

Bevorzugter Zitierstil für diesen Vortrag

Axhausen, K.W. (2015) Smart cards and social networks: Simulation and familiar strangers, presentation at the Excellence in data science, Politecnico di Torino, October 2015.

Smart cards and social networks: Results and familiar strangers

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October 2014

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Acknowledgements

Social networks:

- Timo Ohnmacht
- Andreas Frei
- Matthias Kowald
- Lijun Sun
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- Jonas Larsen, Roskilde/John Urry, Lancaster

Agent-based models

- Thibaut Dubernet
- Pieter Fourie

Social network generation

- Theo Arentze, TU Eindhoven

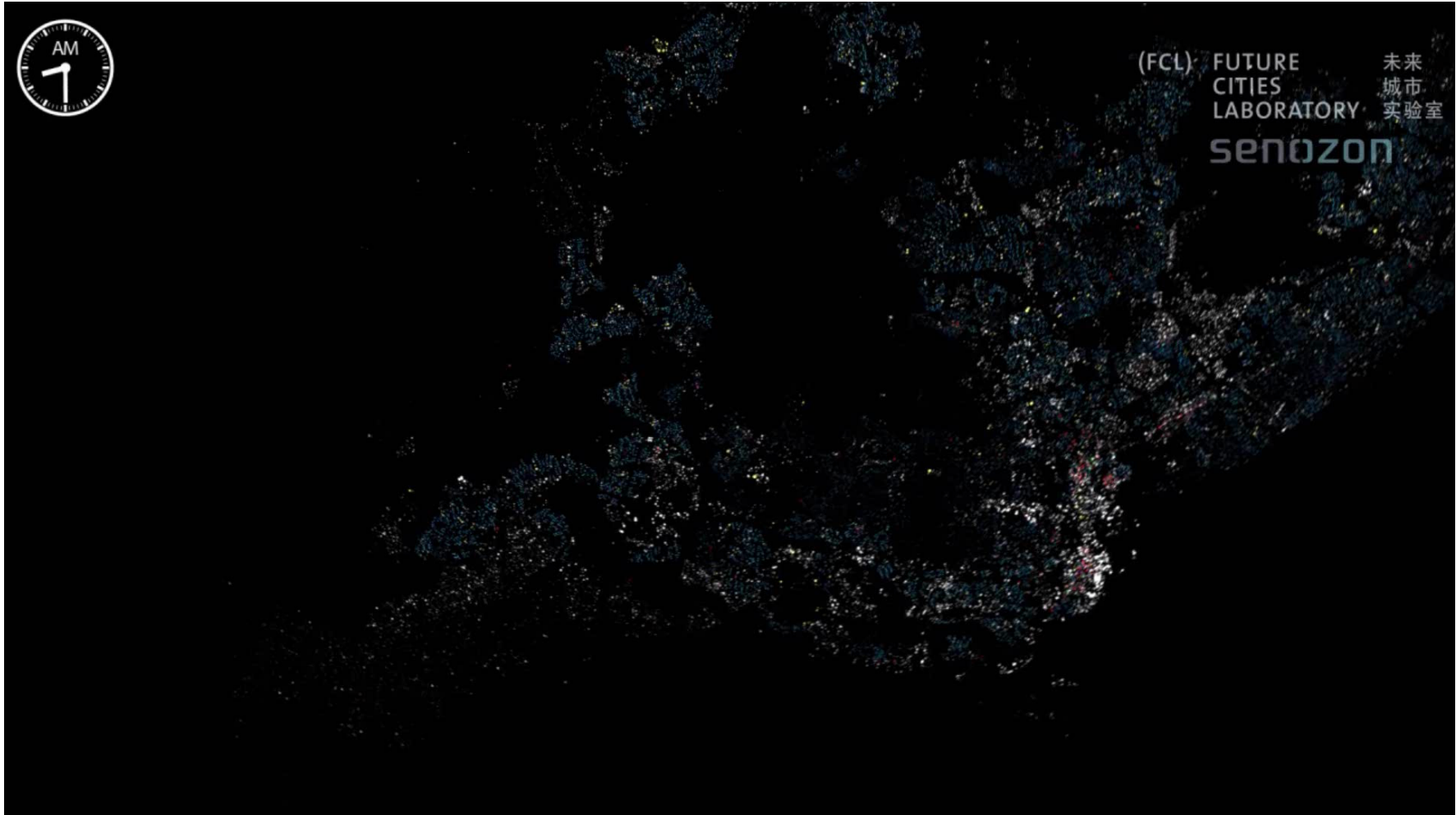
Further acknowledgements

Most of the materials and more will be in:

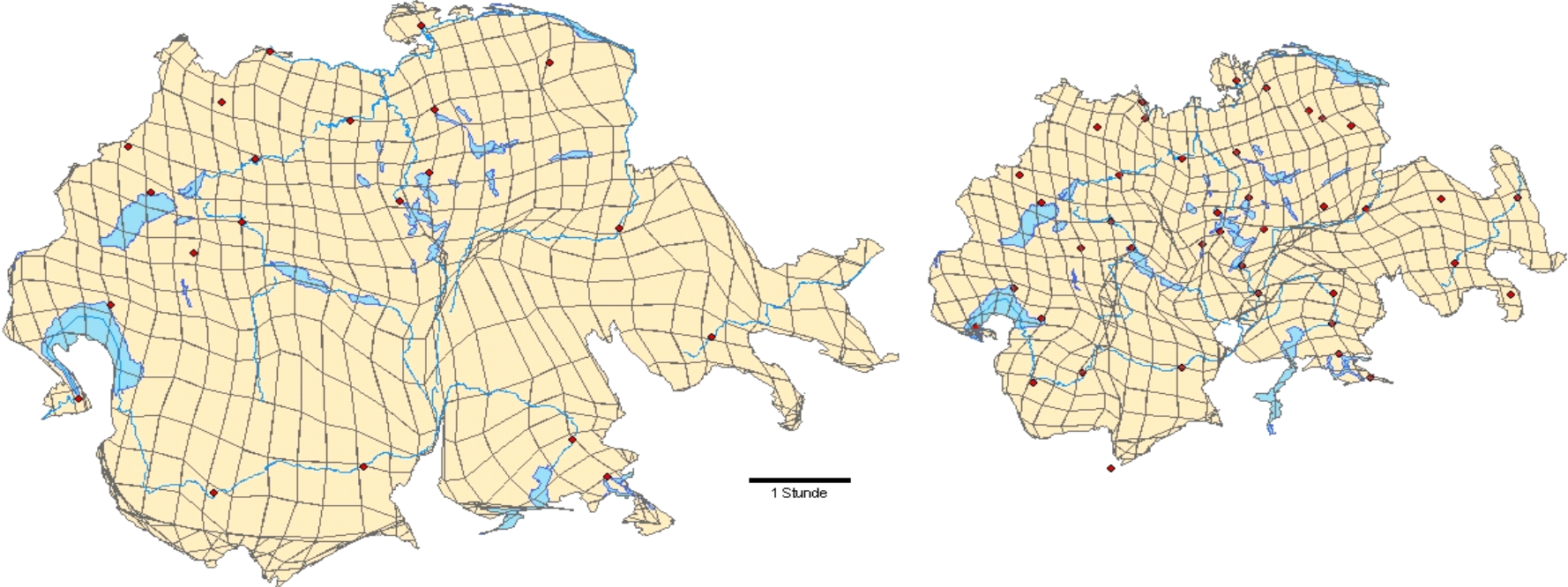
Kowald, M. and K.W. Axhausen (eds.) (2015)
Social networks and travel behaviour,
Ashgate

Why the interest ?

An agent-based model of travel demand: e.g. Singapore



Road based – Switzerland 1950 and 2000

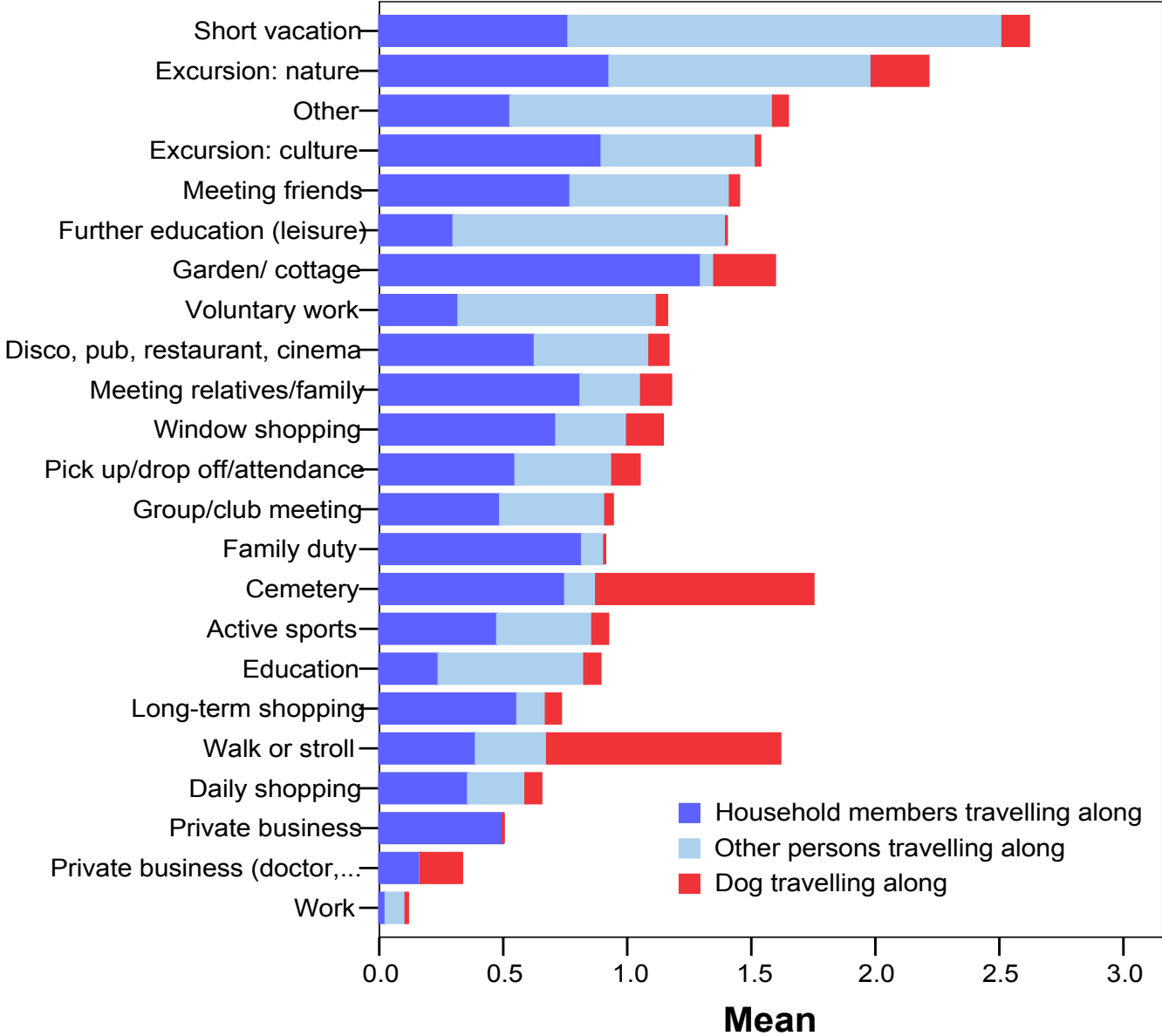


Long distance journeys (100km+) in Germany, 2010's

Type	Number/year	km/journey
Vacation (5 days plus)	1.0	1600
Short vacation (2-4 days)	1.2	410
Other journeys with overnight stays	0.3	410
Day excursions	6.0	200
Business trip with overnight stay	1.2	500
Business trip without overnight stay	1.2	150
Long-distance commuting and other trips	5.0	150

Why social networks in transport/spatial planning ?

