

## Preferred citation style

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Axhausen, K.W. (2005) Activity spaces, social networks and mobility biographies, presentation at the *Seminar of the Transport Operations Research Group*, University of Newcastle upon Tyne, November 2005.

# Activity spaces, social networks and mobility biographies

KW Axhausen

IVT

ETH

Zürich

November 2005

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

**ETH**

Eidgenössische Technische Hochschule Zürich  
Swiss Federal Institute of Technology Zurich

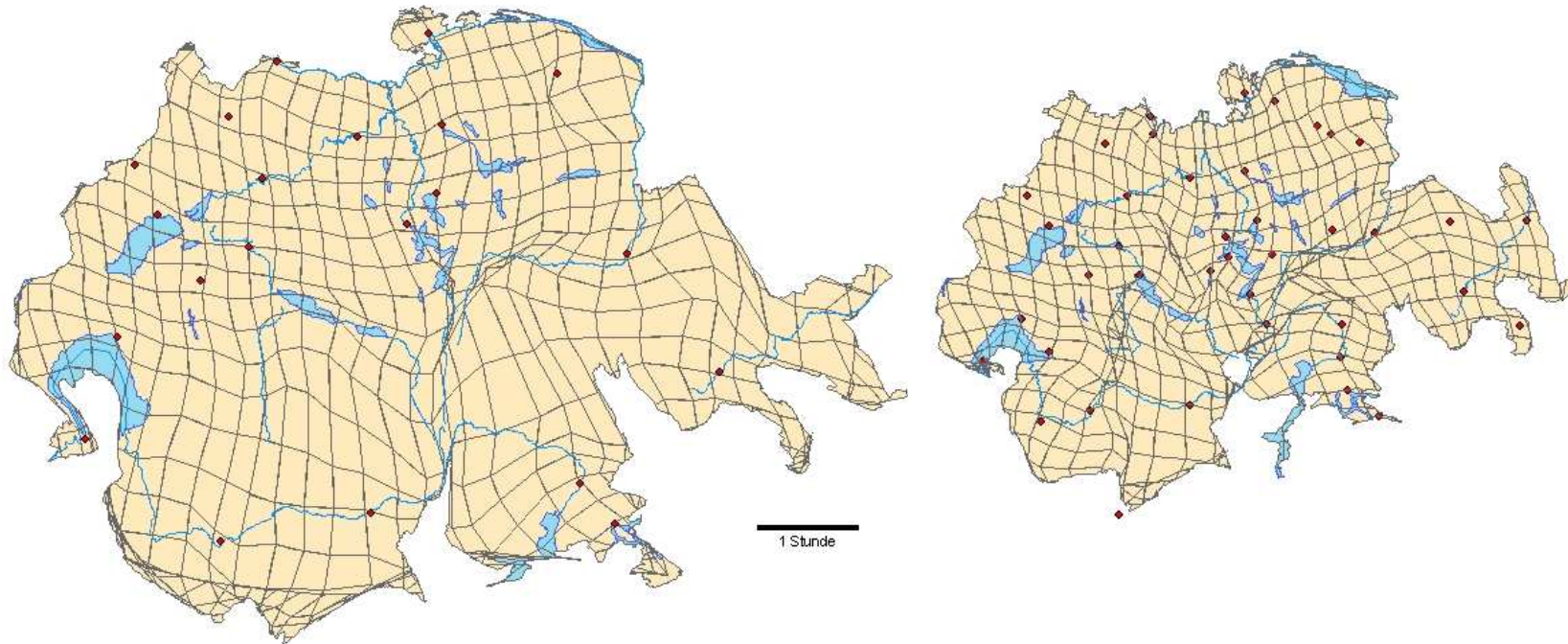
# Plan

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- Remind us of the changes in the amount of travel
- Remind us of what we currently ignore
- Suggest a possible set of mechanisms
- Discuss the measurement of activity space
- Discuss the integration of social network questions into travel surveys
- Integrate social networks and biographies into the explanatory scheme
- Remind us of what needs to be done

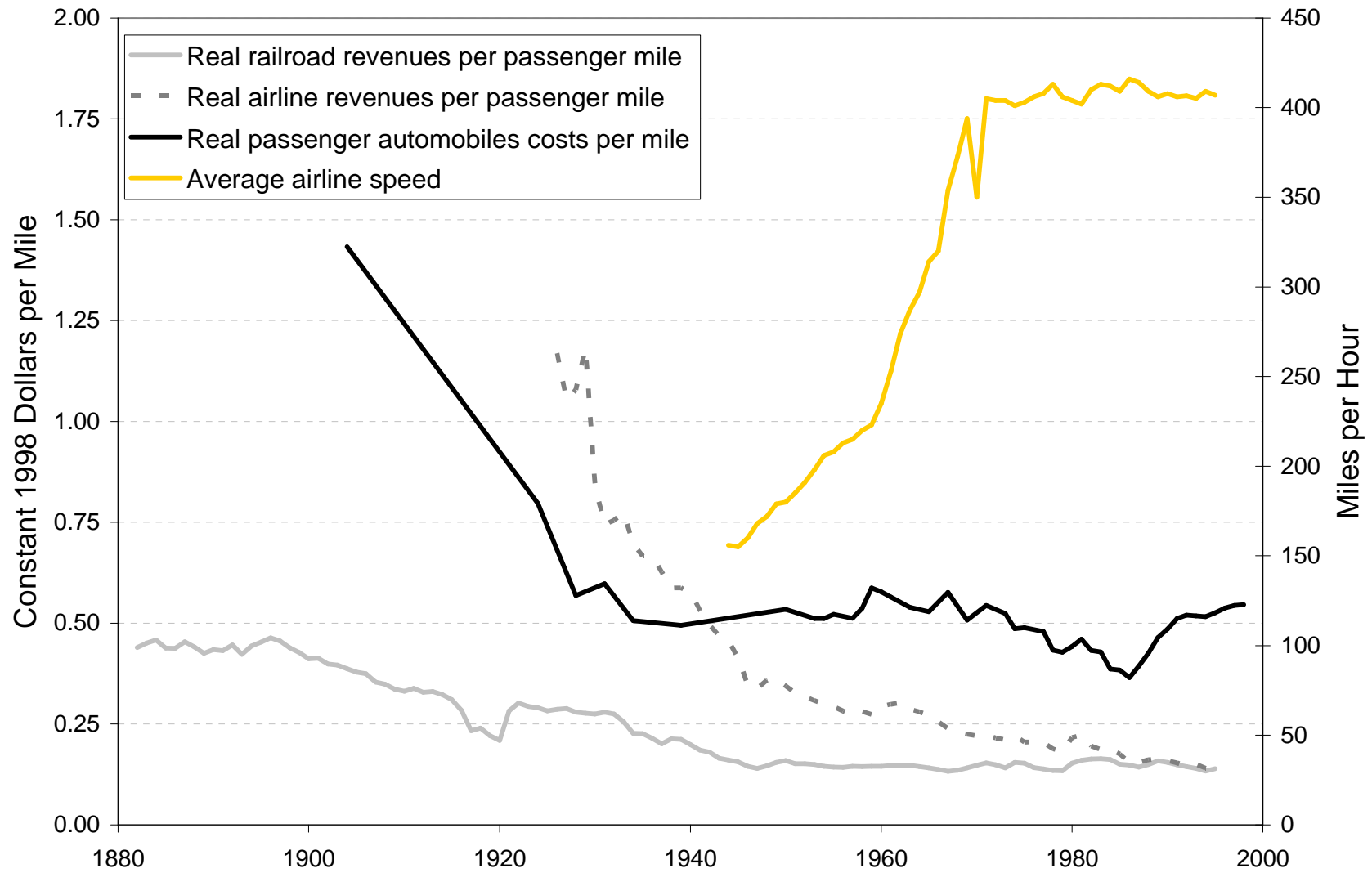
# Trends: Road travel time scaled Switzerland (1950 & 2000)

