Current transport planning research at the IVT: Models and behaviours

KW Axhausen

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ETH
Zürich

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The Institute for Transport Planning and Systems

Three groups with about 40 members of staff:

• **(Road) traffic engineering**: highway safety and design; highway maintenance; system capacity issues; traffic operations
• **Public transport (operations)**: [www.opentrack.ch](http://www.opentrack.ch); public transport management
• **Transport planning**

Our website:

[www.ivt.baug.ethz.ch](http://www.ivt.baug.ethz.ch)
Transport planning: Models and behaviours

Active areas:

- Land use and transport interaction: Switzerland 1950-2000
- Traditional large scale models: e.g. National models for Switzerland; Air traffic networks
- Demand modelling: ICN impact study
- Travel behaviour and valuation: 6-week Mobidrive survey; VTTS SP-survey
- Large scale microsimulation: (the vision of) modelling human activity scheduling
Accessibility surface 1950
Accessibility surface 2000
Accessibility and population change (1950-2000)

Bevölkerungswachstum 1950-2000 [%]

In(Erreichbarkeiten 1950, 2000)

Mittelland cantons
Alpine cantons
Land use and transport interaction

Current status:
- Road and interurban public transport networks and time tables for Switzerland since 1850
- Matching population and economic data
- Growing set of demand measurements (counts, matrices)

Goals:
- Furthering our understanding of the links between transport investment and services and economic development
- Modelling the total travel demand elasticities with respect to infrastructure supply
National UE assignments (road traffic)
Estimation of the demand matrix (road traffic)
Networks: European air traffic; Monday September 2002

Circle ~ Number of departures; Band width ~ Number of flights > 10
Large scale models

Sophisticated applications using existing tools (VISUM by PTV AG, Karlsruhe):

- Experiments with dynamic aggregate assignments
- Development of logit-based matrix estimation from traffic counts (with Prof. M.G.H. Bell, Imperial College)
- European scale time-table based models (air, rail)

Basic questions:

- Definition of design loads (and standardised demand schedules)
Customised stated-choice experiments

Alternative 1

You are taking train 1

- in-vehicle time: 29 minutes
- Transfers: 1 time
- Transfer time: 5 minutes
- Headway: 1 hour
- Comfort: regional train
- Travel cost: 3.5 Fr.

Alternative 2

You are taking train 2

- in-vehicle time: 23 minutes
- Transfers: 0 time
- Transfer time: 0 minutes
- Headway: 1 hour
- Comfort: ICN
- Travel cost: 4 Fr.

Your choice?
Demand modelling

State-of-the-art choice models:

- Binary mode- and route choice models for Switzerland
- Combined mode and destination choice models for leisure travel
- RPL mode choice models
- Joint choice of car ownership and season ticket ownership
Valuation issues

On-going work using SP/RP data and models:

• Value of travel time savings (with G Abay, M. Bierlaire and J. Bates)
• Value of reliability
• Value of real-time travel information (with M. Bierlaire)

• Support of the VSS working party for the development of a Swiss cost-benefit guideline for road infrastructure investment
Measures of human activity space

95% Confidence ellipse
Kernel density estimates
Shortest path networks
Travel behaviour

Current projects:

- Measurement of similarity between activity programmes
- Understanding the structure of human activity spaces
- Stability of activity patterns over time

Support activities:

- Data archive using the NESSTAR server software: www.ivt.baug.ethz.ch/vrp/ethtda.html
Agent-based microsimulation of travel demand

Microsimulation is a standard tool for the modelling of traffic flows
Microsimulation is a standard tool for sample enumeration of
probabilistic choice models of travel demand

Few working examples with combine both approaches in a
consistent and comprehensive manner

Building blocks:
- Fast traffic flow simulations (Prof. Nagel; see
  www.sim.inf.ethz.ch)
- Agent generator
- Exploration of the effects of learning
Vision of a model of dynamics of daily behaviour

Activity repertoire (t) → Activity repertoire (t+1)

Activity calendar (t) → Rescheduling, Execution

Scheduling

Unexecuted activities

Updates, Innovations

Network, Opportunities

Mental map (t) → Mental map (t+1)

Physiological needs
Commitments
Desires
Pending activities
Challenges

Scheduling:
- Activity generation over time
- Construction of schedules (utility functions of activity participation)
- Interpersonal bargaining and cooperation

Learning:
- Construction and updating of mental maps
- Formation of expectations

Computing side:
- Speed
- Interaction between agents/synchronisation
- Steady states?
Outlook

Central issues:

• Measurement of behaviour
• Measurement of social networks and relations
• Activity scheduling
• Valuation of activities and their attributes
• Large scale aggregate models
• Land use - transport interaction
• Behavioural innovation
• System innovation
More information

www.ivt.baug.ethz.ch

-> Verkehrsplanung

-> Publikationen
Appendix: Accessibility surfaces

Current status:

- Network-based travel times distances on the road network using plausible average link speeds
- All Swiss municipalities in the borders of the year 2000
- (log)-sum term of a simple destination choice model with \( \ln(\text{number of residents}) \) and road travel times as the arguments of the utility function
Appendix: VTTS estimation

Approach and current status:

- Customised stated-choice experiments based on the SBB KEP survey
- Tasks: mode choice and route choice; about 1000 respondents
- Current results from MNL estimates using alternative specific variables only (Estimation software BIOGEME by M. Bierlaire)
Appendix: Similarity measurement

Approach:

- A multi-dimensional sequence alignment measure of similarity for discrete sequences, here daily activities by 15 min intervals
- Software CLUSTAL-G and others

Aim:

- Identification of improved approaches to the measurement of the similarity of travel behaviour
Appendix: New leisure locations

Data:

- Continuous 12-week time budget/activity diary; special focus on leisure activities
- About 70 persons in Zürich, Opfikon and Männedorf
- Locations geocoded to the post-code level
- „New“ = not previously observed combination of detailed activity purpose and post code
Appendix: Measuring activity spaces

Data:
- Continuous 6-week travel diary; 361 persons in Karlsruhe and Halle

Issue:
- Measurement of the activity space: the area of which a person has personal knowledge

Approaches:
- Two-dimensional confidence intervals
- Spatial smoothing/regression using kernel estimators
- Length of the shortest paths between all pairs of locations visited as part of a trip