Example: Number of accompanying travellers



Example: Heterogeneity in choice

Location choice

- WTP
- Taste
- Joint choice with family, friends, persons to meet
- Schedule constraints
- Social constraints

For mode choice in addition

- Luggage
- Company
- Weather
- Temperature

Example: Residential location choice in Kt. Zürich

Variable	Beta	t-Test
Rent/Income	-5.51	***
log(m2/head)	0.98	***
Frequency weighted mean distance to friends	-8.16	*
Exponent (friends)	0.22	**
Mean distance to work/school	-1.59	**
Exponent (distance to work)	0.37	**
Travel time to Bürkliplatz	0.02	**
log(transit accessibility) * "No car"	0.41	**
log(car accessibility) * "Car"	-0.30	**
Share of equally sized HH within 1 km	0.02	*
Population density within 1 km	0.01	**
Share of empty flats in municipality	-0.11	
N= 683, rho ² = 0.2128; * > 0.1; ** > 0.05; *** > 0.01		

Travel and social networks

Benchmarking the current state

- Numbers of contacts
- Distance distributions
- Geographies
- Frequency and mode of contact

- “Productivity”
- Levels of local anomie
- Levels of local trust
- Level of place attachment

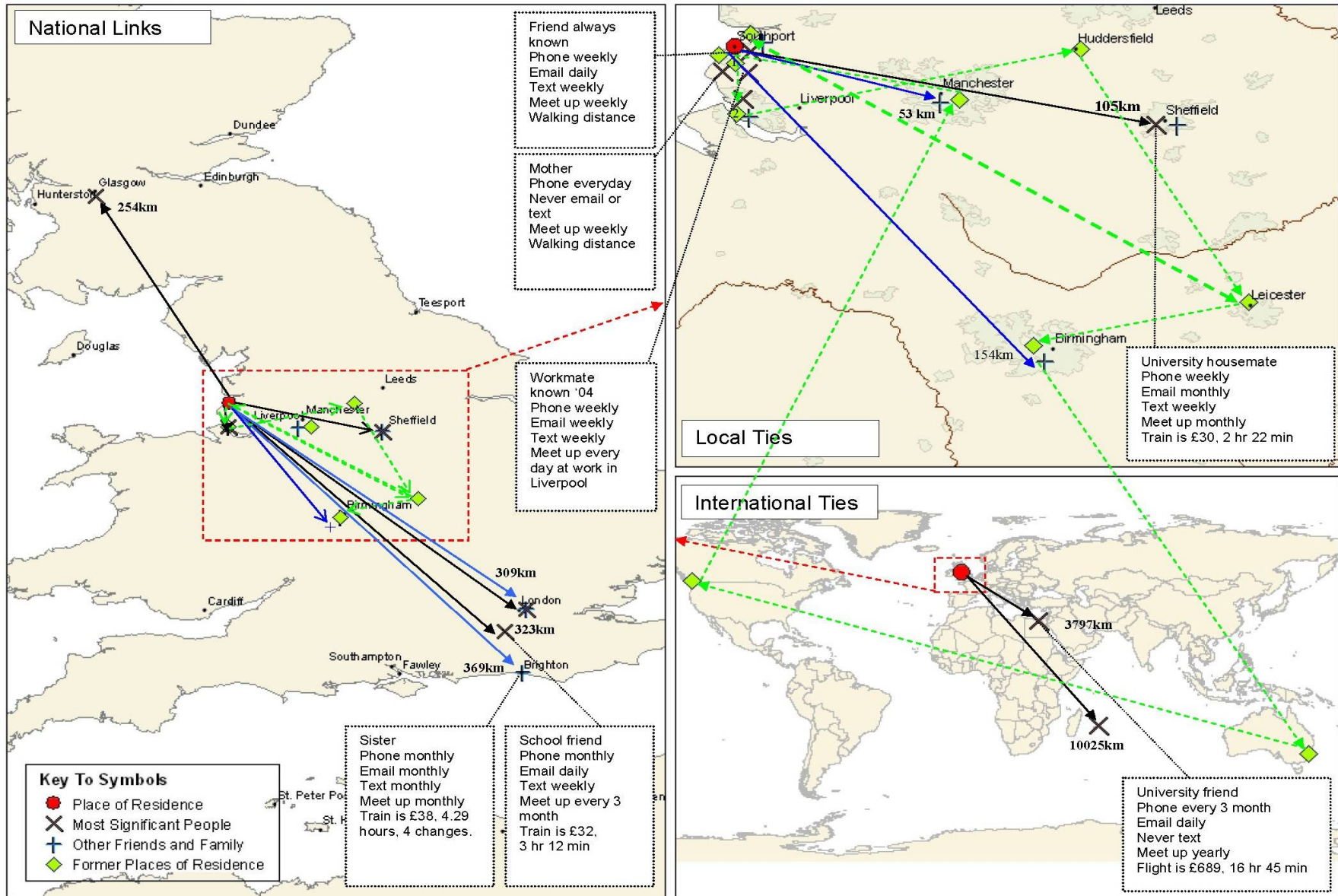
Empirical strategy

- Surveys of social geographies & mobility biographies
 - Egocentric
 - Snowball
- Travel diaries
 - One-Day
 - Multiple days
- With/without information about the presence of others
- With/without named co-travellers, co-present persons

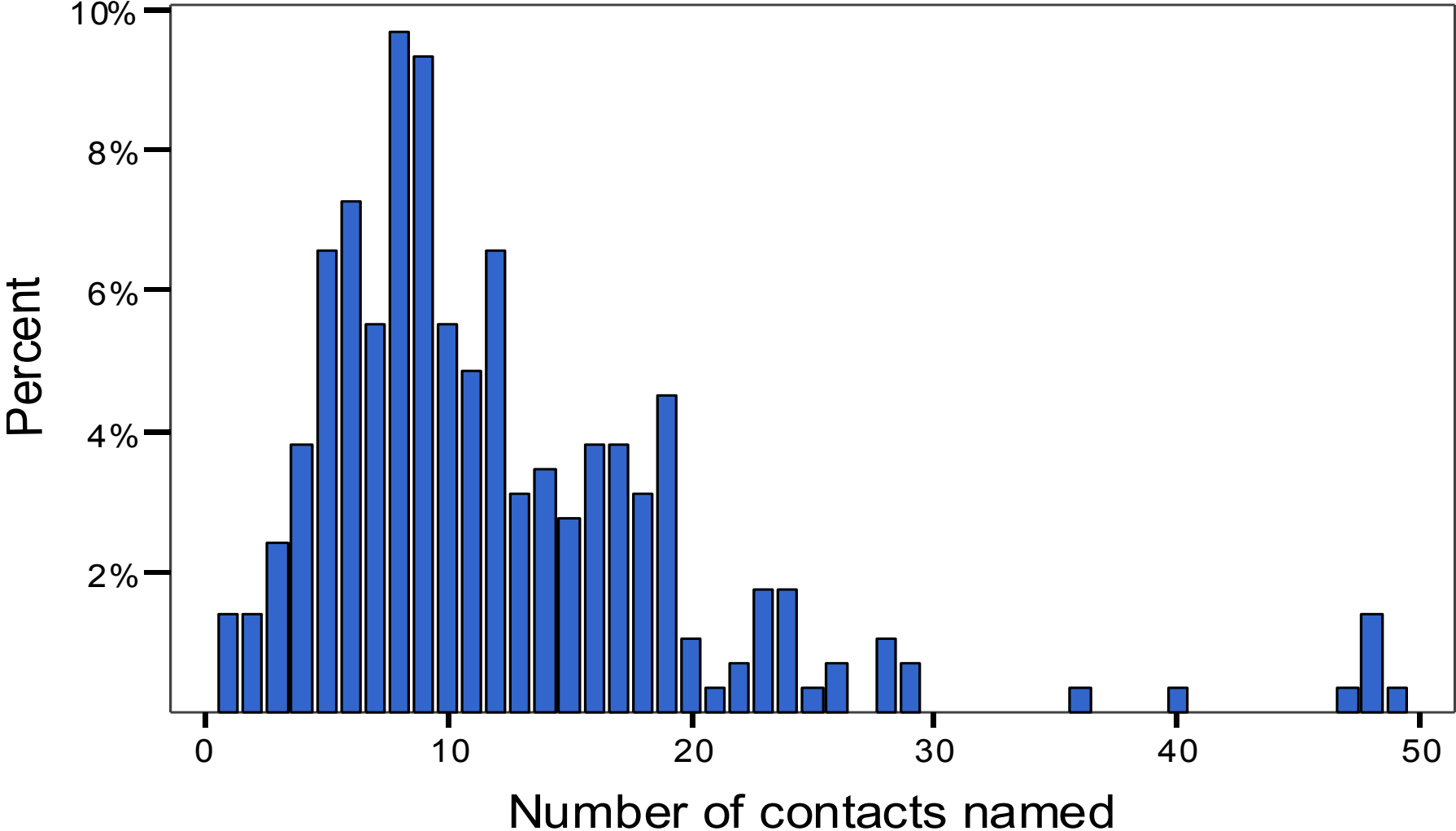
Social network surveys @ IVT

- Ohnmacht: 50 egos qualitative/quantitative in Zürich
- Larsen/Urry: 24 egos qualitative/quantitative in NE England
- Frei: 300 egos quantitative in Zürich
- Kowald: snowball; 750 egos quantitative worldwide (starting with 40 egos in Kanton Zürich)(12000 alters in total) (8 day diary included)
- Kowald/Diekmann: 2000 respondents of the Swiss Environment Survey – 5 core alters
- Sun: Smart card use on busses in Singapore