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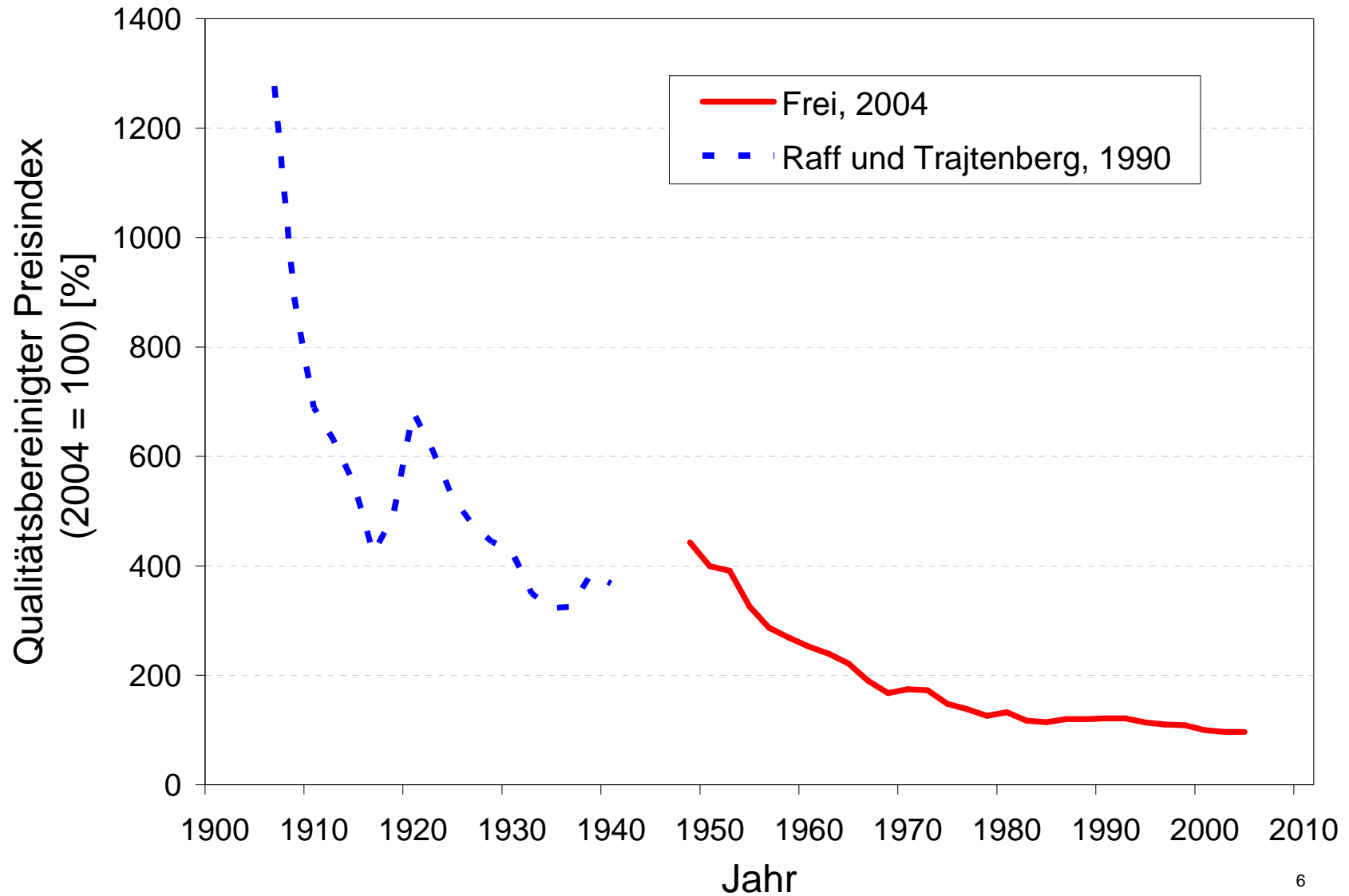


