

Current works on UrbanSim at the IVT

Schirmer, P., C. Zöllig, B. Bodenmann, K. Müller and K.W. Axhausen (2011): Current works on UrbanSim at the IVT, *UrbanSim Workshop: Developing Common Data Structures for Urban Modeling and 3D-Visualisation*, Zurich, February 2011

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

ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

SustainCity 2011

Current works on UrbanSim at the IVT

Patrick Schirmer, IVT, ETH Zürich

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Swiss Federal Institute of Technology Zurich



UrbanSim Workshop 25.02.2011

IVT (VPL)

The IVT-VPL group (traffic planning)

- Head: Prof. Dr. Kay W. Axhausen
- 2 Post-docs, 16 PhD-students, 4 PhD-students (FCL), 10 student assistant scientists
- Professions:
 - 5 Computer Science
 - 3 Civil Engineering/Traffic Engineering
 - 2 Architecture/Urban Planning
 - 2 Business Science / Business Information Systems
 - 2 Environmental Engineering
 - 1 Geomatics and Geography
 - 1 Sociology
- 3 subgroups: MatSim, behavioral modelling and land use simulation
- 4+ Servers for simulations, ~25 computer work stations (win, mac, linux)

IVT (VPL)

Survey/Behaviour

Alexander Erath: Reliability of roadnetworks

Claude Weis: Induced traffic

Boris Jäggi: Willingness to invest into energy saving techniques

Social networks

Matthias Kowald: snow ball sample of social Networks

MATSim

David Charypar: Continuous simulation of traffic demand

Francesco Ciari: Optimisation of car sharing offers

Christoph Dobler: Evacuation after accidents

Nadine Schüssler: Route choice and GPS-data

Andreas Horni: Highly detailed destination choice models

Fabian Märki: Continuous modelling of traffic generation

Konrad Meister: Equilibrium in agent-based simulation

Rashid Waraich: Electric cars and their effect on the power supply system

UrbanSimE

Balz Bodenmann: Location choice of enterprises

Kirill Müller: Generation of synthetic populations

Patrick Schirmer: Location of Urban typologies and their relevance for socio-demographic groups

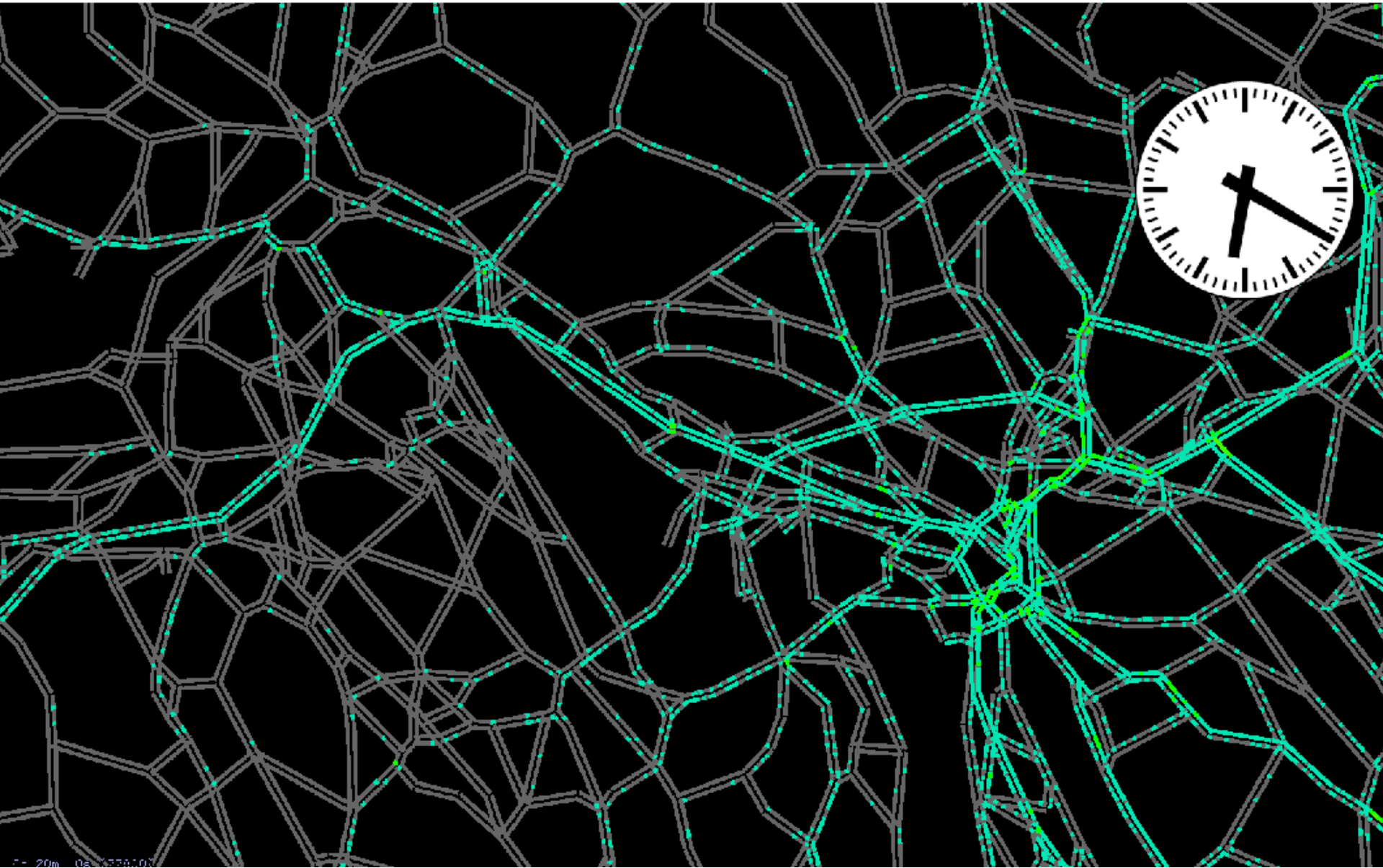
Christof Zöllig: Developers and their effect on urban developments

