary studies

Long-duration diary studies: MOBIS/COVID19 2019-2022



Advances: (Long duration) diary studies

Standard ca. 1990

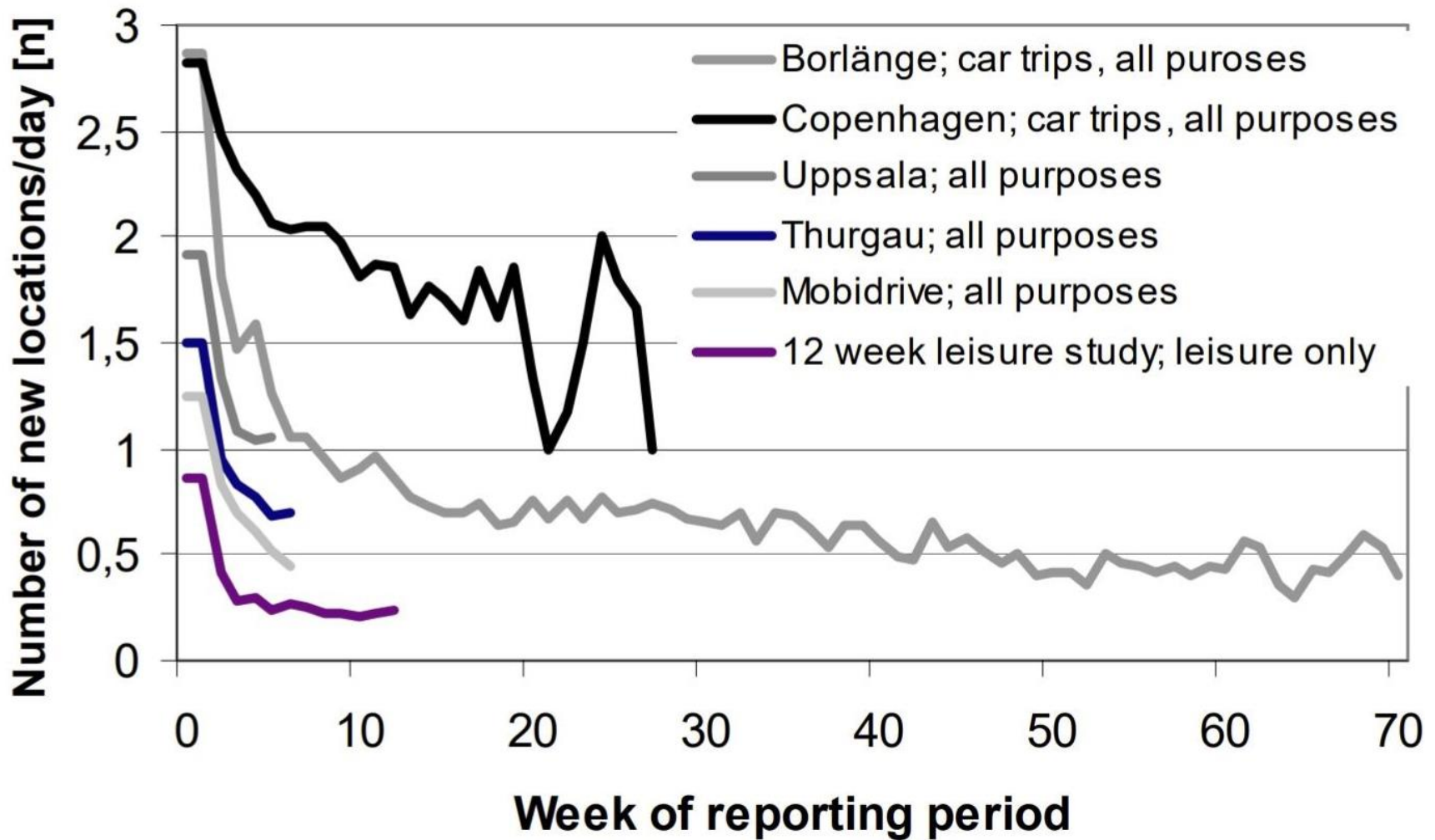
- 1 (to 2) day telephone (household) diary survey
- Official registry sample of households
- Trip-based survey

State-of-the art (standard) 2025

- 7 (14) day GPS tracking plus validation app
- 2 day “verification” telephone survey
- Official registry sample of individuals
- Integrated stated choice surveys as in Swiss MZ 2010 +
- Big data observations (e.g. GSM, ticket smart cards)