Carosio, Dolci und Scherer, 2005

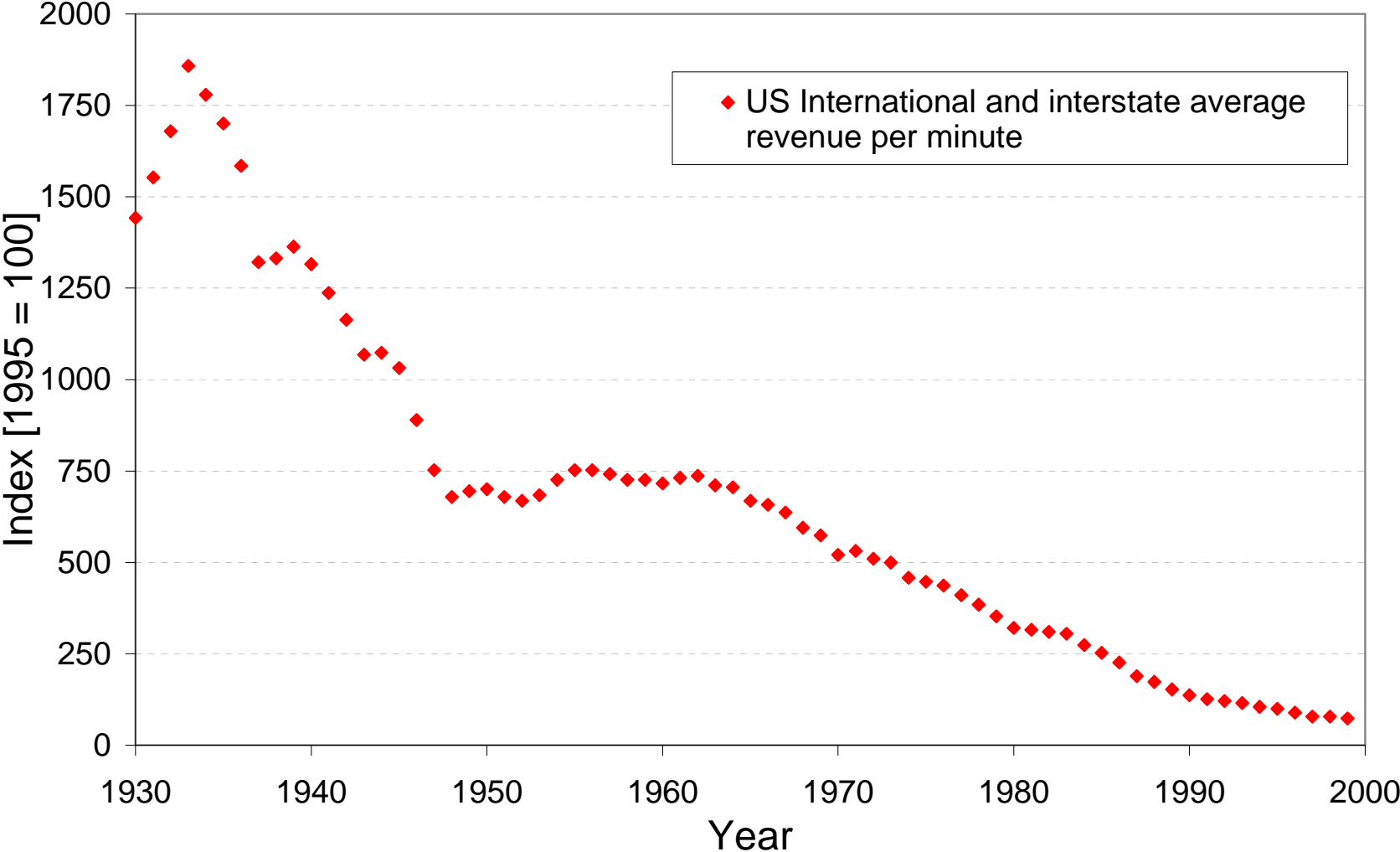
# Trends: Real revenues per mile (USA since 1880)



# Trends: Quality controlled prices of the mean new Swiss car

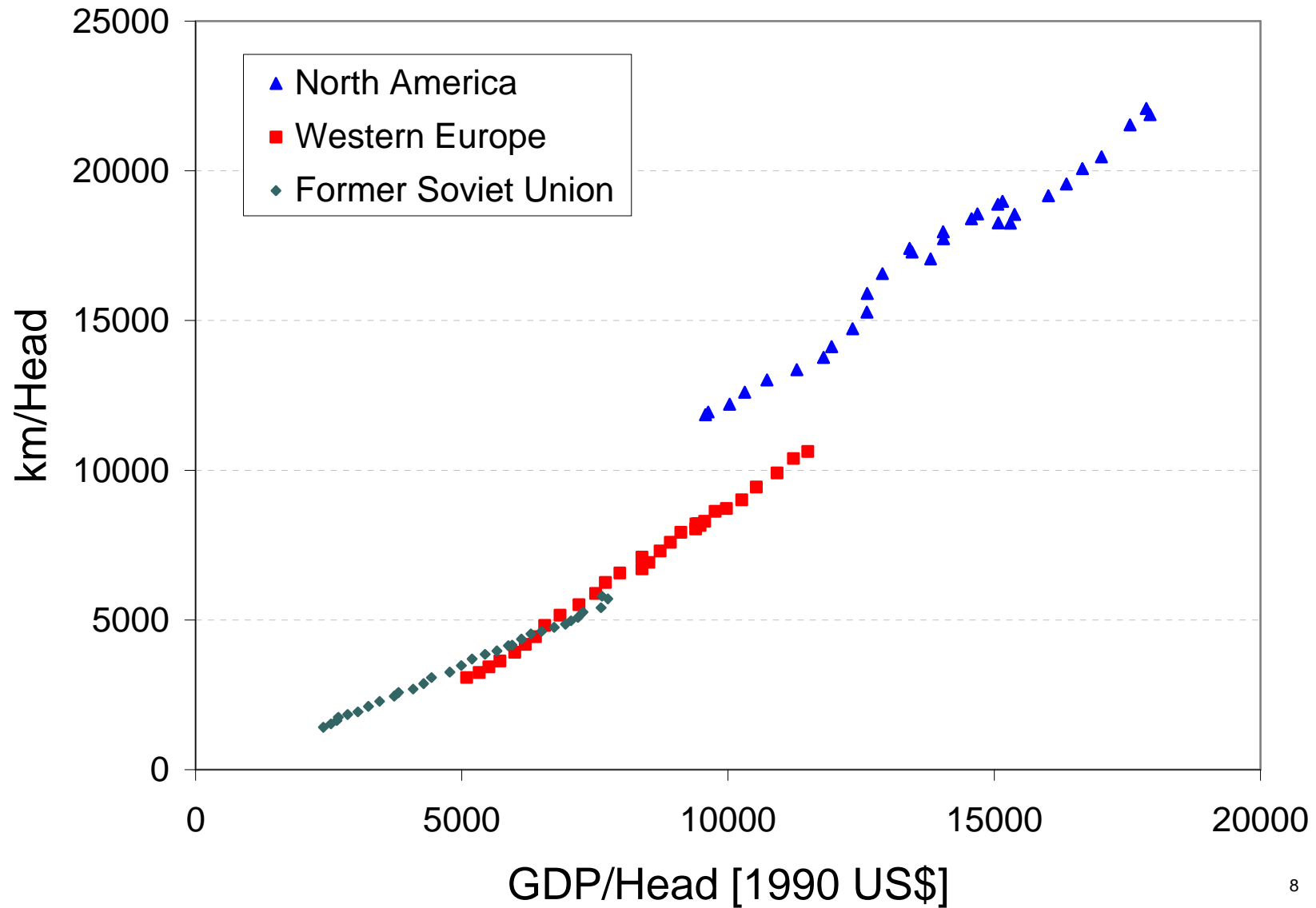


# Trends: Real price of telecommunication



Adapted from FCC (2001)