Development of networks

Basil Vitins: Optimisation of networks

Veronika Killer: Commuters' catchment areas since 1970

MatSim

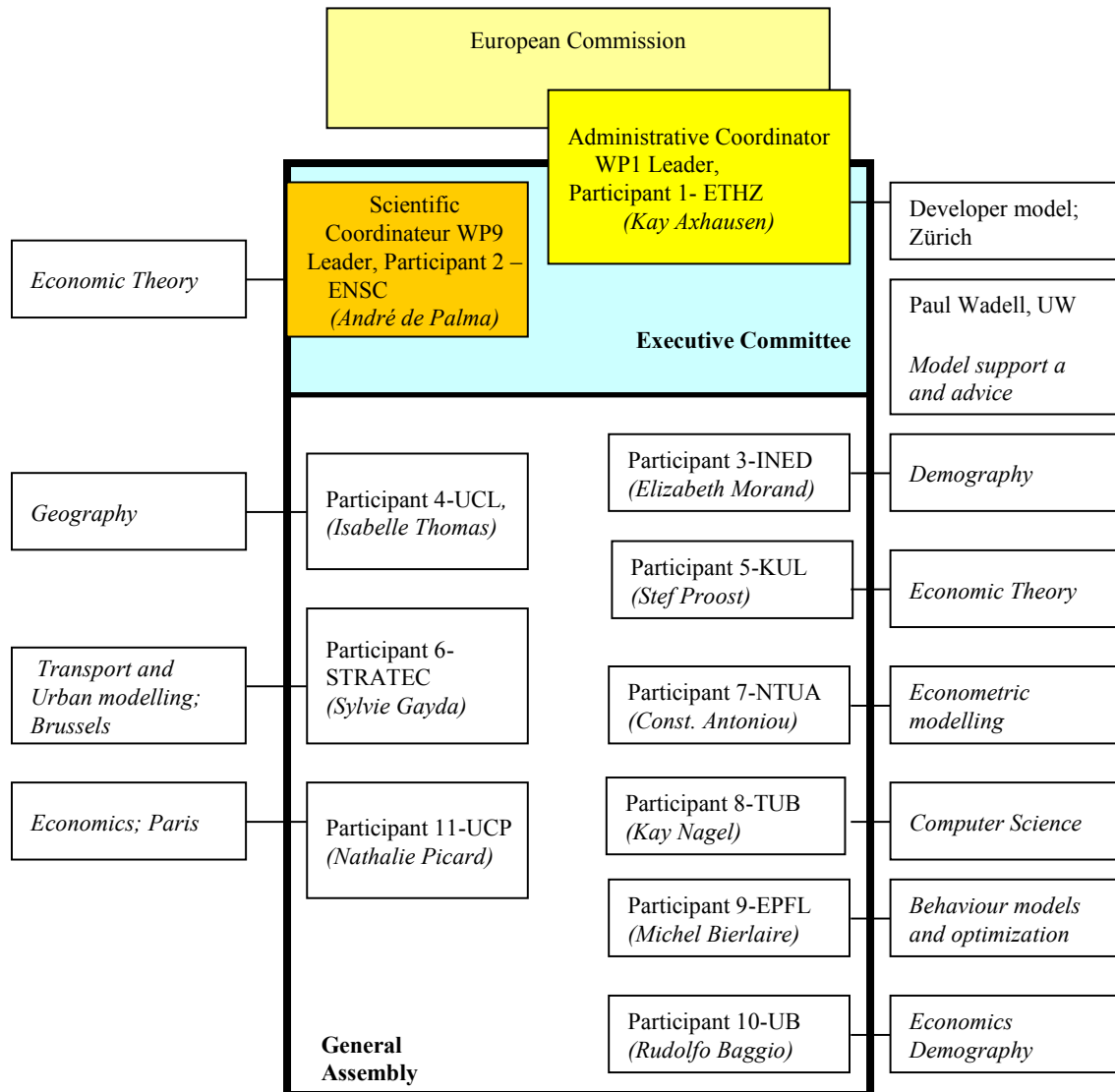


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Objective

- EU-funded FP7 research-project (2010-2012)
- 12 research institutions participating
- 3 case-studies of UrbanSim: Brussels, Paris, Zurich
- Previous UrbanSim-experience in all cities (Zurich: Zukunft Urbaner Kulturlandschaften, 2007)
- Aim of Project:
 - adapt 'UrbanSim' to European conditions => version 'UrbanSimE'
 - include additional models (demographics, developers, MatSim-exchange,...)
 - evaluate and compare results of case-studies

SustainCity

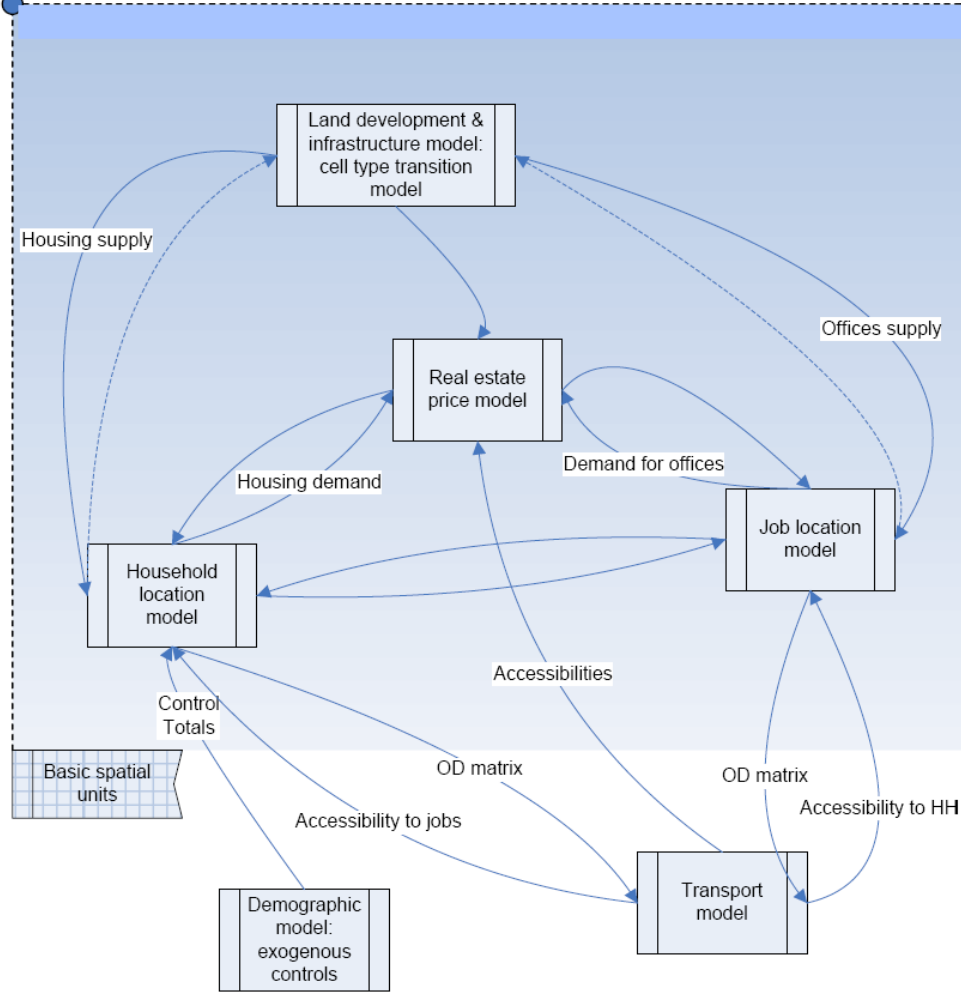


Facilities

- Swiss Federal Institute of Technology Zurich
- Ecole Normale Supérieure de Cachan
- Institut National d'Etudes Démographiques
- Université Catholique de Louvain
- STRATEC SA
- National Technical University of Athens
- Technical University of Berlin
- Ecole Polytechnique Fédéral de Lausanne
- Bocconi University
- Université de Cergy Pontoise
- University of California Berkeley