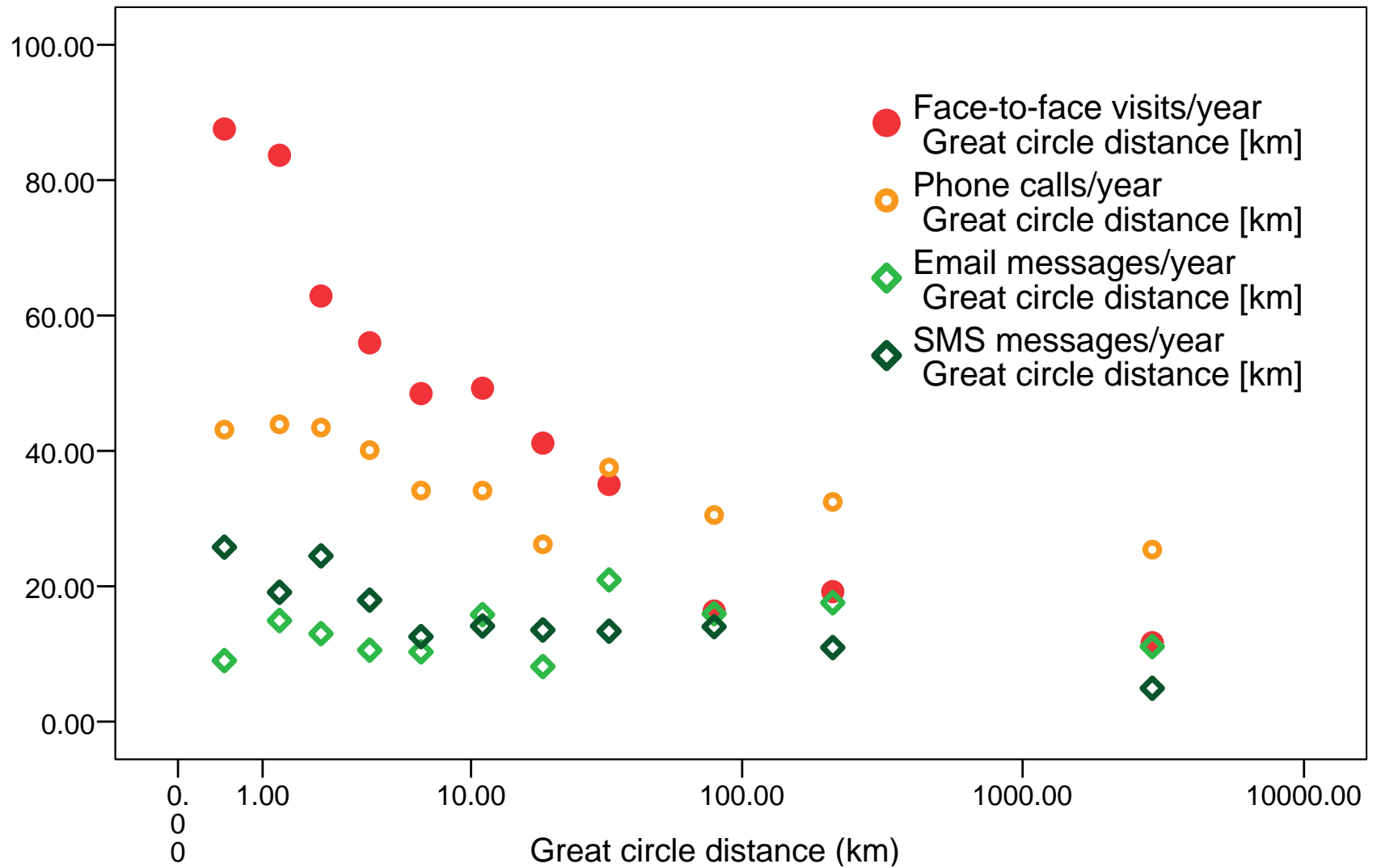
Advances: Structures of behavior

Structures: Innovation rates



Source: Schönfelder and Axhausen, 2004

Structures: Social interactions by mode and home distance



Advances: Structures of behavior

Standard ca. 1990

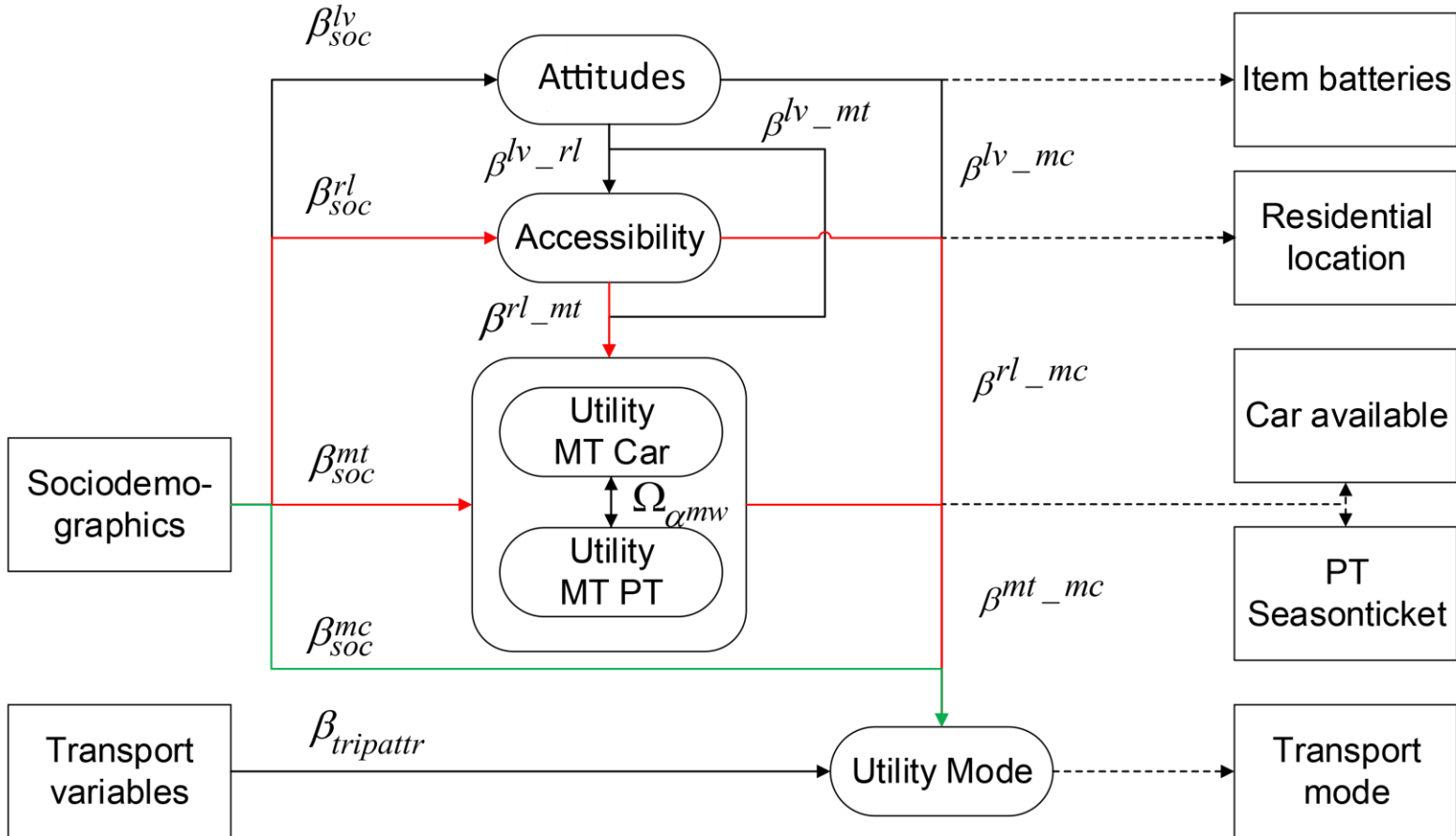
- Trip-based
- Isolated utility maximiser (generalized cost minimizer) based on mental maps
- Habitual weekday of the workers

State-of-the art (standard) 2025

- Constant churn and variance of behavior
- Tour-based utility maximizer in its small-world social network based on the mental map/attitude informed “internet”
 - Generalized costs
 - Reliability
 - Mobility tools
- Trade-offs within the week (year) (WFH)

Advances: Modelling at the micro-scale

Micro-scale: Long-term short-term linkage



Source: Schmid, Becker, Axhausen and Widmer, 2023

Advances: Micro-scale

Standard ca. 1990

- Trip-based
- MNL/NL with proprietary software
- Model-based non-chosen alternatives