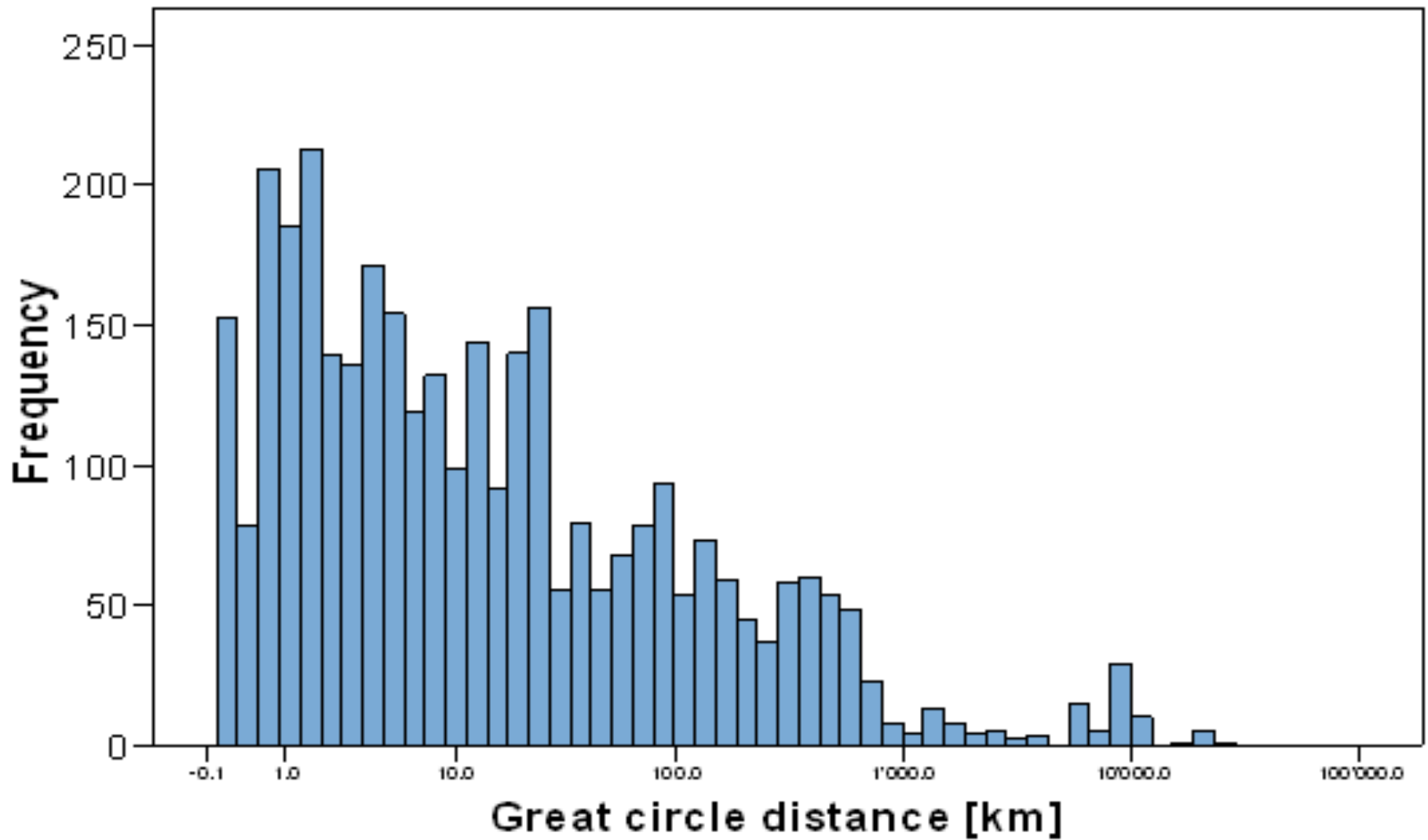
Biography of an architect, about thirty



Number of contacts reported

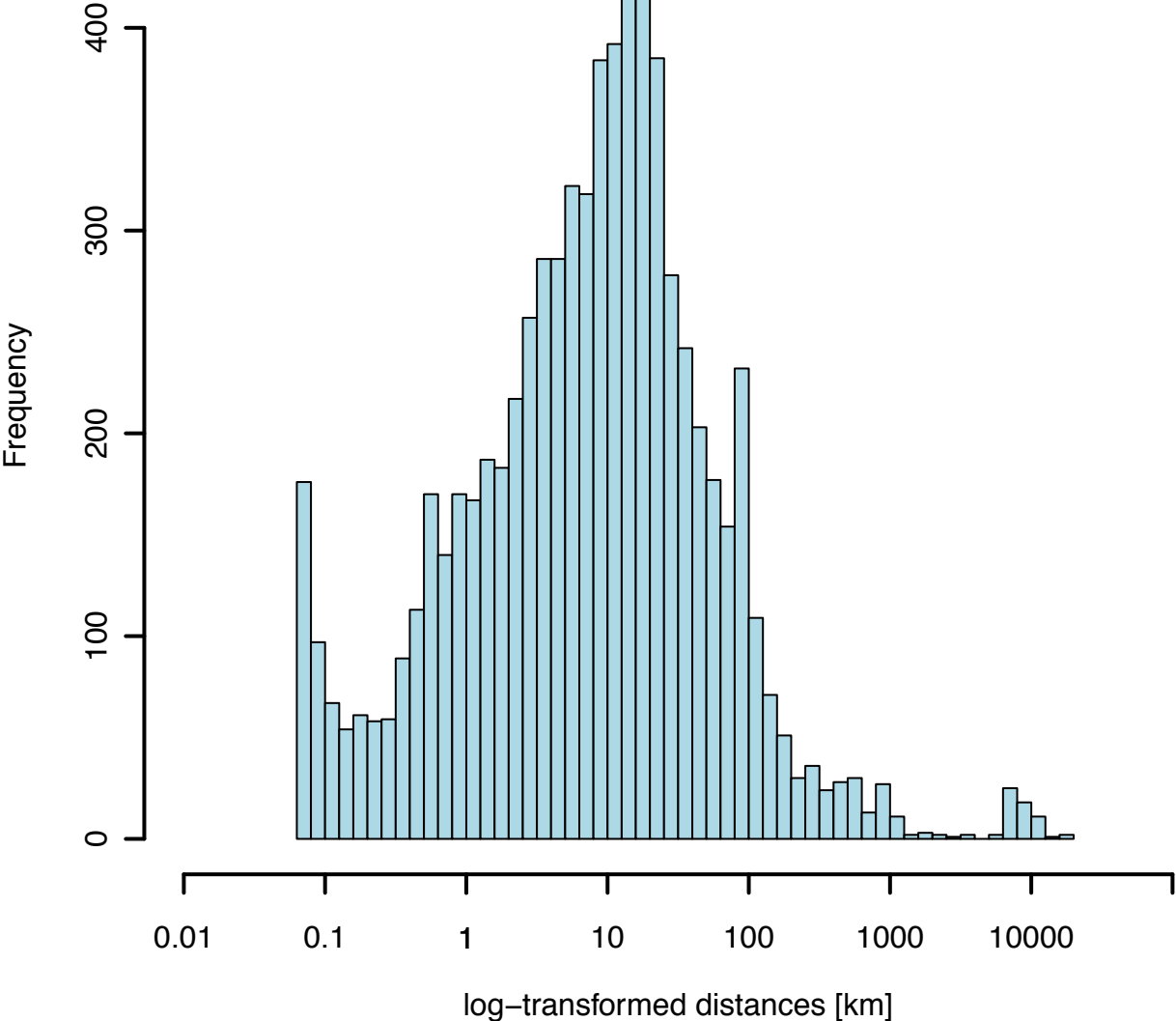


Great circle distances between “leisure” contacts: Zürich

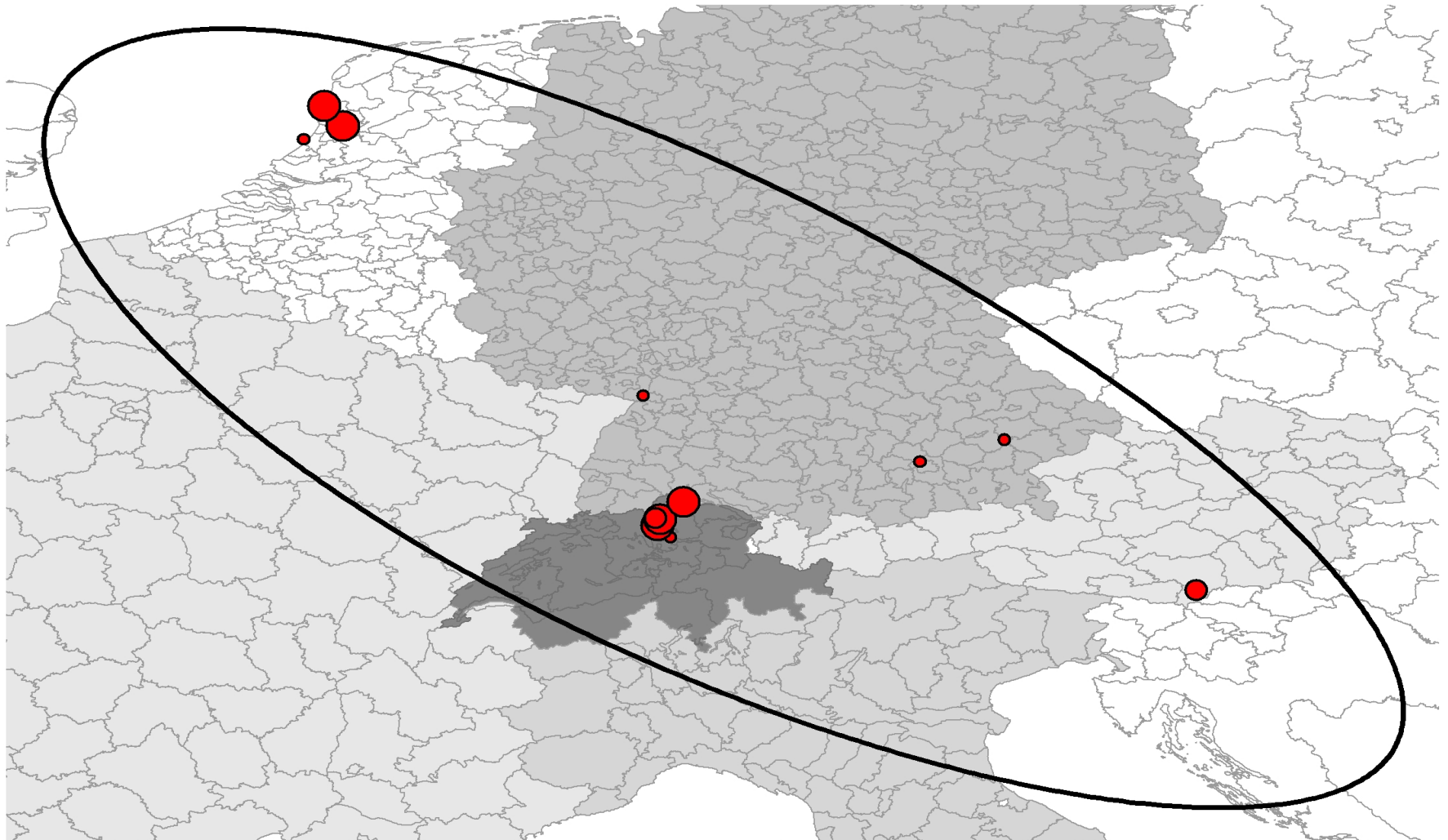


Great circle distances between “leisure” contacts: Snowball

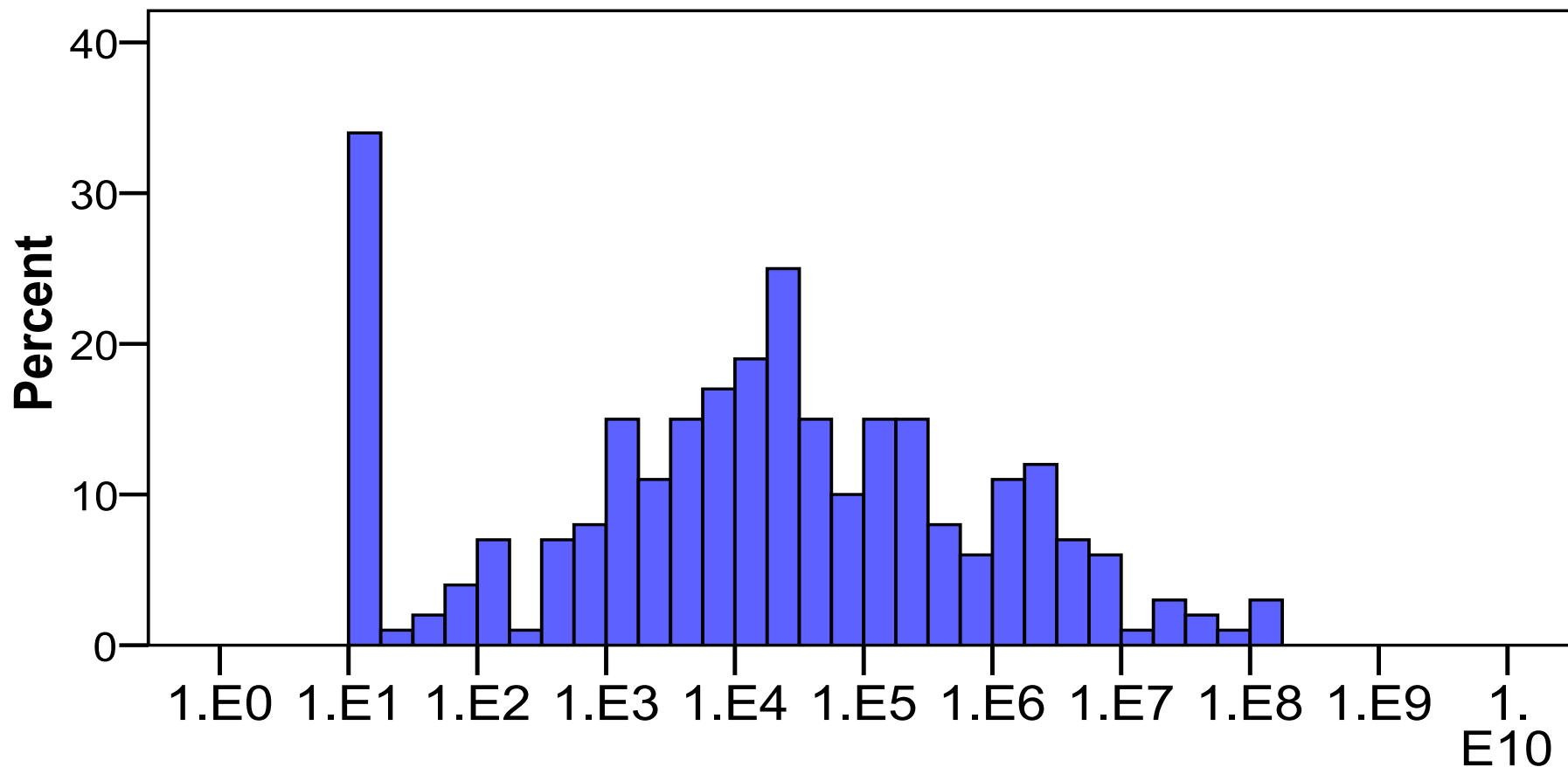