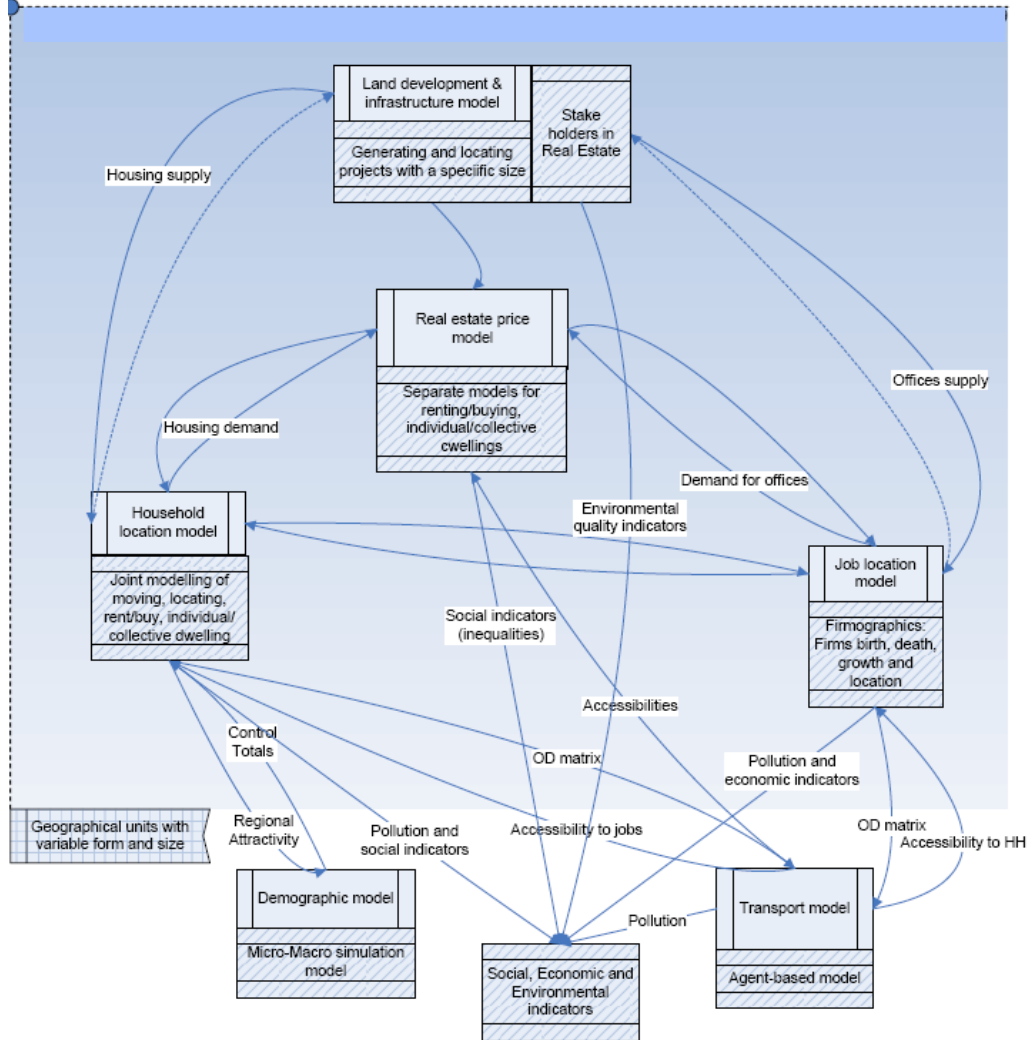
SustainCity

UrbanSim



SustainCity

UrbanSimE



Zurich case study

Previous work (ZUK) @ IVT-VPL

- Zukunft urbaner Kulturlandschaften (ZUK 2004-2006)
- Interdisciplinary project:
 - 5 projects at Network City and Landscape
 - Participants: IBB, ILA, IRL, ISB, IVT
 - IVT: Infrastructure, Accessibility and Spatial Planning
- Setup of UrbanSim model (gridcell version) on the greater Zurich area
- Estimation of models for UrbanSim
 - Household location choice (survey with ~3000 observations 2007)
 - Household relocation rates (~20.000 observations S.Beige 2001)
 - Hedonic rent prices (2007)
- Literature: <http://www.ivt.ethz.ch/vpl/research/iasp>

Zurich case study

UrbanSim - gridcell

gridcell includes:

- aggregated areas
- mix of use
- % of public space
- mean distance
- mean constraints

=>statistical approach

UrbanSim - parcel

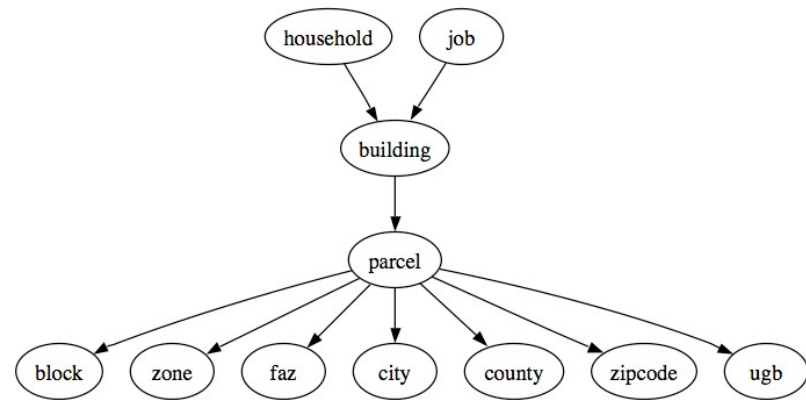
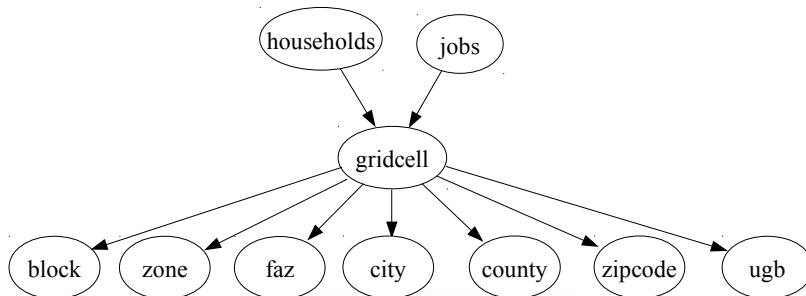
building includes