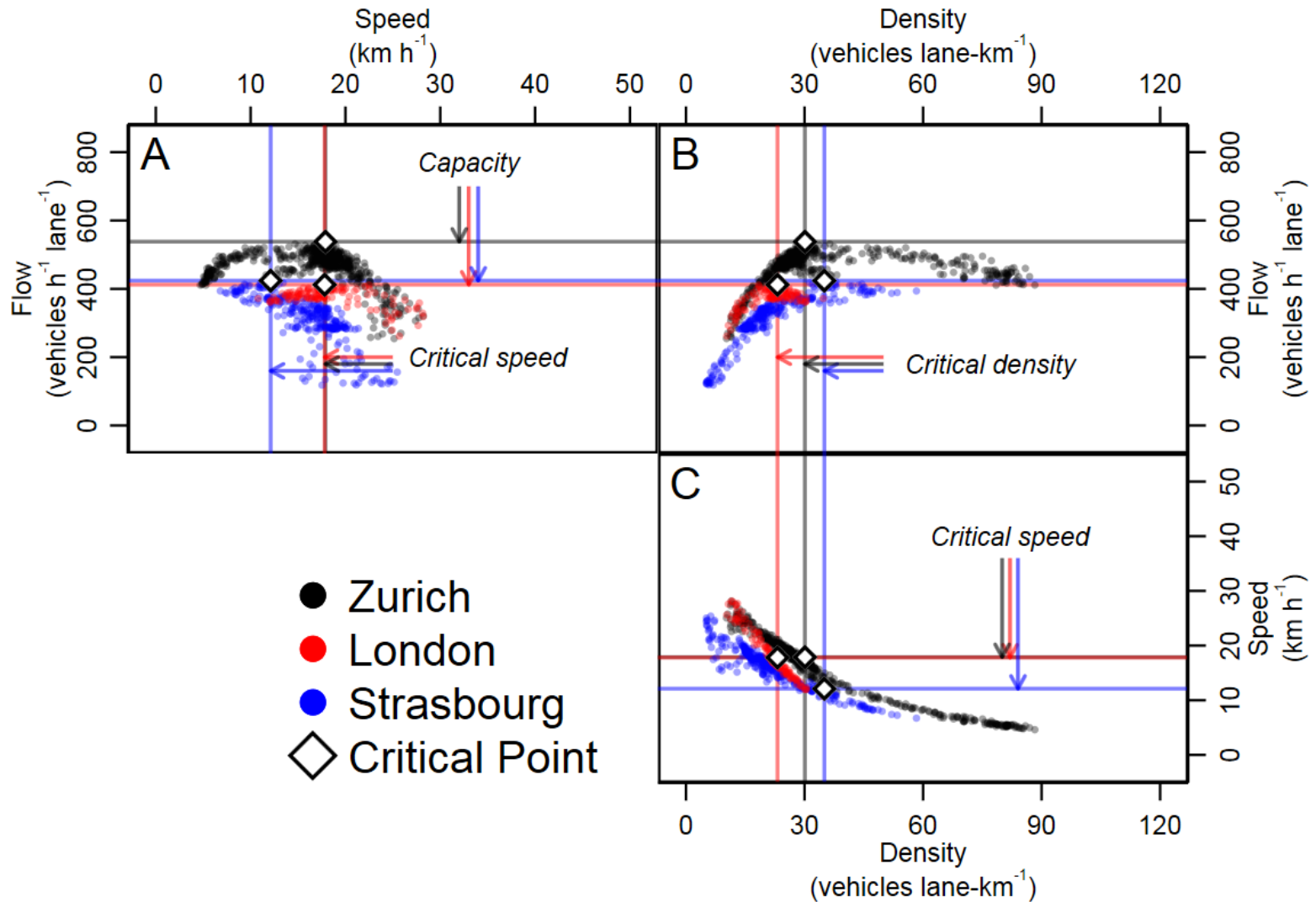
Standard 2025

- Tour-based
- Mixed logit formulations with open-source software (mixl, Apollo etc.)
- Big data-based non-chosen alternatives
- Accounting for self-selection

- VOT and VOL

Advances: Modelling at the macro-scale

Advances: Macroscopic fundamental diagram



Source: Loder, Ambühl, Menendez, Axhausen, 2015

Macro-scale: Large agent-based MATSim implementations

(FCL) FUTURE CITIES LABORATORY 未来城市实验室
senozon
MATSim
Multi-Agent Transport Simulation