Daten: Schneeballbefragung IVT, Siehe Kowald et al. 2012



Example of a social network geography

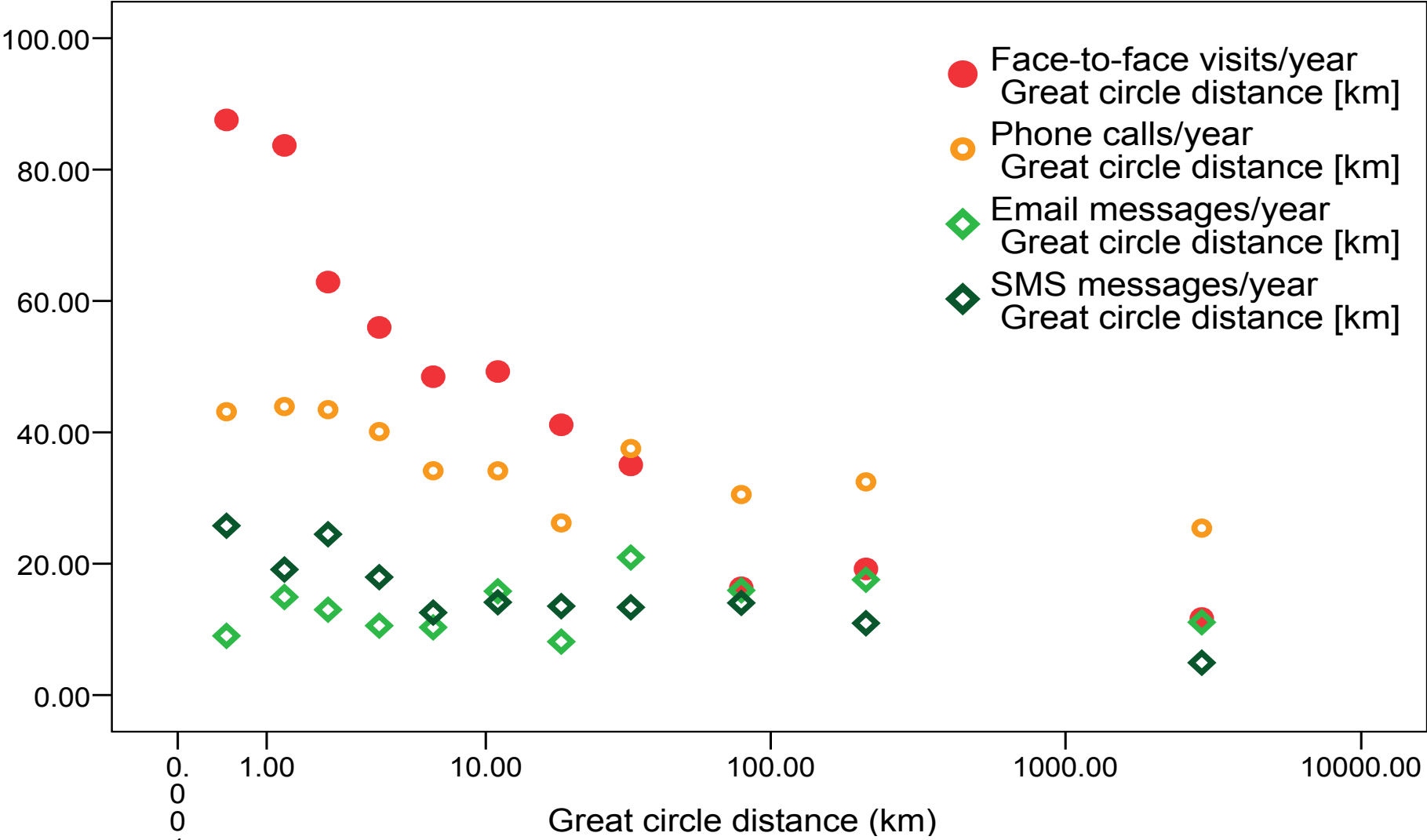


Size of network geometries



95%-confidence ellipse of the social network geography

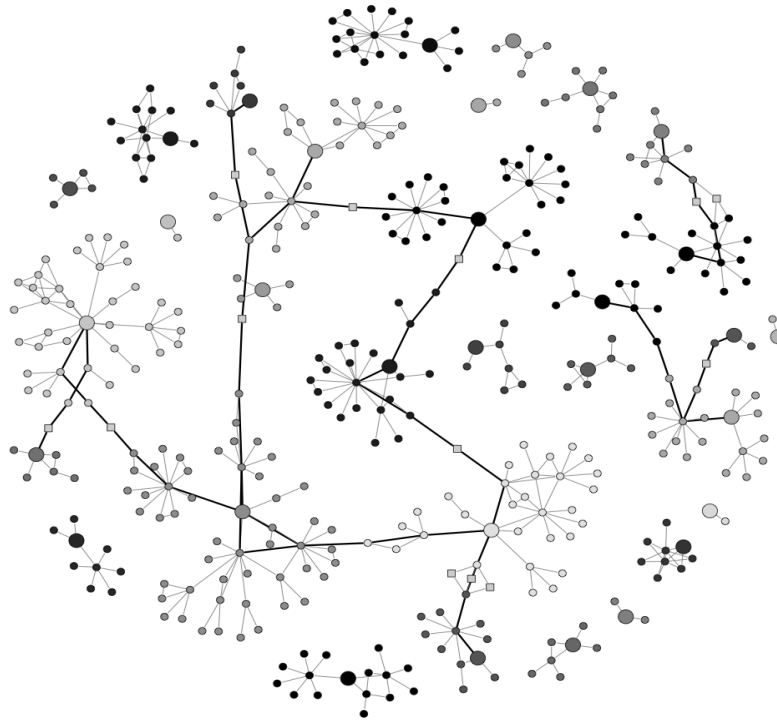
Interactions by mode and distance between homes