- precise building information
 - area per use
 - age, ownership,...
 - value and height

parcel includes

- geocoding
- constraints
- landvalue

=>built-environment approach

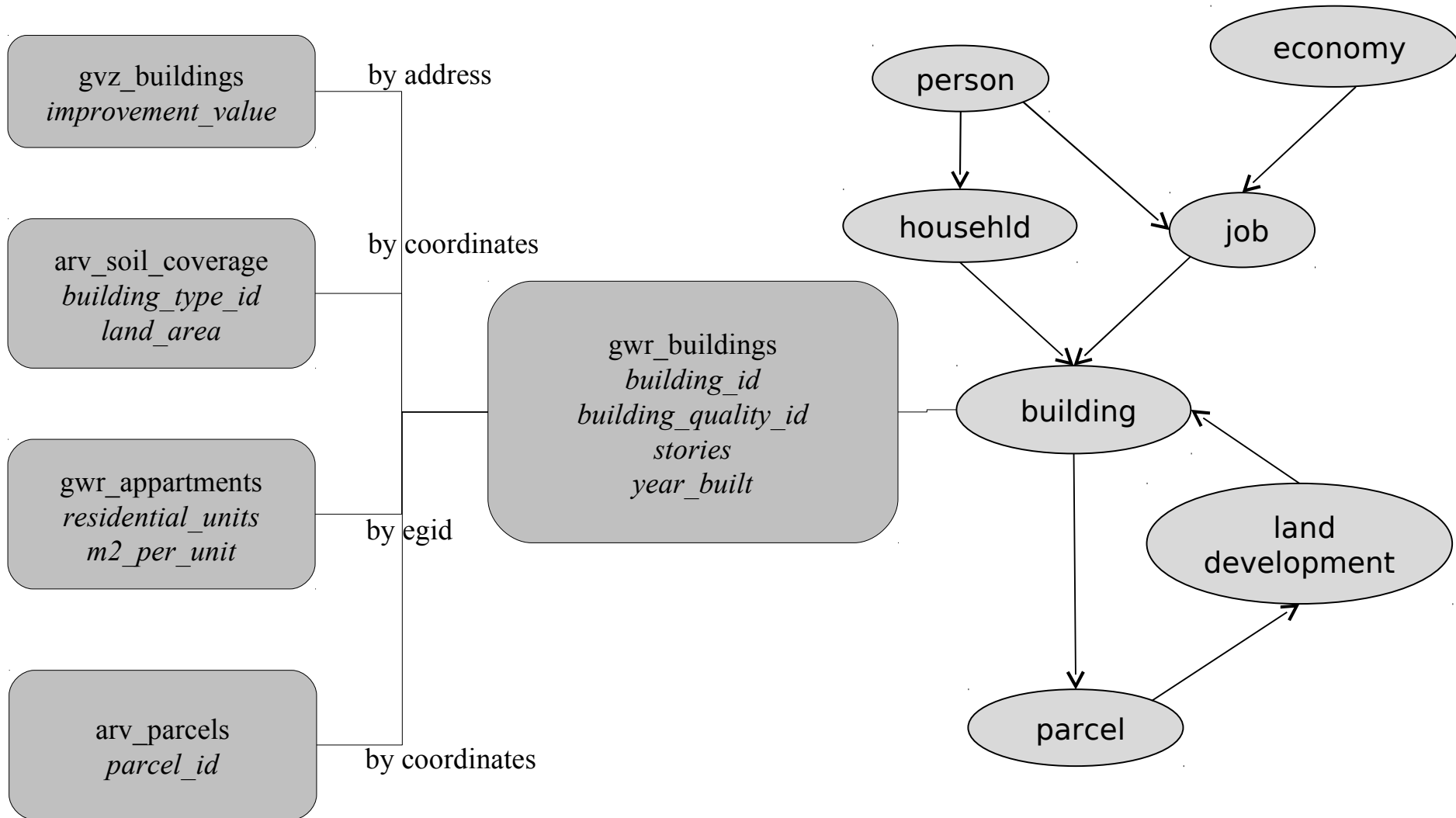


Zurich case study

Basisdata (extract)

- Vectormaps
 - Parcels & Buildings
 - Soil coverage zones
 - Landuse zones
 - Traffic-zones (KVM & OeVM)
 - Networks & stops
 - Topography
 - Noisemaps
- Agent information
 - Population census (2000)
 - Micro census (2005)
 - Enterprise census (2001)
 - Various surveys of IVT (2000-2011)
- Object information
 - Residential building register (GWR)
 - Cantonal building assurance (GVZ)
 - Landprices (internet)