Source: Fourie, 2014

Advances: Macro-scale

Standard ca. 1990

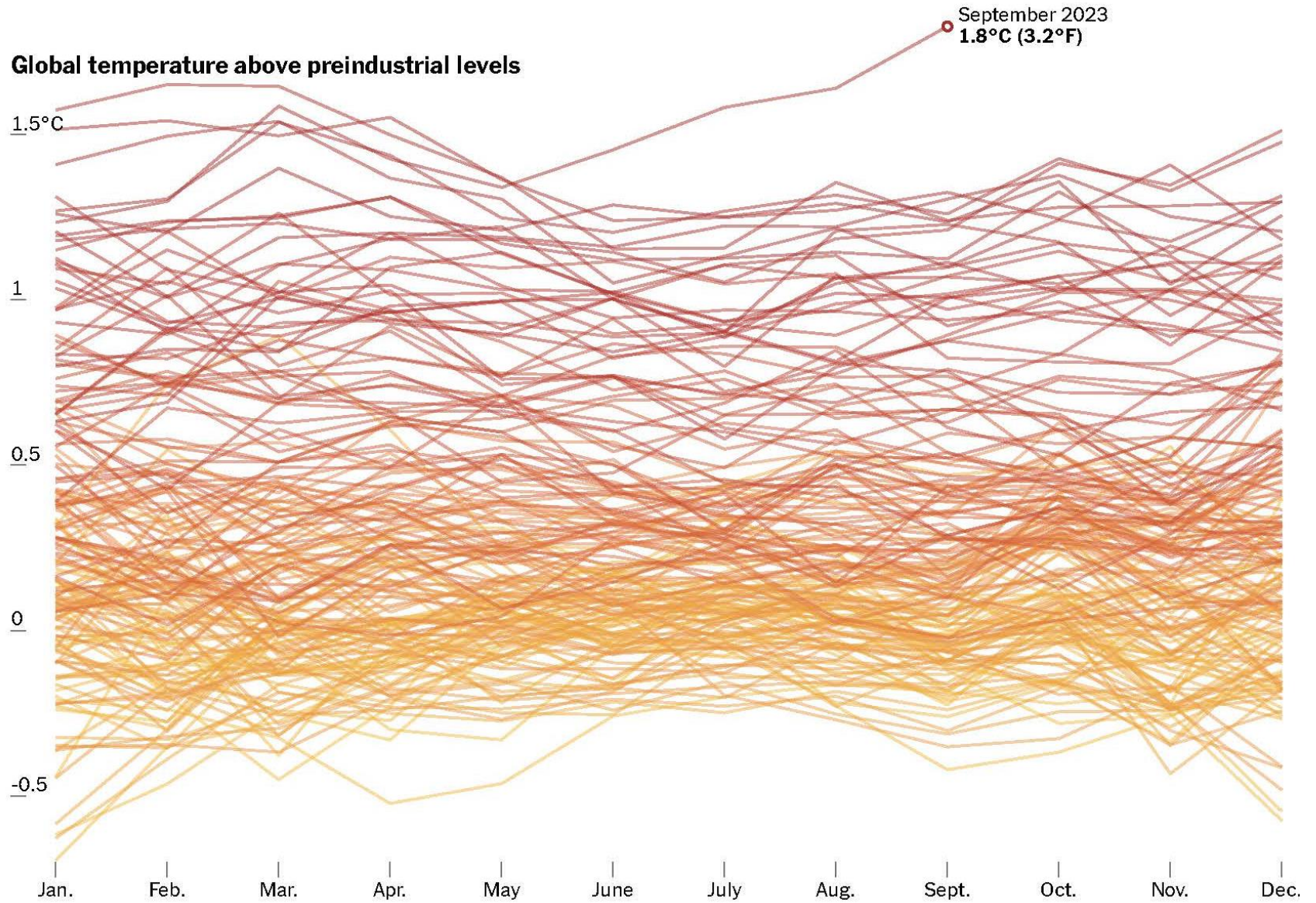
- Aggregate four-step model
- Proprietary software and data
- Environmental indicators

State-of-the-art 2025

- Agent-populations
- Open-source agent-based simulations
- Interfaced with shared services dispatch and optimization
- LCA-based environmental accounting
- Induced demand elasticities
- MFD-based control

What next ?

What next ?



What next ?

- Business as usual, i.e. capacity expansion ?
- Managed transport ?
 - Pricing
 - Rationing
 - Mobility as a Service (MaaS)
- Automated electric vehicles ?
- 15 min city ? E-bike-city ? and its suburban counter-part ?
- Carbon capture at vast scale ?

Questions ?

www.matsim.org

www.ivt.ethz.ch

ebikecity.ch

Appendix

Publications: What are they worth ?

My point-scheme:

- | | | |
|--|------|------|
| • Refereed papers | | 5.00 |
| • Refereed contributions in books | 2.50 | |
| • Refereed conference papers | | 1.50 |
| • Professional journals, reports, invited papers | | 1.00 |
| • Consultancy and research reports | | 0.50 |
| • Working and conference papers | 0.20 | |
| • Invited presentation | | 0.05 |