2010/11 Snowball survey

Behind egos' horizons: The connected 'snowball'-graph

- Seed
- Ego
- Bridging alter



	Vertices	Edges	Density	Components	Triangles
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Without sociogram	6'584	7'349	0.000	19	0.017
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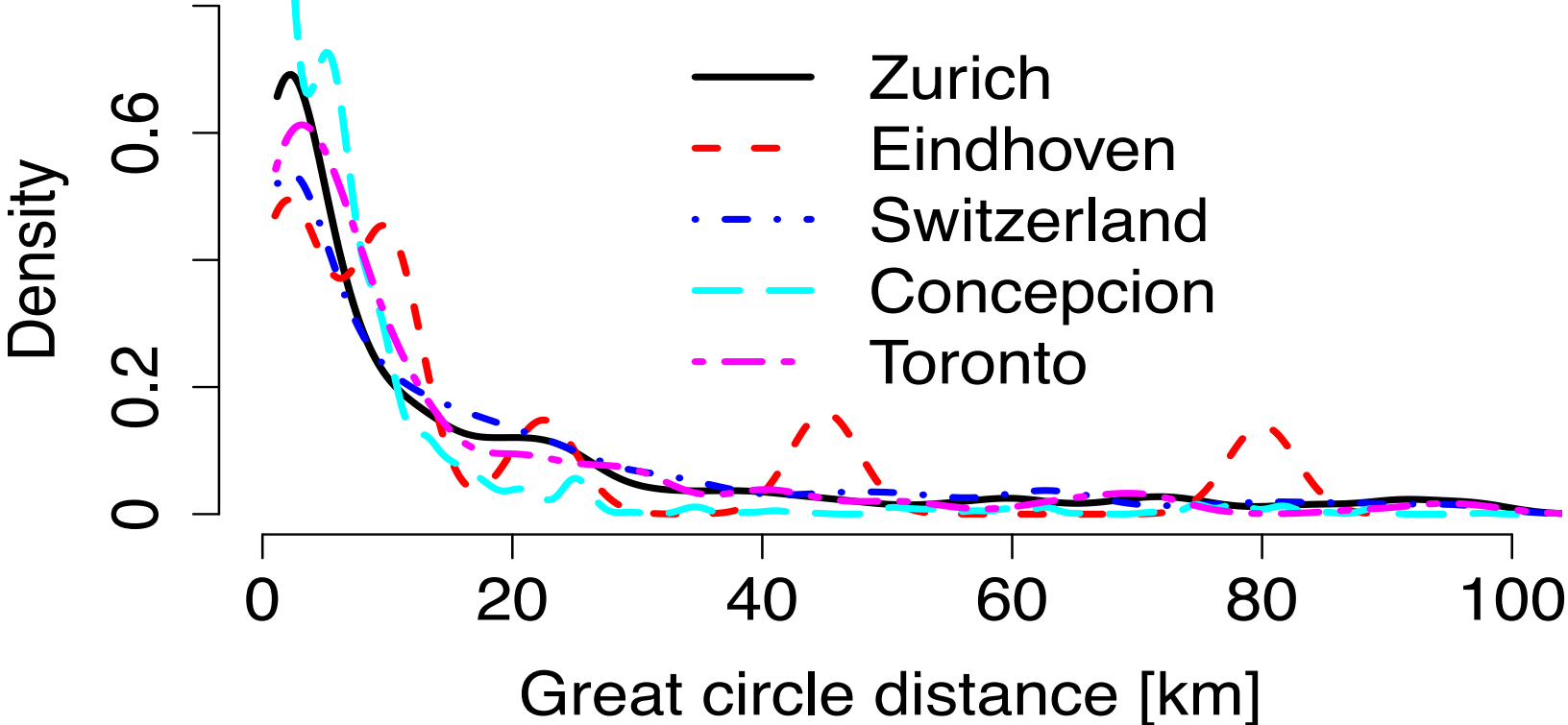
With sociogram	6'584	32'671	0.002	19	0.518
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Comparisons

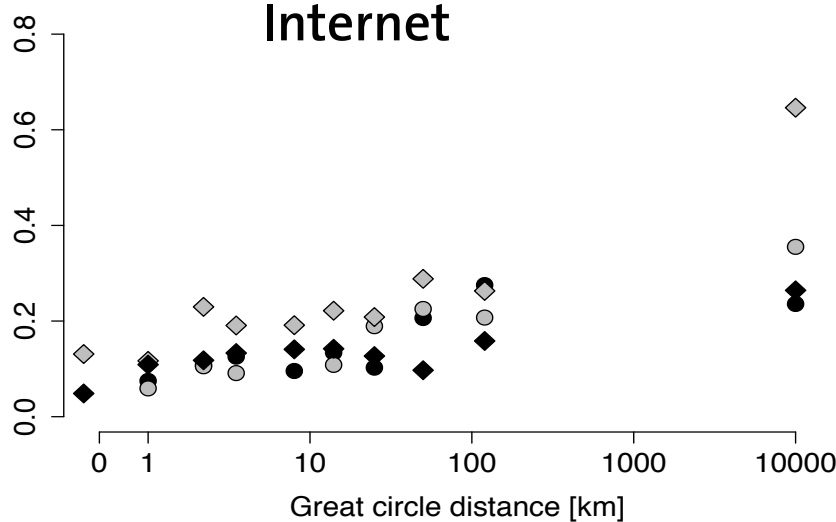
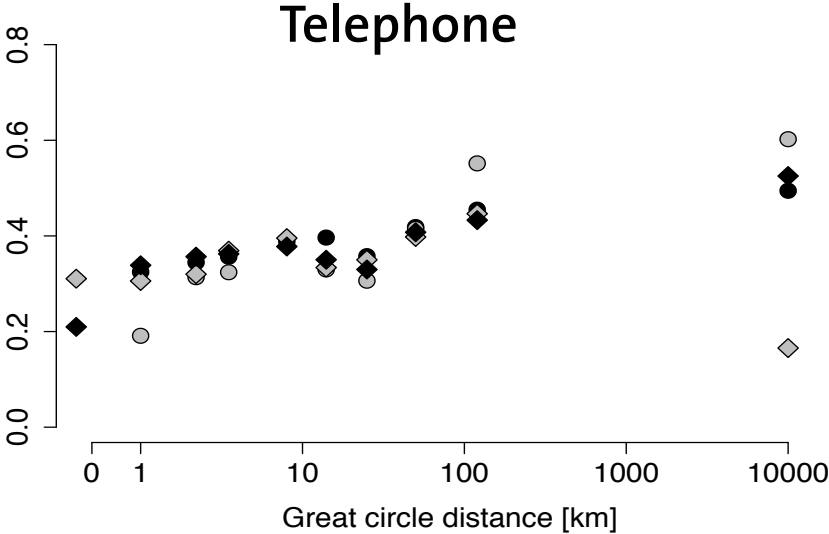
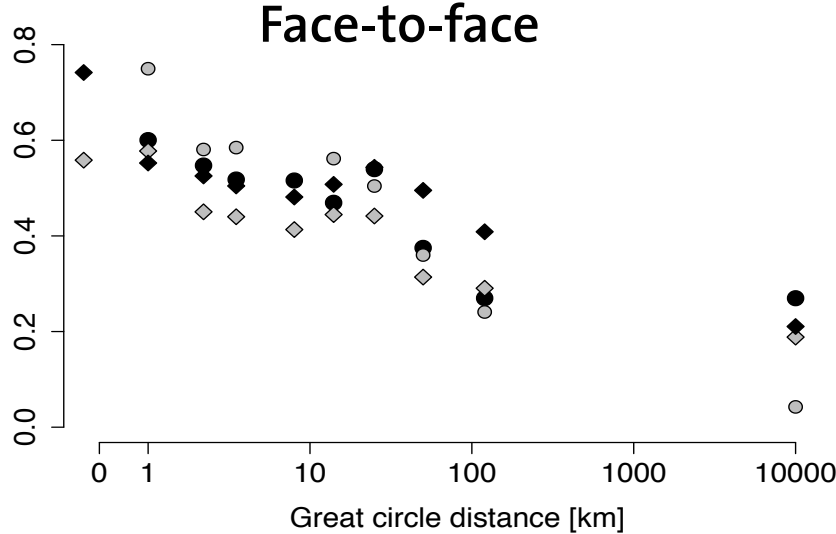
Transport motivated social network surveys

- East York, Ontario (Wellman, Carrasco et al.)
- Eindhoven, Netherlands (Arentze, Van der Berg)
- Concepcion, Chile (Carrasco)
- City of Zürich (Frei)
- Kanton Zürich snowball (Kowald)