Zurich case study

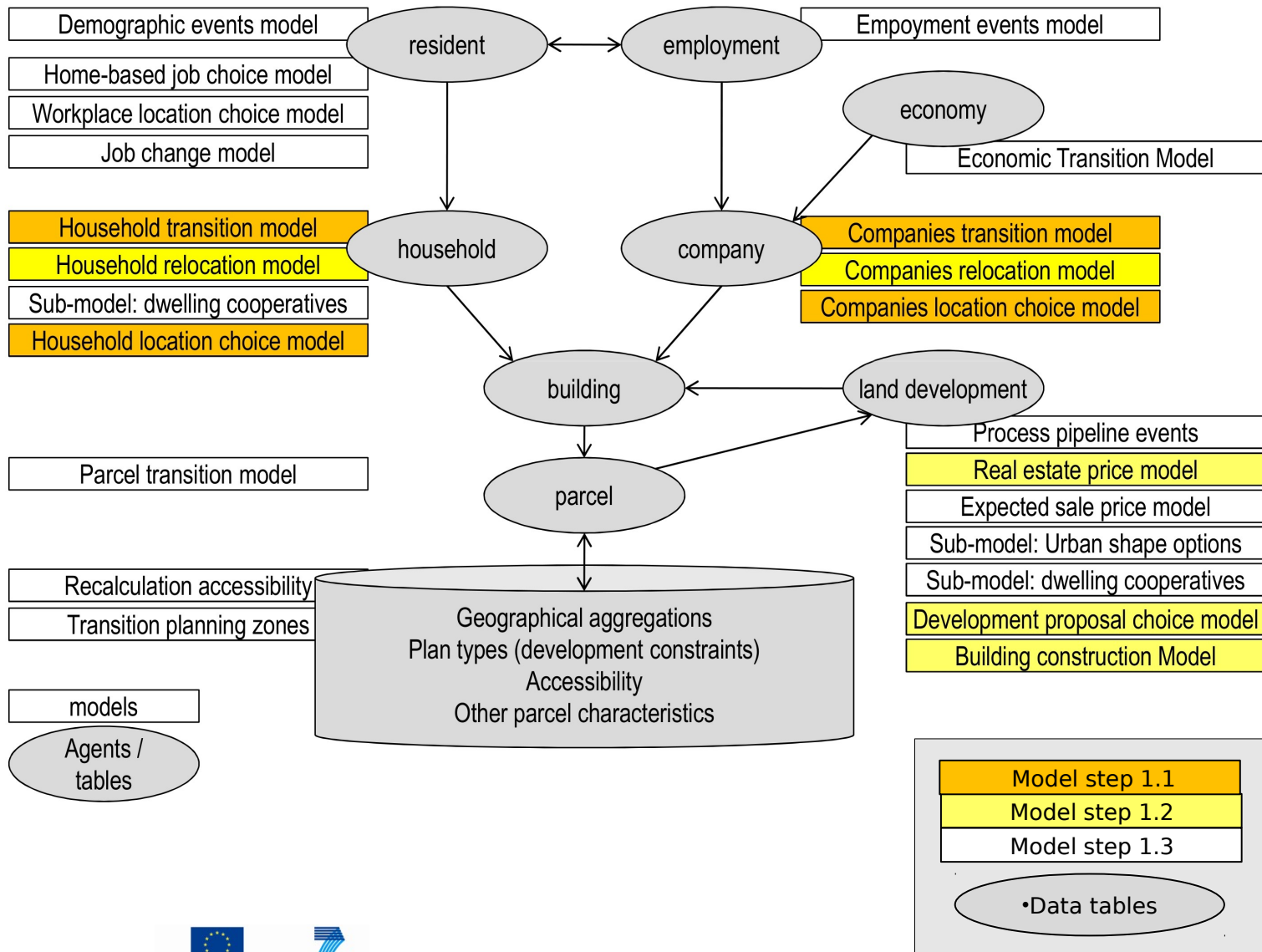


Zurich case study

Model extensions @ IVT-VPL

- Generation of synthetic populations (Müller, K.)
- Firmographics (Bodenmann, B.)
- Developers in Zurich (Zöllig, C.)
- Urban typologies – preferences and options (Schirmer, P.)

First run – data structure and models



Zurich case study

Integrating shape into simulation process

1.) Behaviour and Shape

- Extraction of shape-attributes
- “Synthetisation” for Prototypes

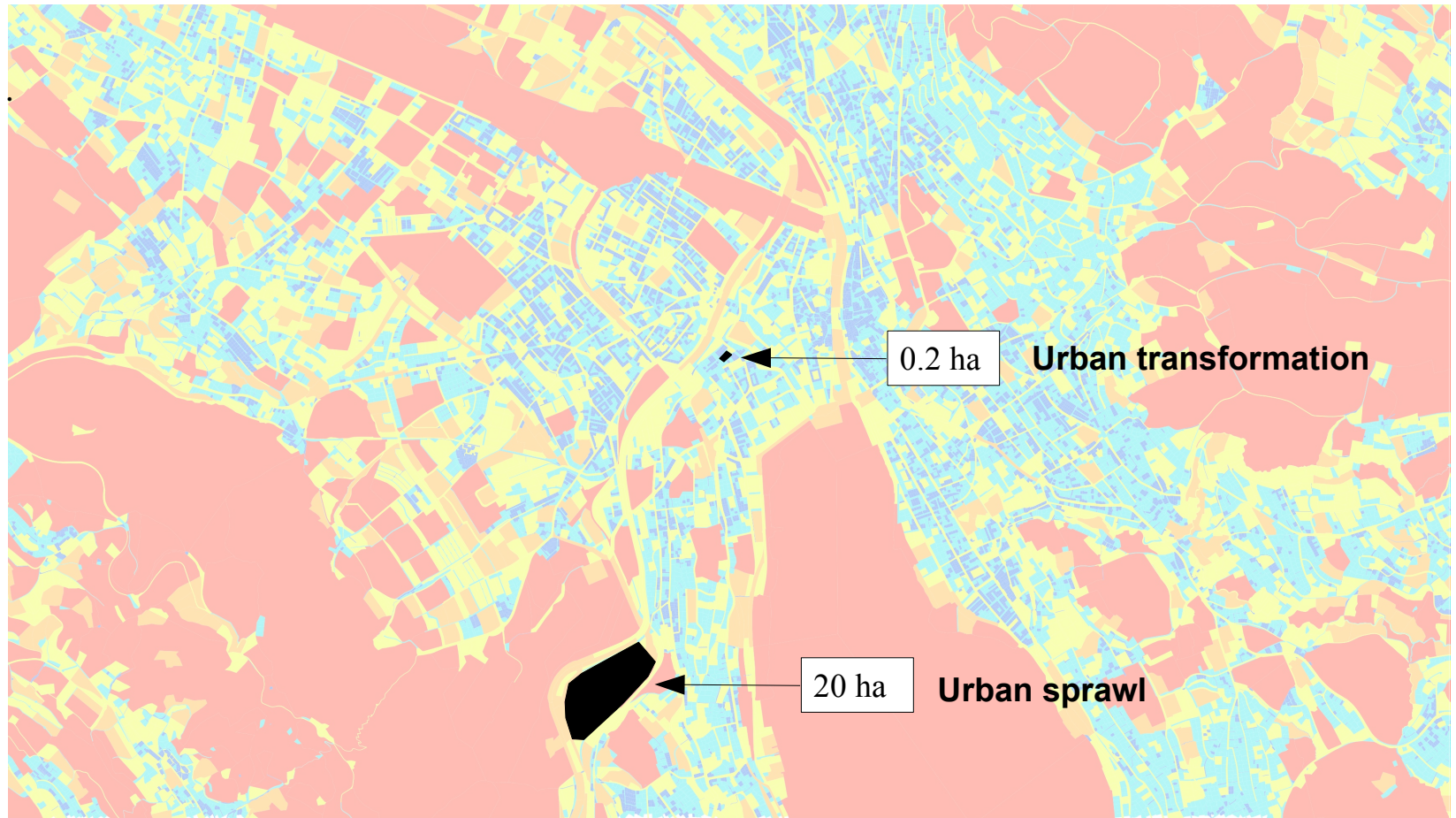
2.) Simulation of Development

- Categorisation for behavioral modelling
- Extract developments options in urban transformation
- Find “natural rules” of urban sprawl
- Create visualisation output

Schirmer, P. (2010) Options and constraints of a parcel based approach in 'UrbanSimE', paper presented at 10th Swiss Transport Research Conference, Ascona, September 2010.