# Response: Annual vmt increase since 1960

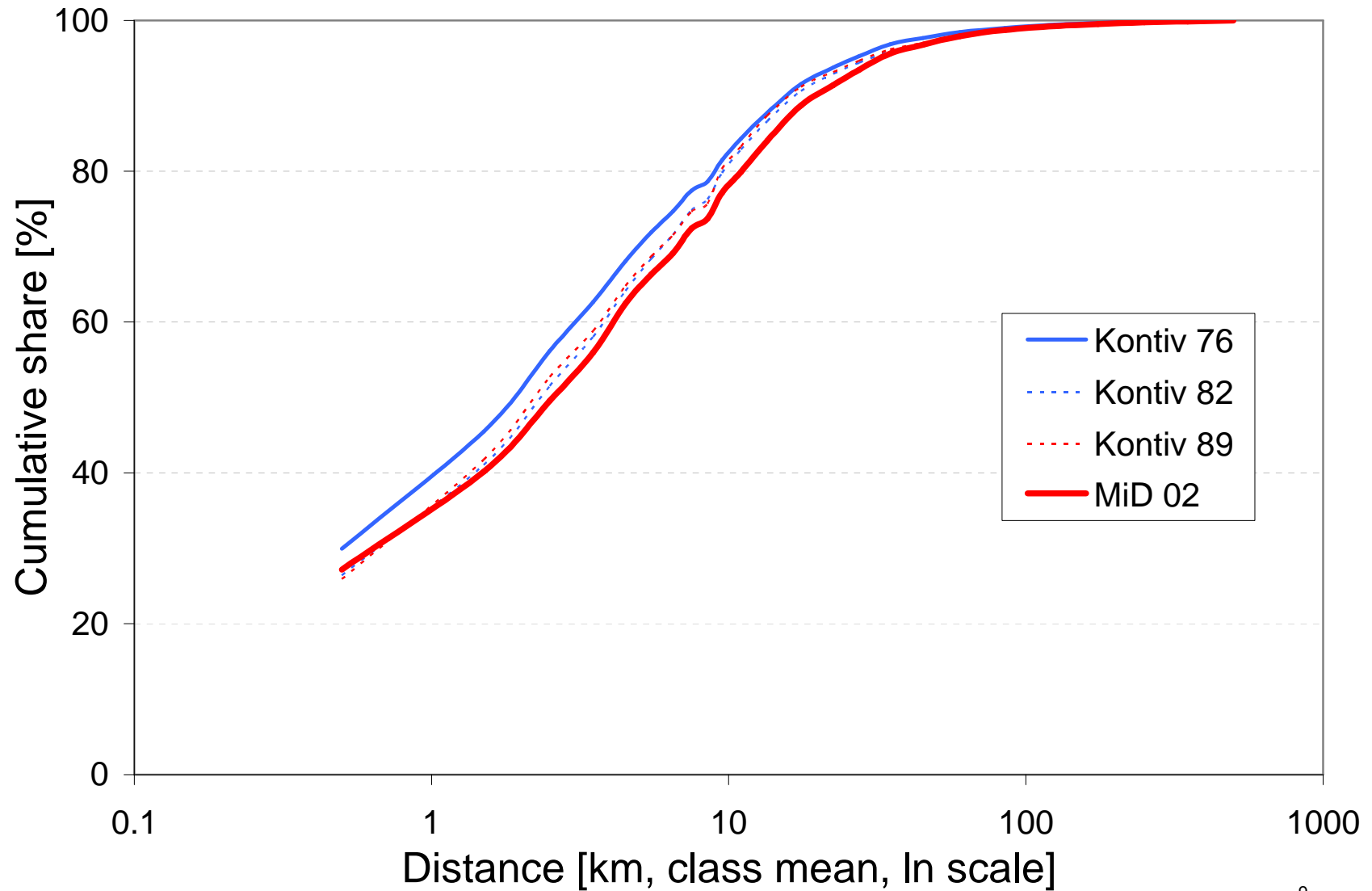


Source: Schäfer

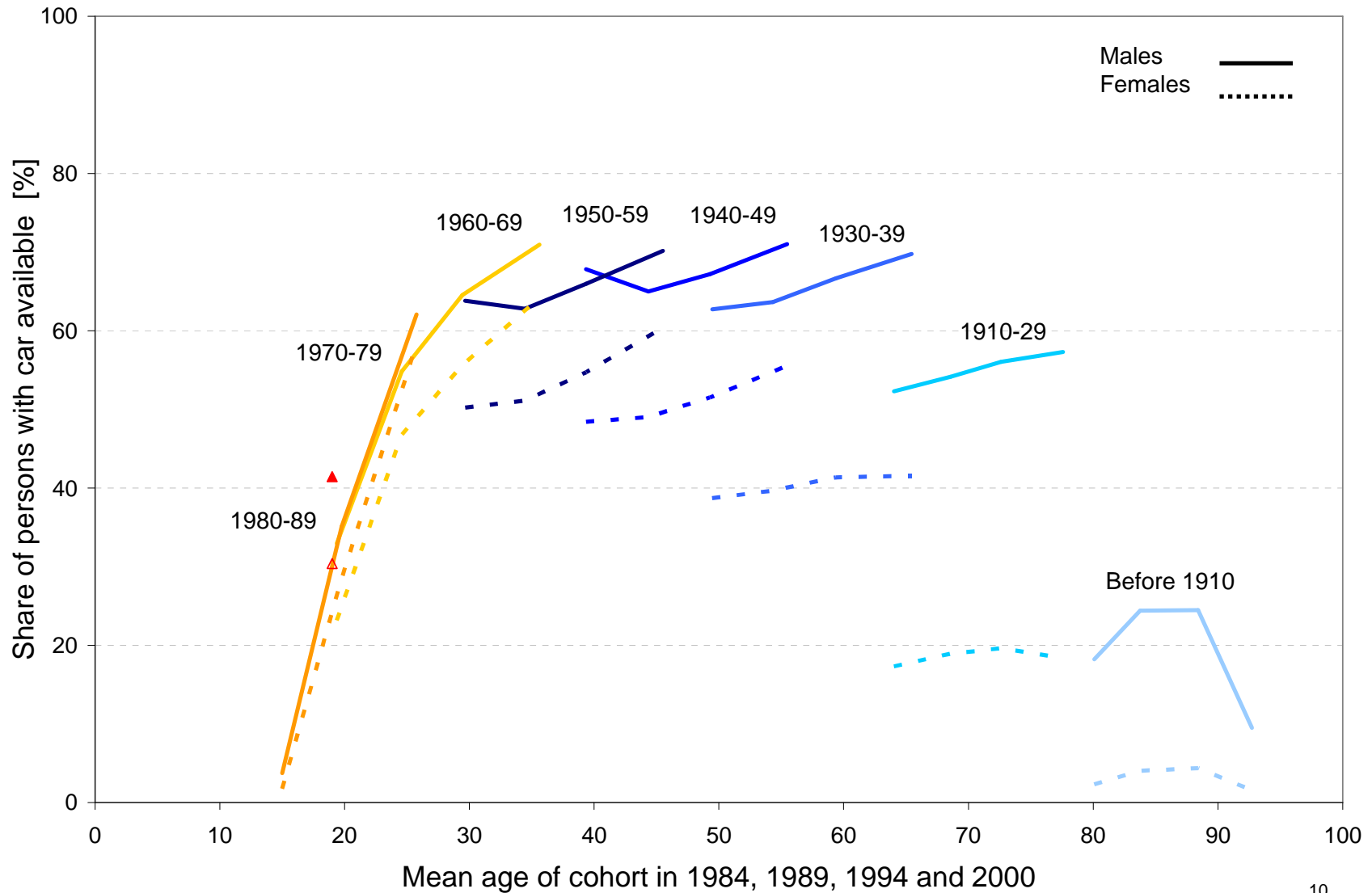


## Response: Increasing trip length (Germany since 1976)

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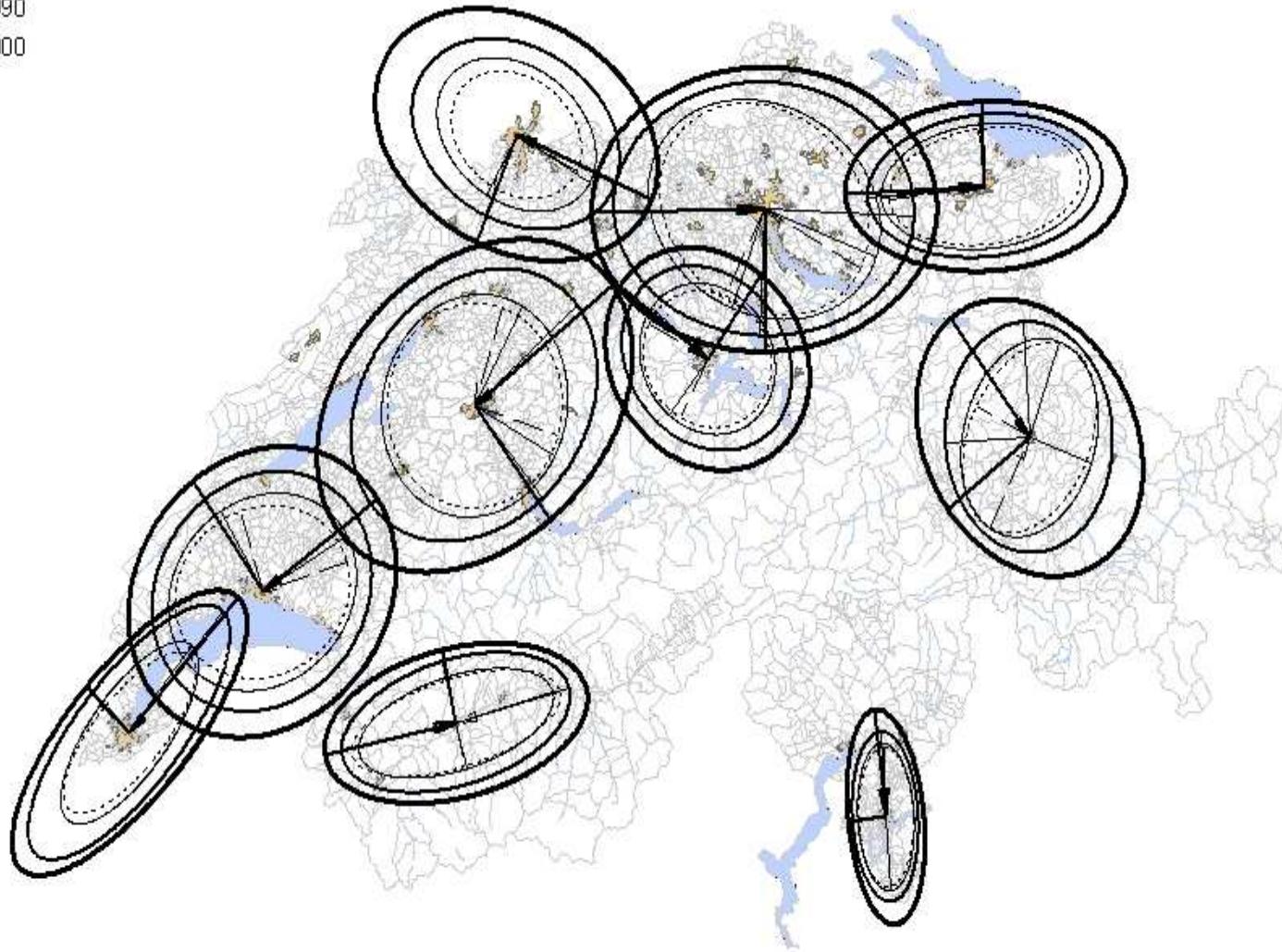
# Response: Swiss car availability since 1984



# Response: Swiss Suburbanisation since 1970

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- 1970
- 1980
- 1990
- 2000



Adapted from Botte, 2003

## Response: Kilometers travelled by purpose [%]

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Purpose	CH - 2000	D – 2002	UK - 2003	USA - 1995
Leisure	44.8	38.3	33.7	32.2
Work/school	35.0	29.7	32.0	31.3
Shopping/private business	11.2	21.7	19.7	27.6
Accompanying	4.9	4.5	7.6	8.5
Other	1.8	4.8	7.1	0.5