Contact “density” – shares by distance class



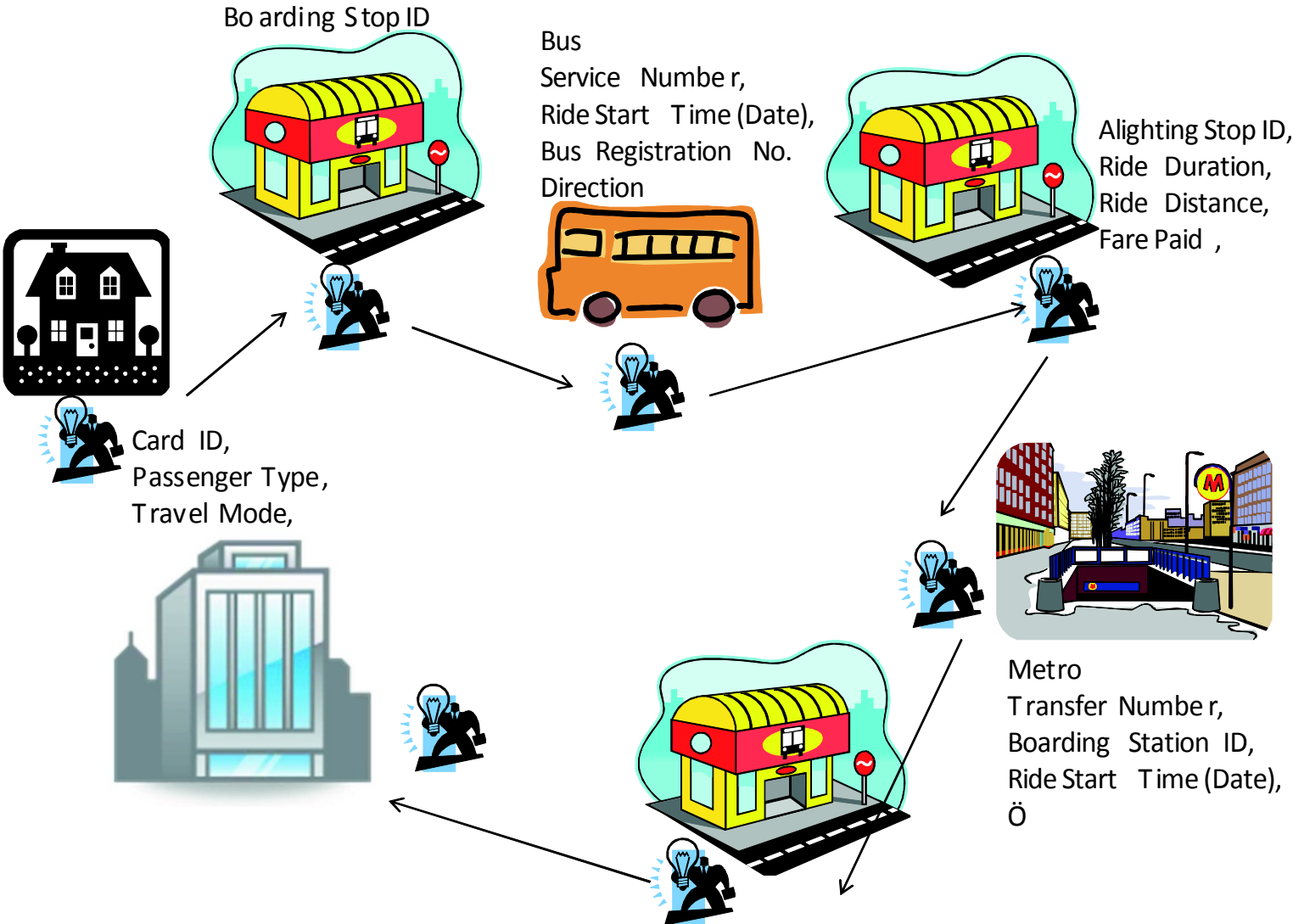
Shares of contact by mode



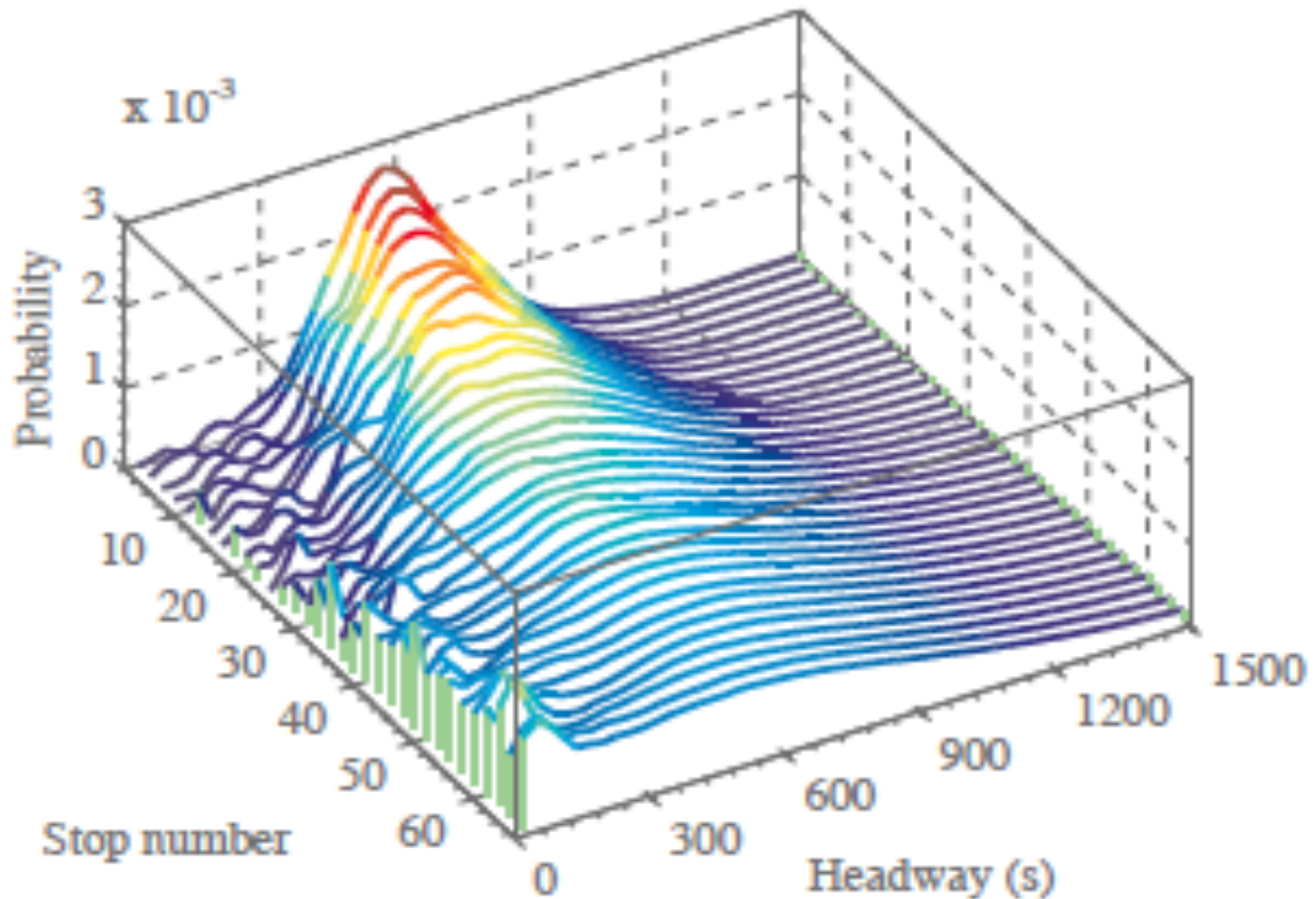
- Zurich
- Eindhoven
- ◇ Switzerland
- ◆ Concepcion