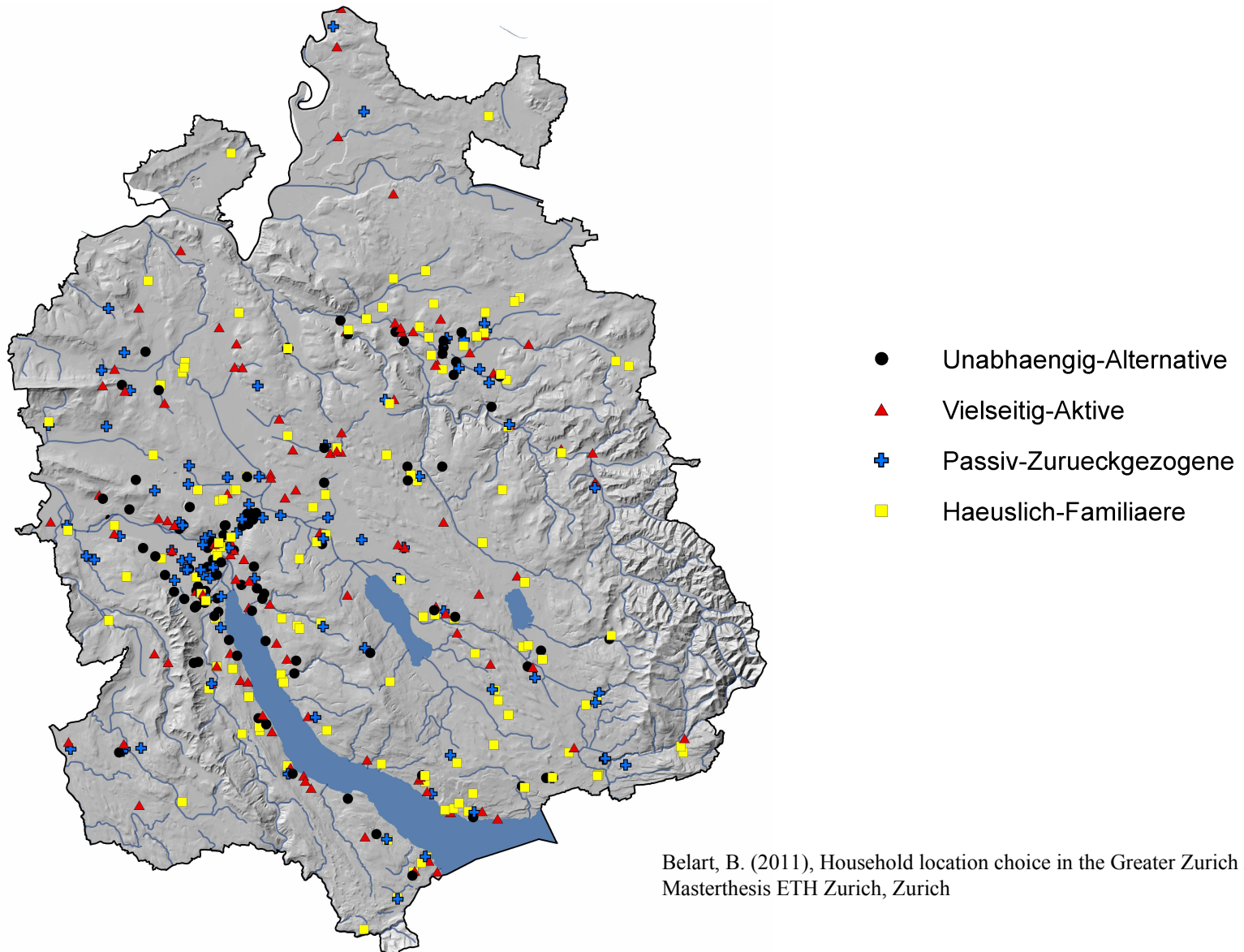
Simulation and Visualisation

Urban growing scenarios



Parcel sizes of Canton Zurich

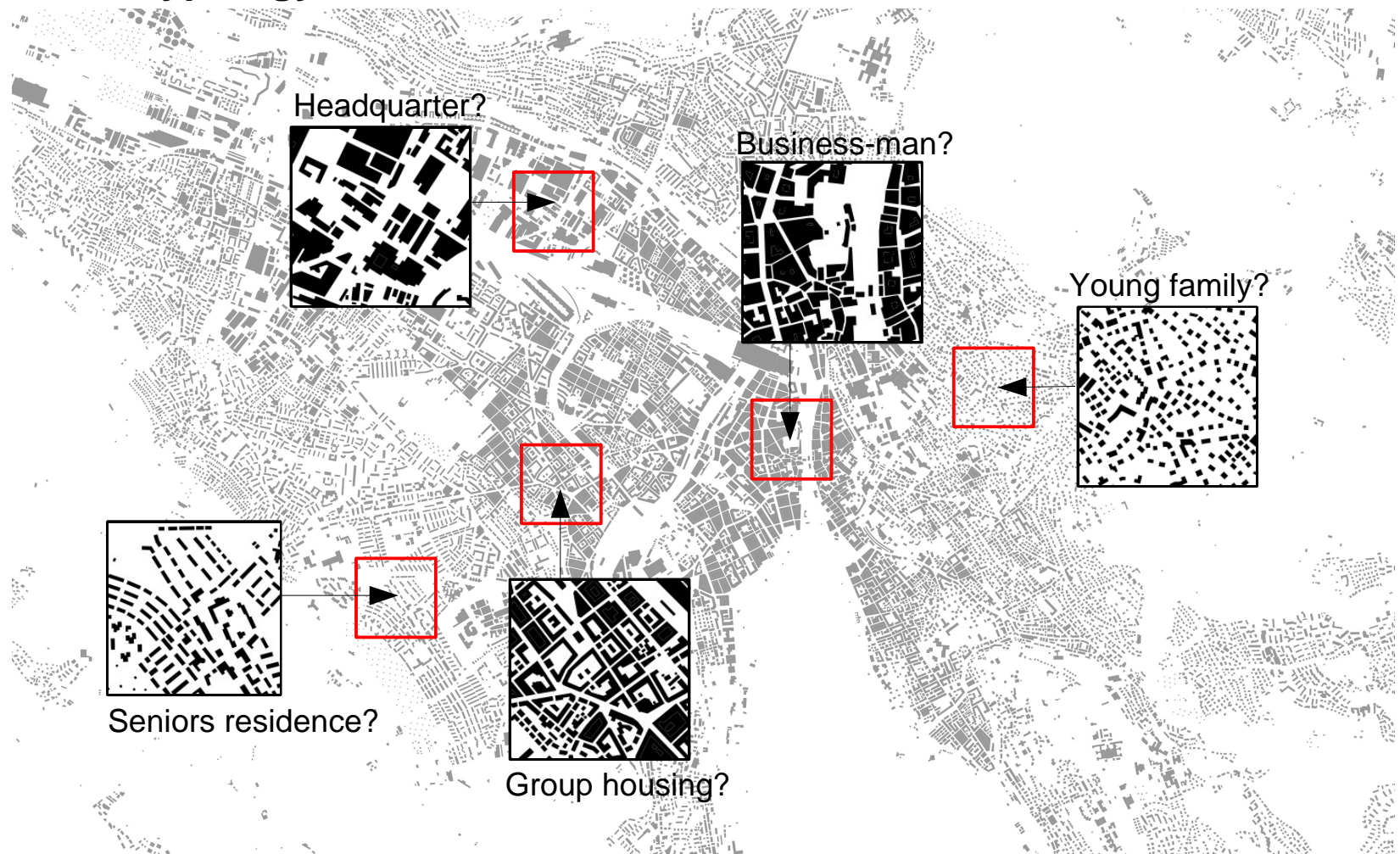
Zurich case study



Belart, B. (2011), Household location choice in the Greater Zurich Area, Masterthesis ETH Zurich, Zurich




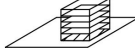






Zurich case study

Urban Typology



Simulation of Development

Typology-classes mixed-use

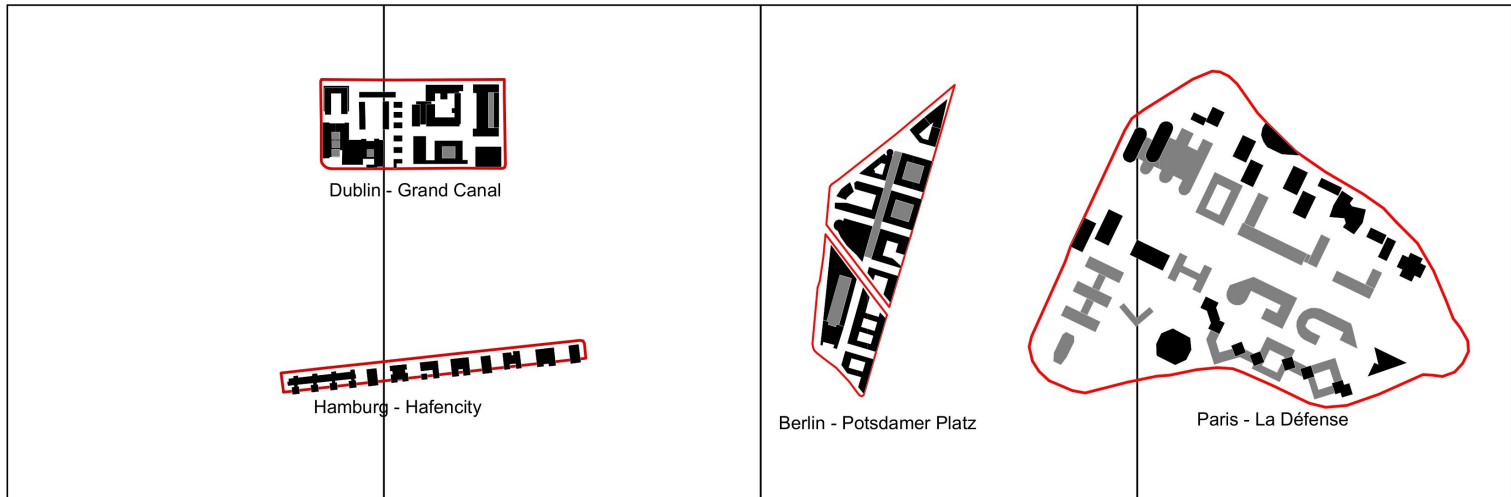
						