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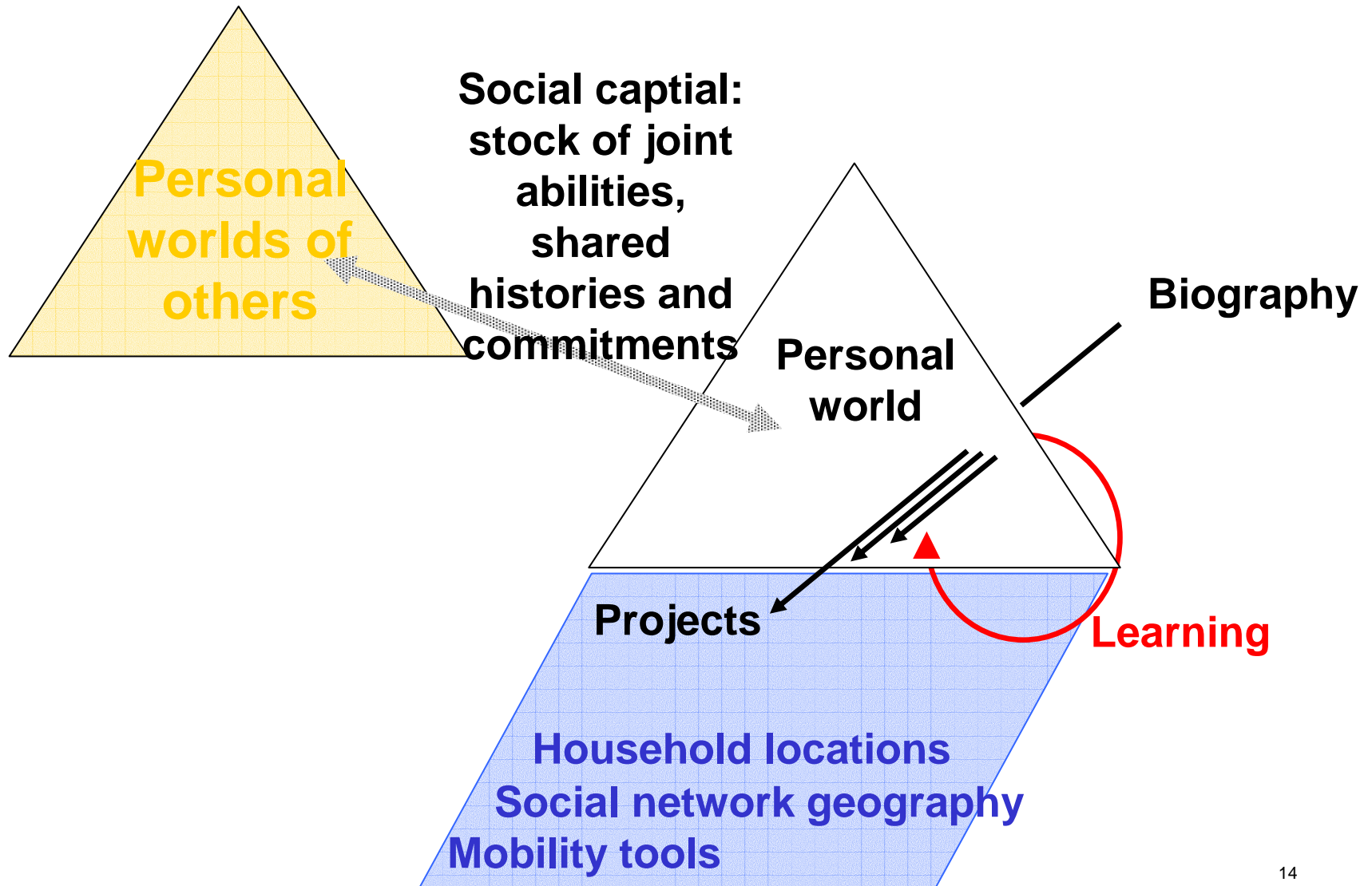
# What do we, what don't we account for ?

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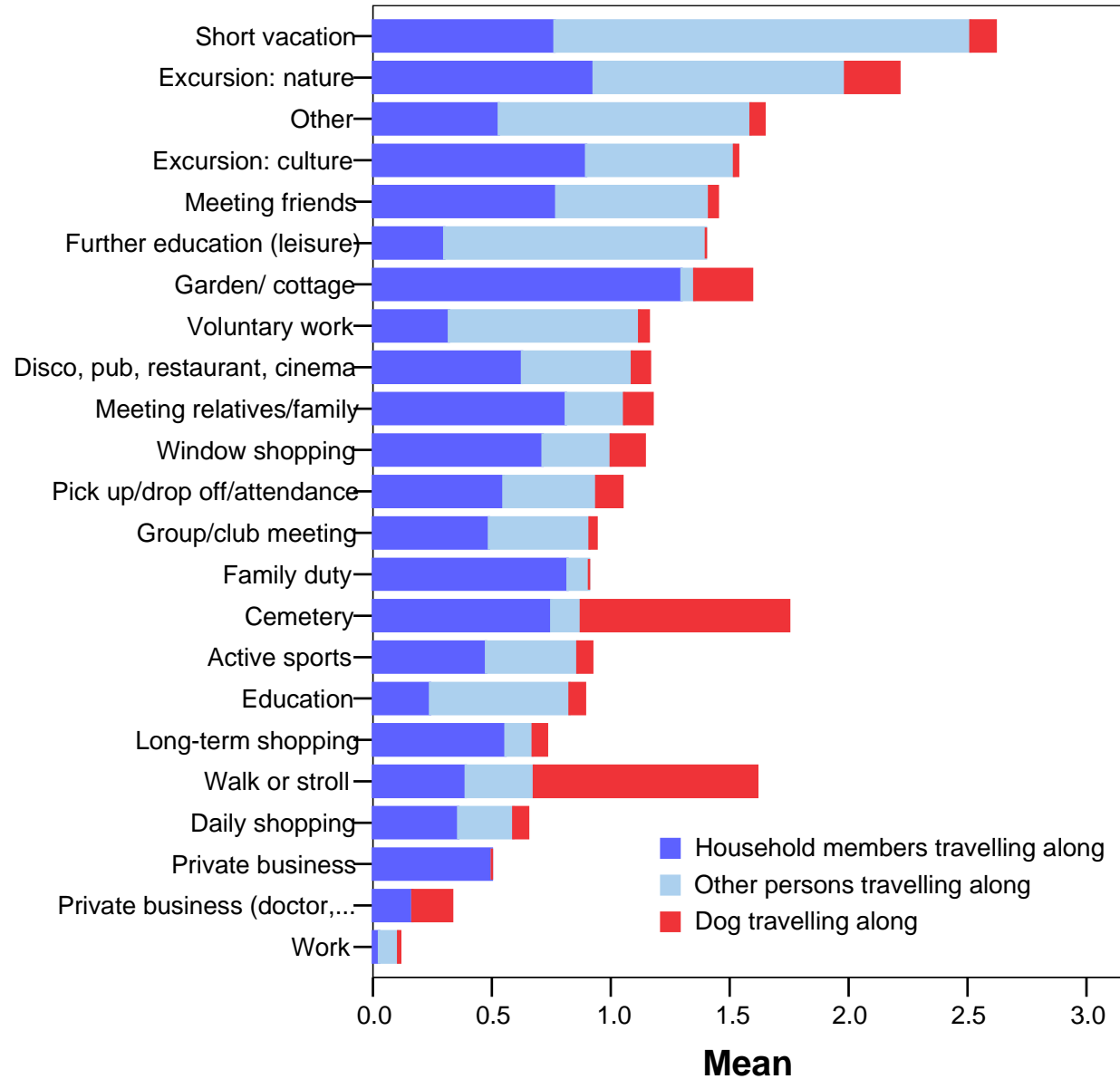
- Generalised costs of travel
- Sociodemographics
- Attitude and values
- Life style
- Biography
- Social networks

# The „network actor“ in a dynamic social context

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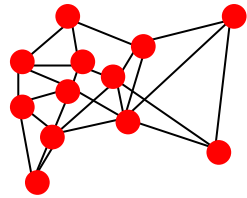