Low level networks as a building block

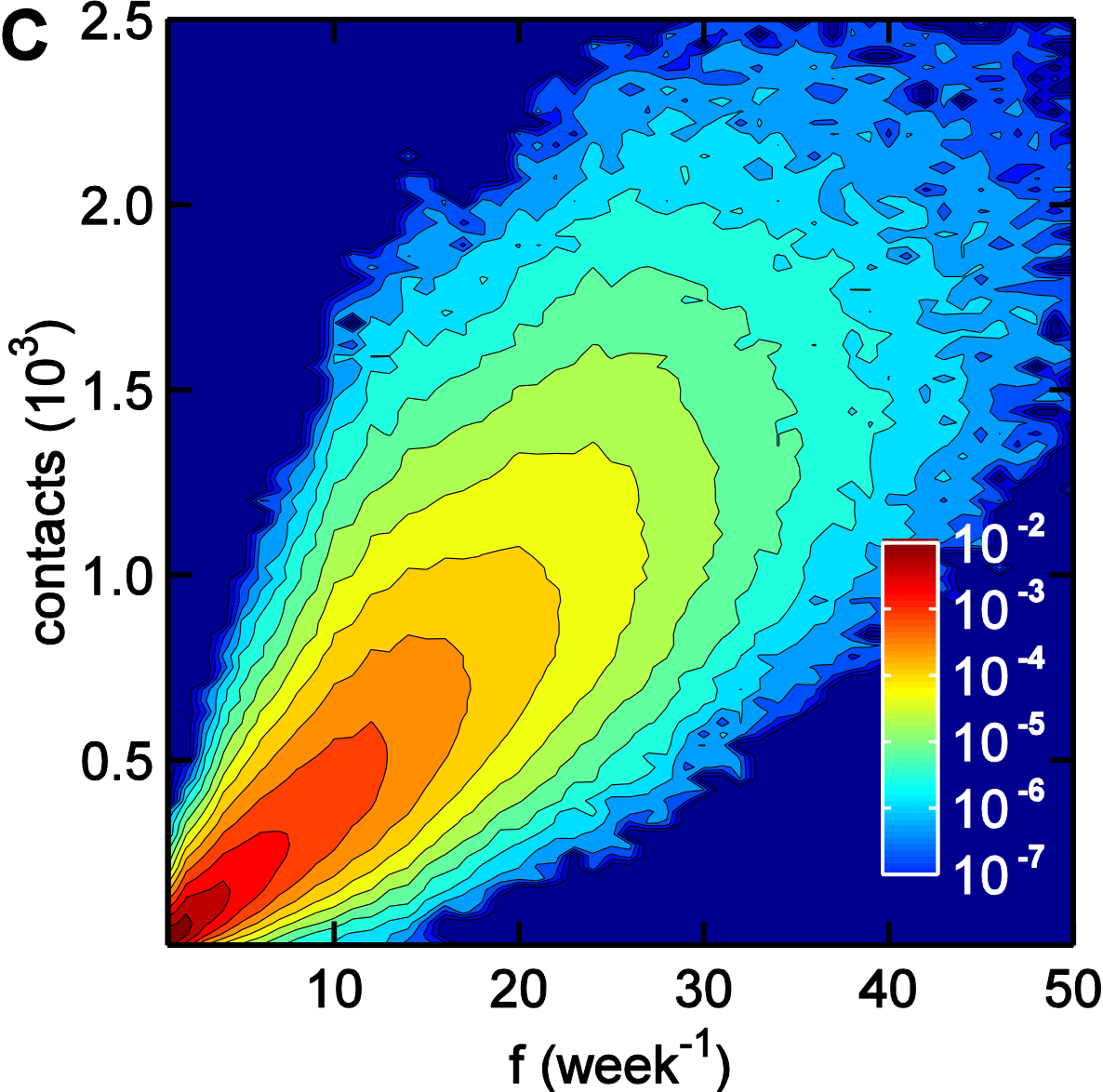
Smart card records as a source



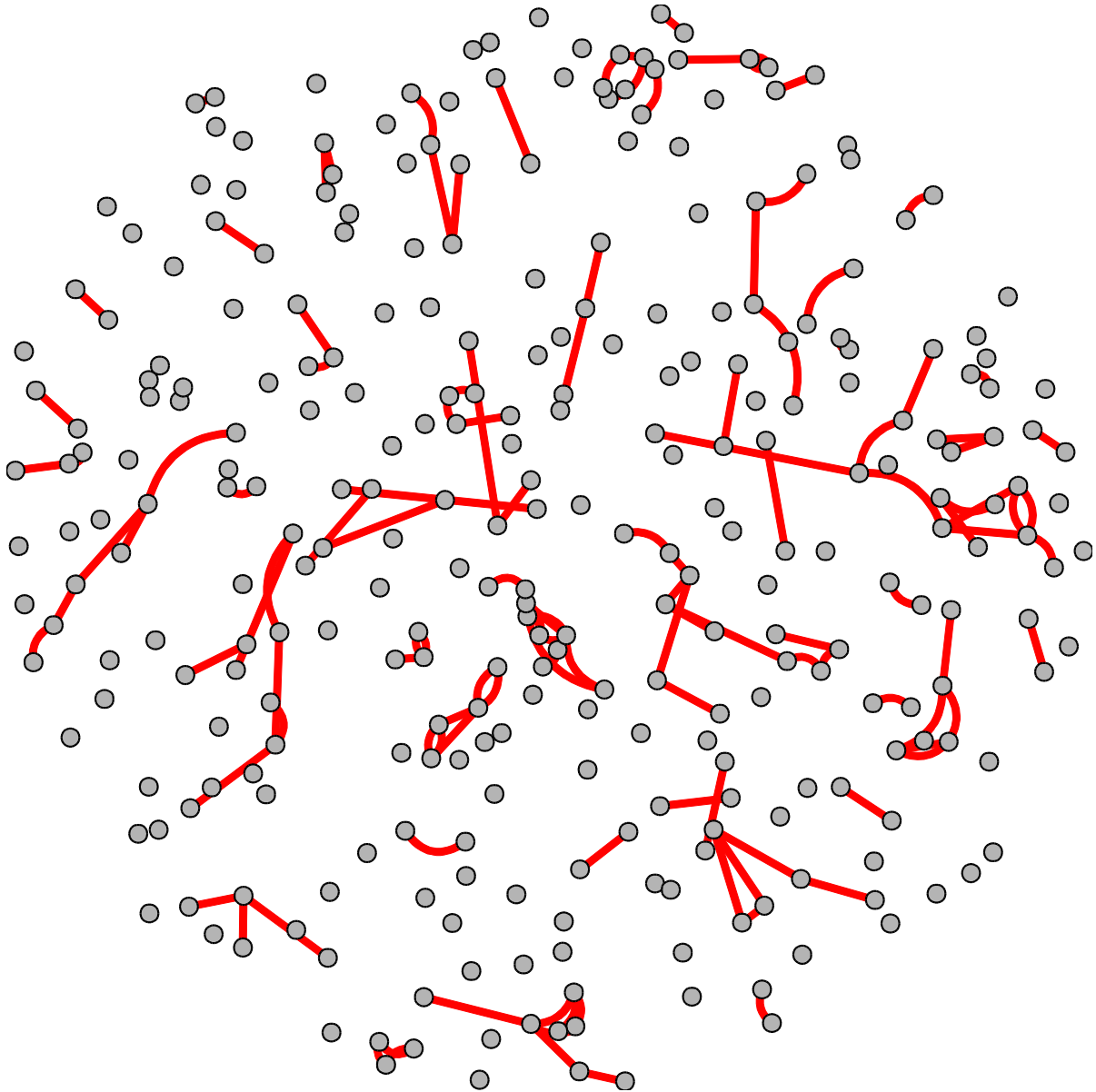
Arrival distribution along a line



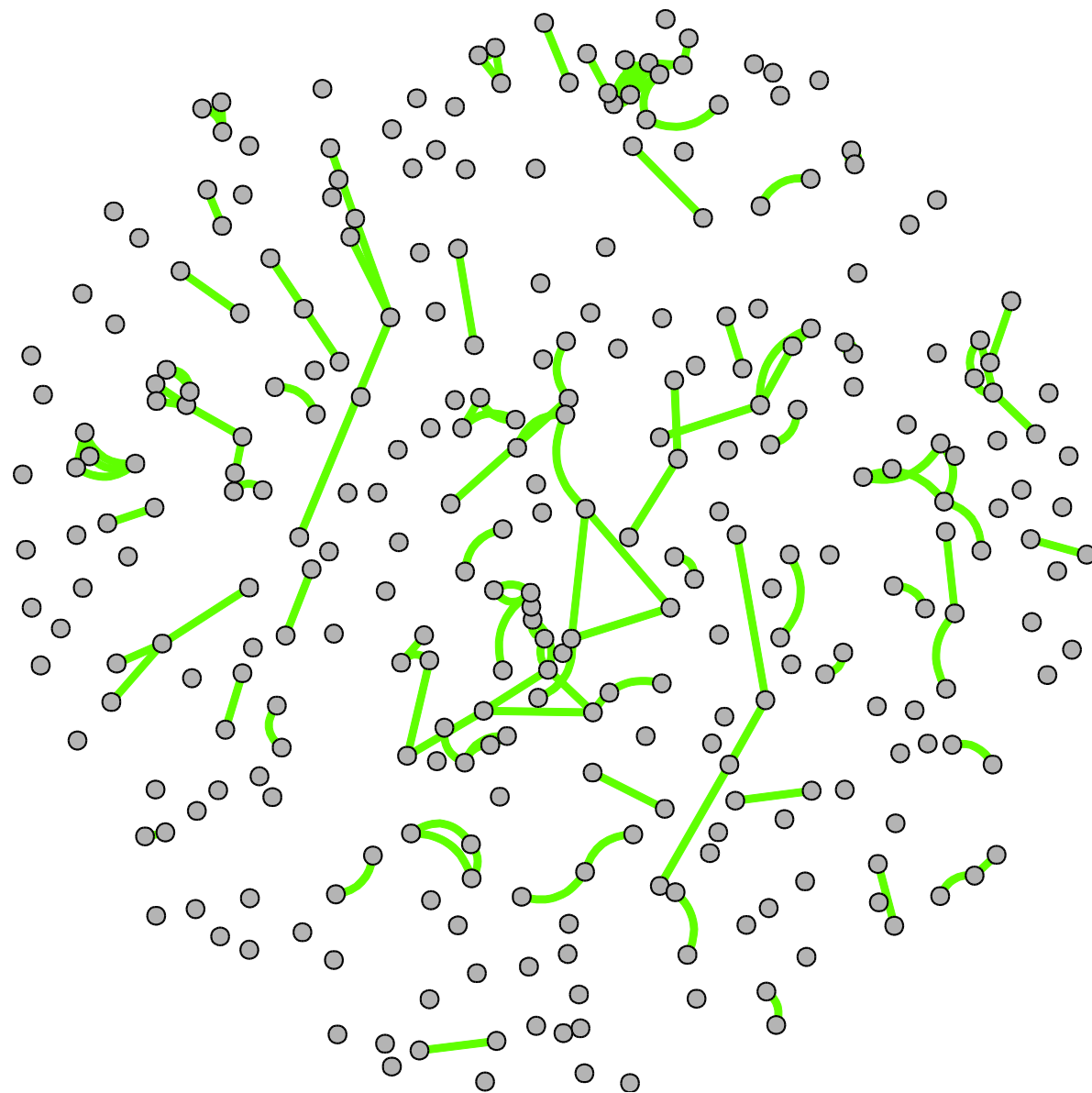
Number of contacts versus usage frequency