low	0 - 15.000 sqm	0,3	2,0	0 - 5.000 sqm	3	
average (min)	15.000 - 30.000 sqm	0,4	3,0	5.000 - 10.000 sqm	9	
average (max)	30.000 - 50.000 sqm	0,5	4,0	10.000 - 20.000 sqm	15	
high	50.000 - 270.000 sqm	?	5,0	20.000 - 30.000 sqm	26	

small

medium

large

extra large

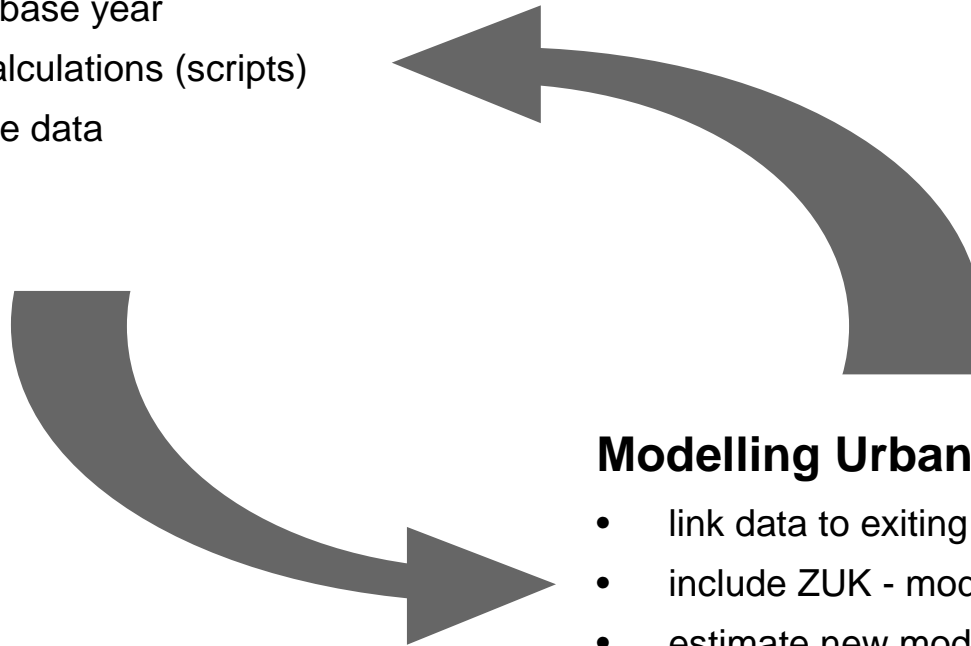


Comparison in scale

Workpackages

Processing Data

- create rough first run
- clean data
- create common base year
- include ZUK - calculations (scripts)
- include new base data
- derive new data
-

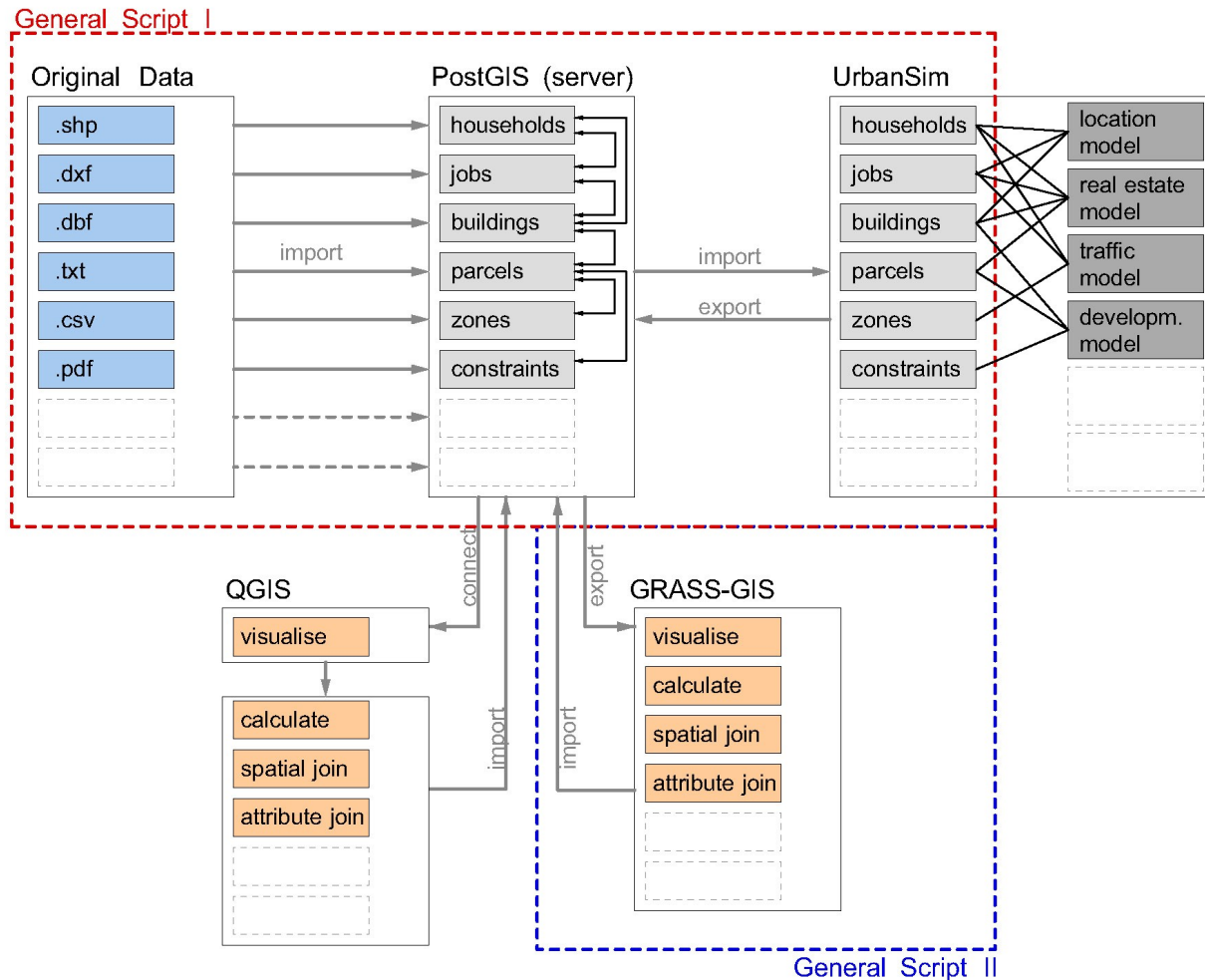


Modelling UrbanSim

- link data to exiting models
- include ZUK - models
- estimate new models
-

Processing

Workflow in SustainCity



Combined work

Interaction points to FCL and SUPat

- + Results of surveys
- + Behavioural models for Canton Zurich
- + UrbanSim environment Canton Zurich (regulations on Data)
- + User-knowledge UrbanSim
- + User-knowledge in GIS (GRASS, QGIS) and contact to developers

- Software-development for interaction to shapegrammars and GIS
- Computational-time optimizations
- Visualisation of output

Combined work

Conferences

04.04. - 08.04.2011 MATSim Tutorial and User Meeting0

04.07. - 06.07.2011 UrbanSim Workshop (Athens)

30.08. - 03.09.2011 ERSA 2011 Special Session: SustainCity Seminar on land-use and transport

Combined work

Literature (IVT-VPL)

Belart, B. (2011) *Wohnstandortwahl im Grossraum Zürich*, dissertation, ETH Zürich, Zürich.

Bodenmann, B.R. and K.W. Axhausen (2008) Schweizer Unternehmen – quo vaditis? Firmendemographische Trends am Beispiel des Wirtschaftsraums St. Gallen, *Raumforschung und Raumordnung*, 66 (4) 318-332.

Bürgle, M. (2006) Residential location choice model for the Greater Zurich area, paper presented at *6th Swiss Transport Research Conference*, Ascona, 2006.

Ciari, F., M. Löchl and K.W. Axhausen (2008) Location decisions of retailers: an agent-based approach, paper presented at *15th International Conference on Recent Advances in Retailing and Services Science*, Zagreb, July 2008.

Löchl, M. (2010) *Application of spatial analysis methods for understanding geographic variation of prices, demand and market success*, dissertation, ETH Zürich, Zürich.

Löchl, M. (2006) Real estate and land price models for UrbanSim's Greater Zurich application, *Arbeitsberichte Polyprojekt Zukunft urbane Kulturlandschaften*, 6.

Löchl, M. (2008) Standortplanung im Detail-/Einzelhandel–Auswertung von Interviews mit Unternehmen in Deutschland und der Schweiz, *Arbeitsberichte Verkehrs- und Raumplanung*, 492.

Löchl, M. and K.W. Axhausen (2010) Modelling hedonic residential rents for land use and transport simulation while considering spatial effects, *Journal of Transport and Land Use*, 3 (2) 39–63.

Müller, K. and K.W. Axhausen (2011) Population synthesis for microsimulation: State of the art, paper presented at the 90th Annual Meeting of the Transportation Research Board, Washington, D.C., January 2011.

Schirmer, P. (2010) Options and constraints of a parcel based approach in 'UrbanSimE', paper presented at *10th Swiss Transport Research Conference*, Ascona, September 2010.

Waldner, U., M. Löchl, M. Bürgle and K.W. Axhausen (2005) Haushaltsbefragung zur Wohnsituation im Grossraum Zürich–Feldbericht, *Arbeitsberichte Polyprojekt Zukunft urbane Kulturlandschaften*, 1.

Zöllig, C. and K.W. Axhausen (2010) Calculating benefits of infrastructural investment, *Arbeitsberichte Verkehrs- und Raumplanung*, 612, IVT, ETH Zürich, Zürich.

Zöllig, C. (2010) Real estate developers in Zurich, presentation, 10th STRC Swiss Transport Research Conference, Ascona, September 2010.