Monday

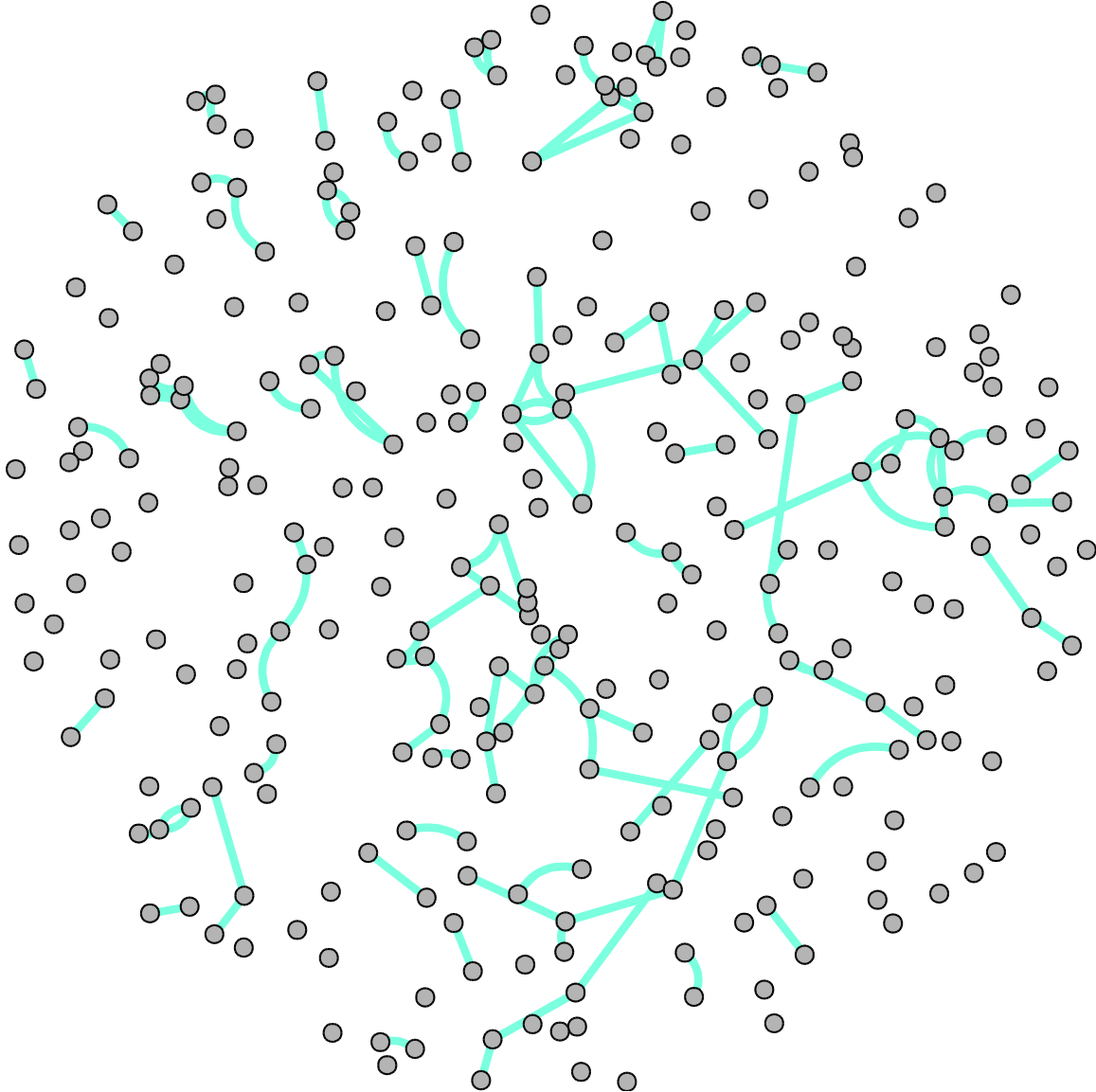


Tuesday



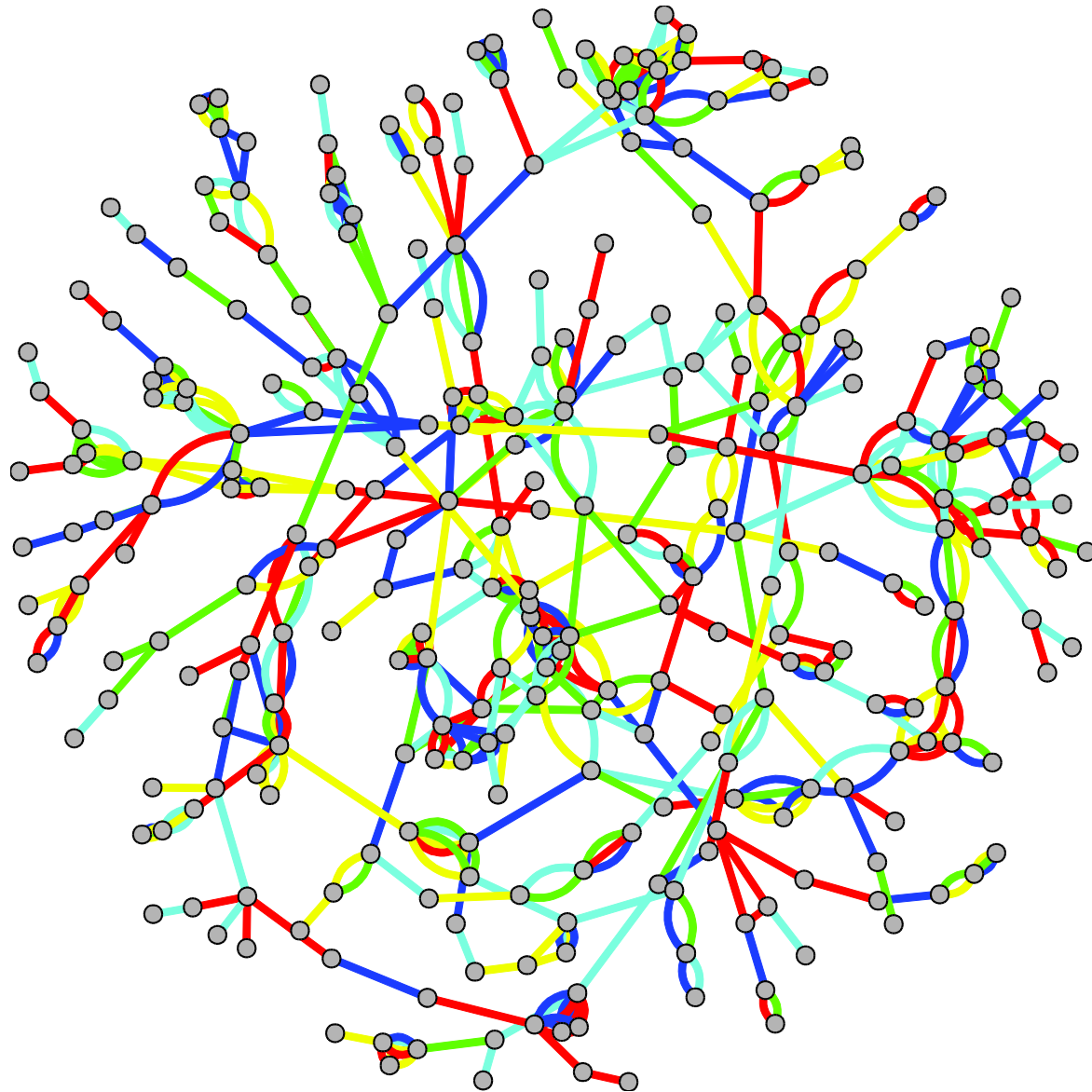
Sun, 2013

... Friday



Sun, 2013

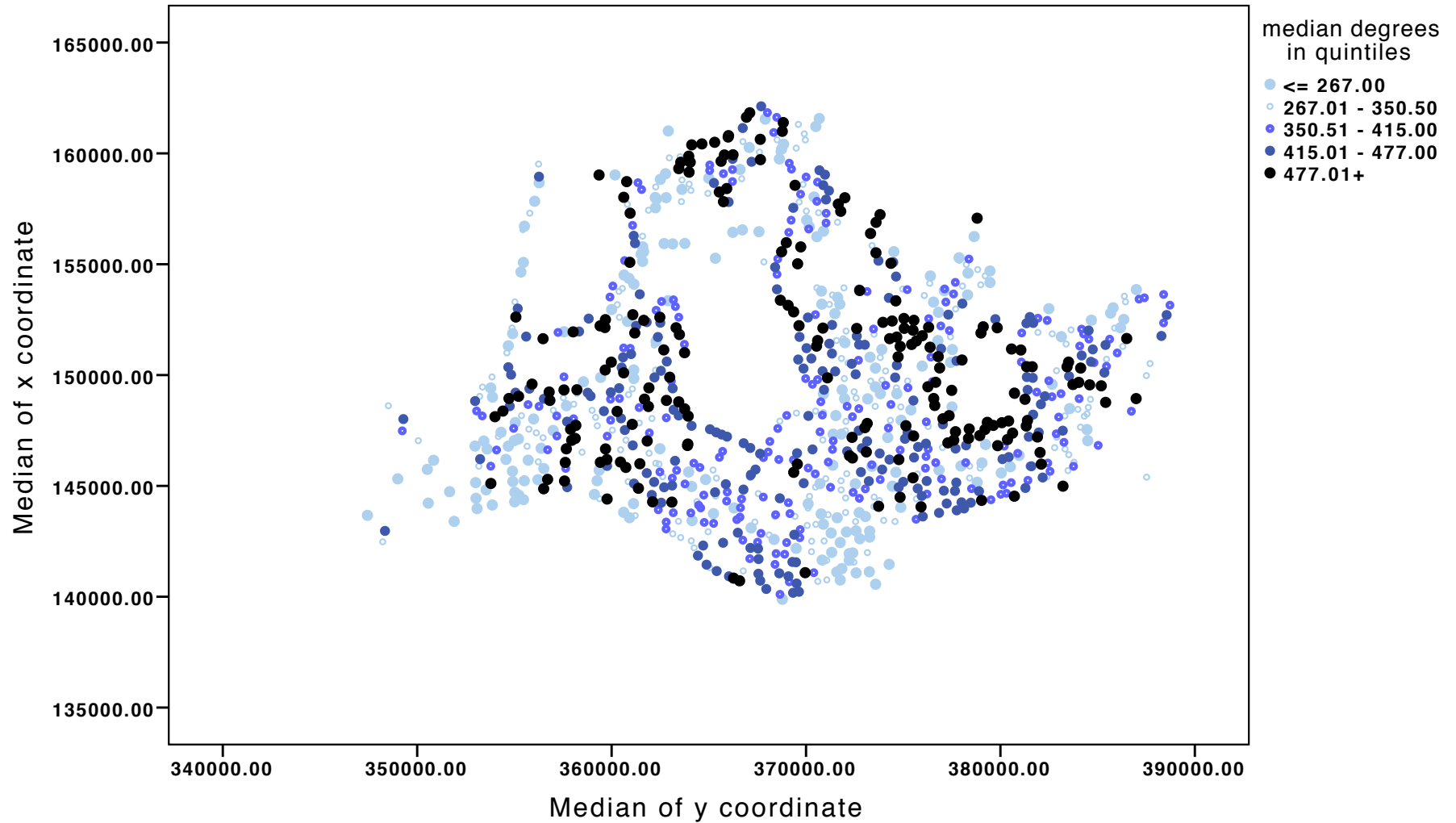
... the weekly summary



A small world network in Singapore's busses

- One component by Wednesday
- Diameter: 6
- Characteristic path length: 2.95
 - (random: 2.63)
- Average clustering coefficient: 0.19
 - (random: 4.5×10^{-4})
- Small-world
 - Watts DJ & Strogatz SH (1998) Collective dynamics of 'small-world' networks. Nature 393:440-442.

A small world network in Singapore's busses, but uneven



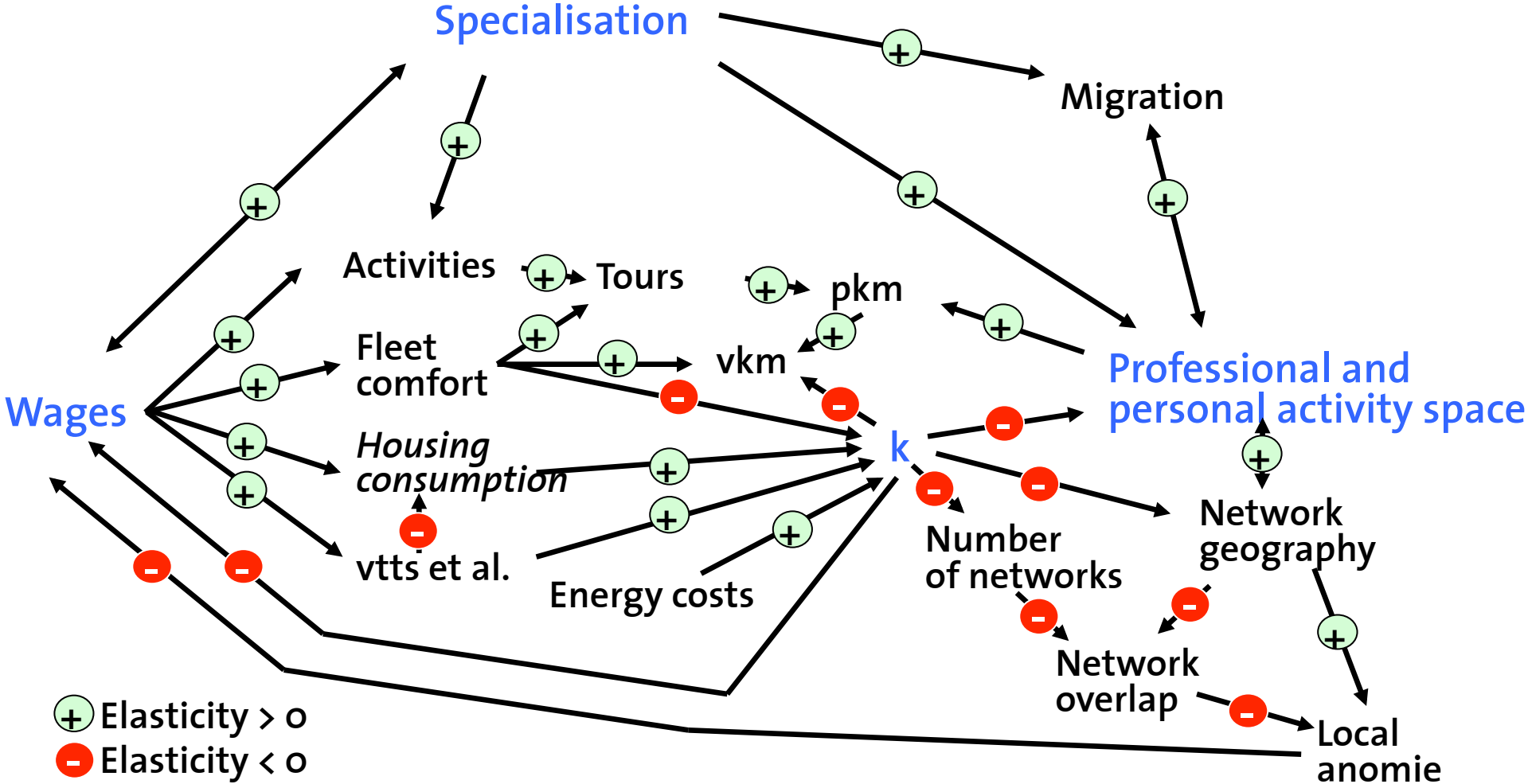
Integration

Integration and future work

- Generation of artificial social networks (Arentze et al., 2012) (degree, clustering, distances)
- Repeat of Switzerland Snowball
- Measurement of network size (leisure, work, civic engagement)
- Measurement of network dynamics (Timmerman's ERC project, Carrasco's Concepcion survey)
- Measurement of anomie, trust and social network geography
- Integration of network choice/decision making model (Dubernet)

Integration, again

Some hypotheses for travel behaviour and more



Questions ?

www.ivt.ethz.ch

www.matsim.org

www.futurecities.ethz.ch

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- Sun, L., K.W. Axhausen, D.-H. Lee and X. Huang (2013) Understanding metropolitan patterns of daily encounters, *Proceedings of the National Academy of Science (PNAS)*, **110** (34) 13774-9. ⁴⁶