# The social content of travel (2003 Thurgau)

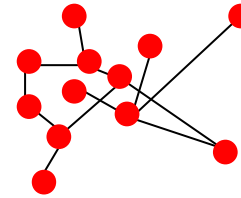


# Spatial and social density

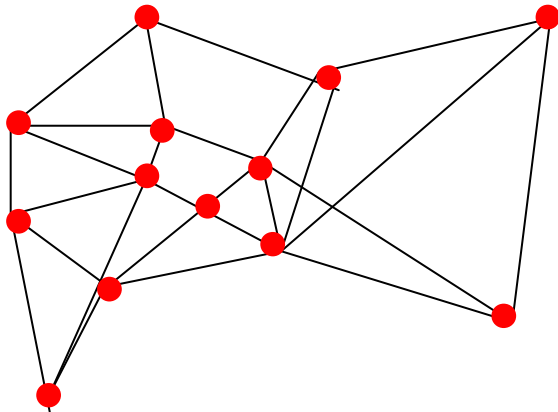
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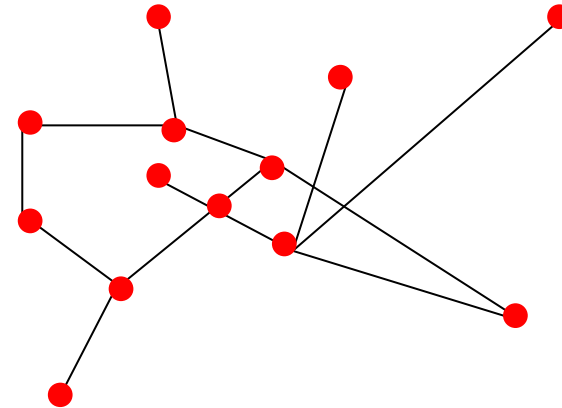
Dense/tight



Dense/loose



Sparse/tight



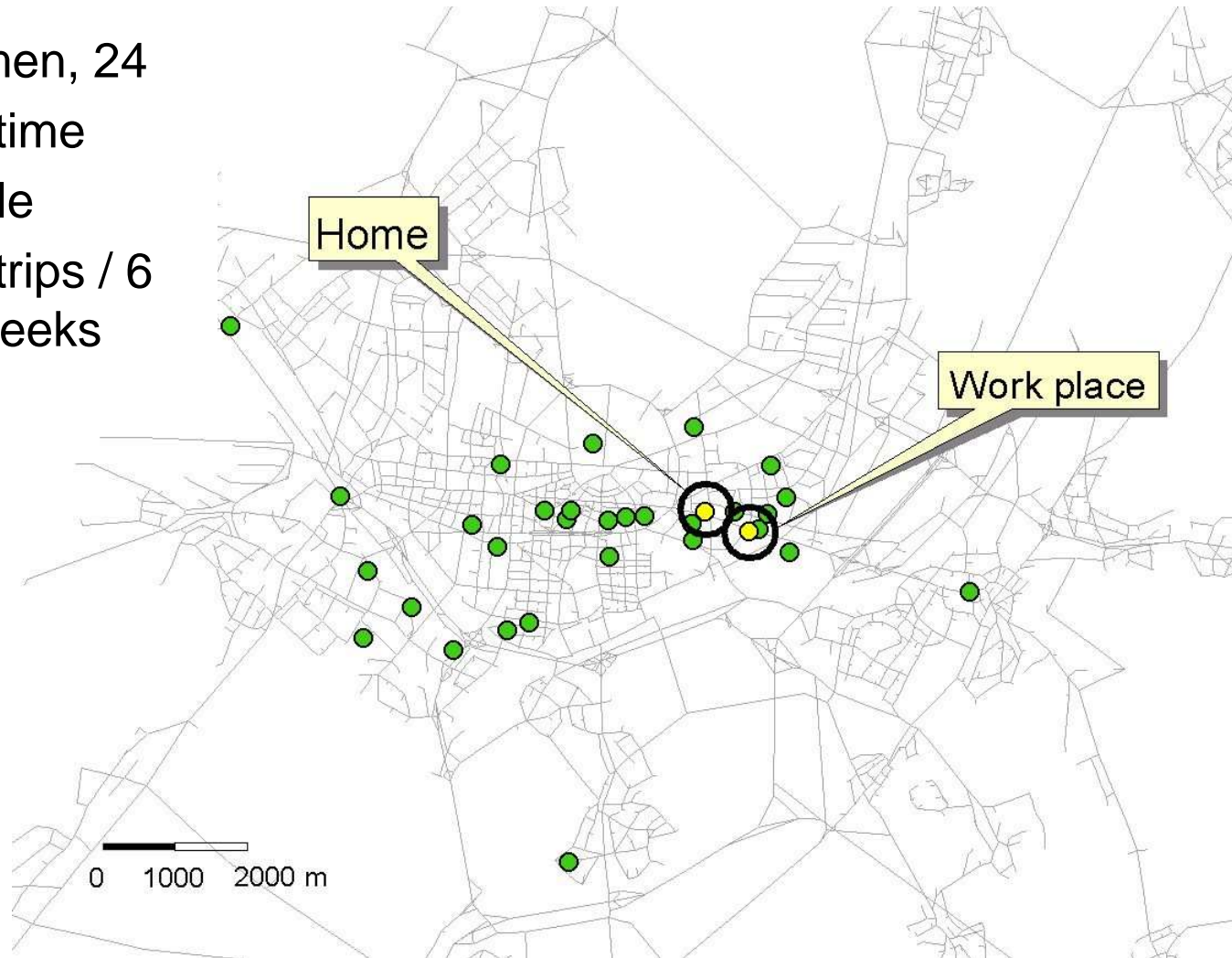
Sparse/loose



# Example of an activity location distribution (1)

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Women, 24  
Full-time  
Single  
216 trips / 6  
weeks



## Example of an activity location distribution (2)

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Man, 50

Full-time

1 child

120 trips / 6  
weeks



# How to measure the activity space

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## Parametric:

- 95% confidence ellipse

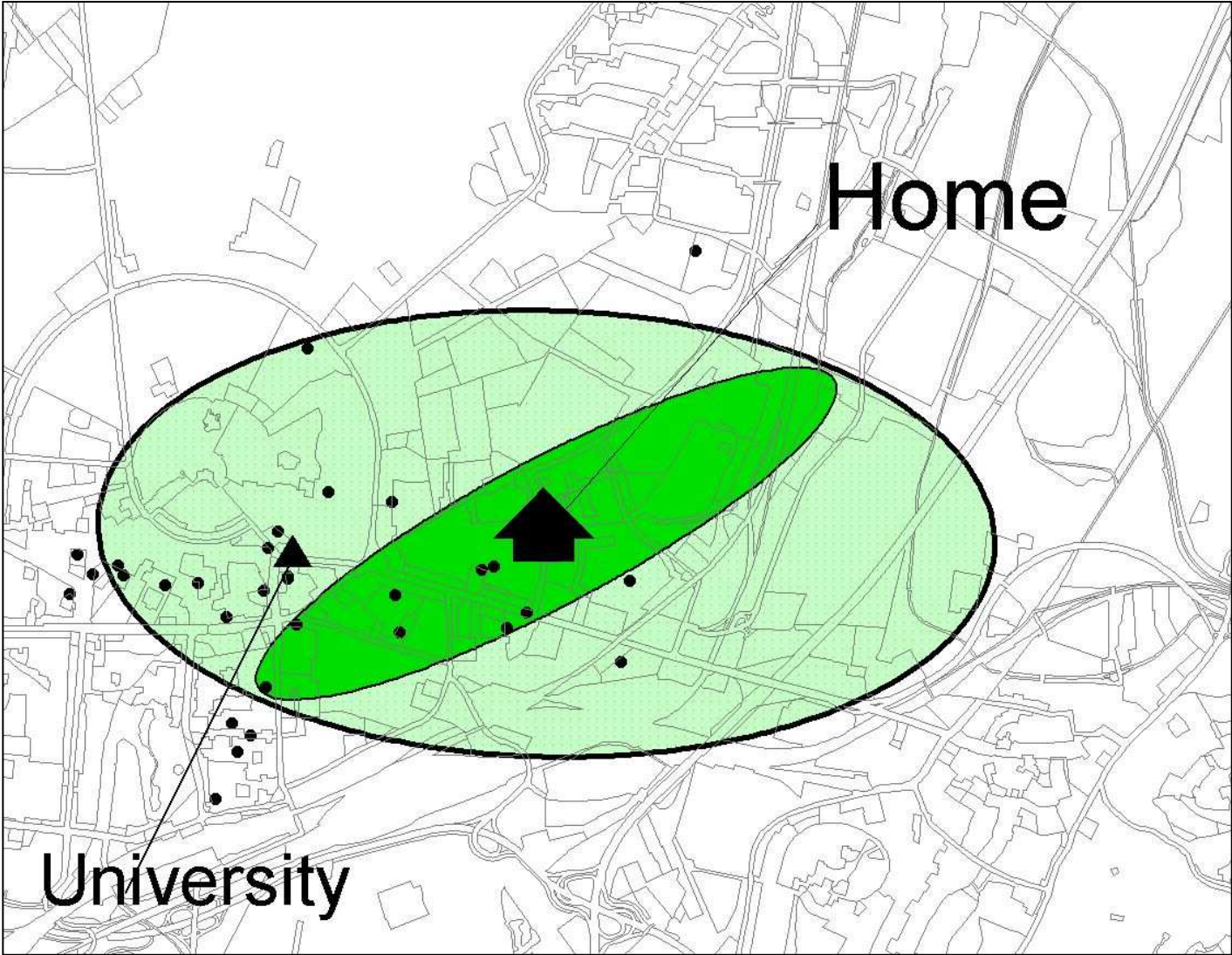
## Semiparametric:

- Kernel density estimator
- Inclusion geometries
- Shortest path networks

## Non-parametric

- Observed path geometries

# Measurement approaches: Confidence ellipse





# Measurement approaches: Kernel densities

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# Measurement approaches: Inclusion geometries

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Find:

$$\min A_i(\beta_{i1} \dots \beta_{in})$$

s.t.

Area  $A_i$  covering  $p\%$  of all observed points

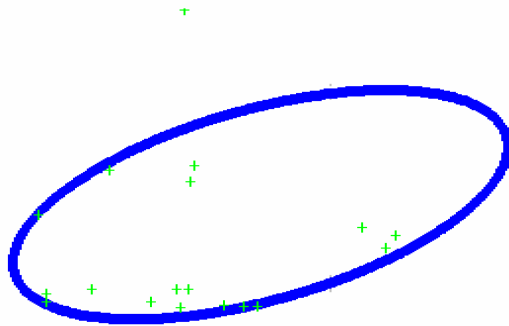
with:

- $i$  : Type of geometry (Ellipse, bean, Cassini ...)
- $p$  : Predetermined share, e.g. 95%

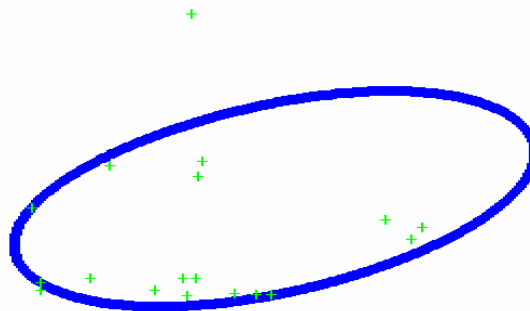
# Measurement approaches: Inclusion geometries

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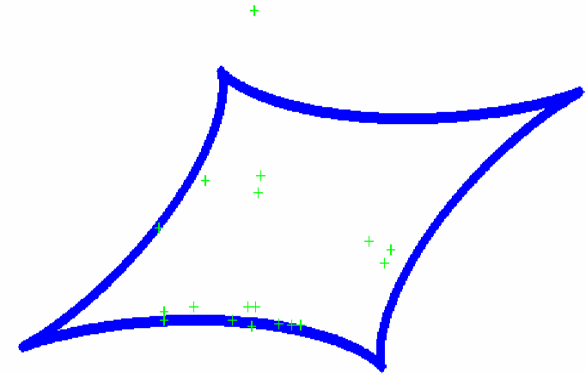
Ellipse



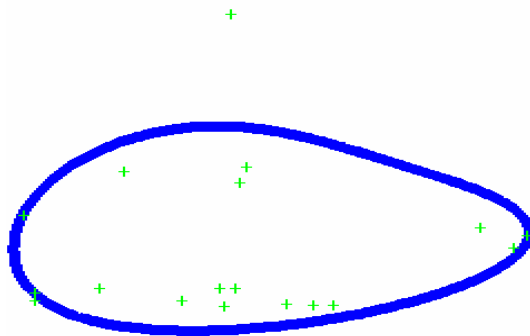
Superellipse 1



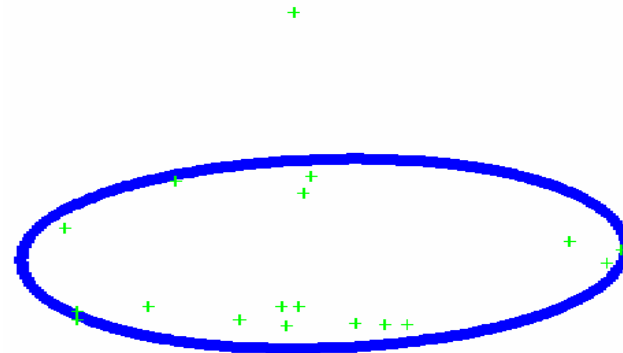
Superellipse 2



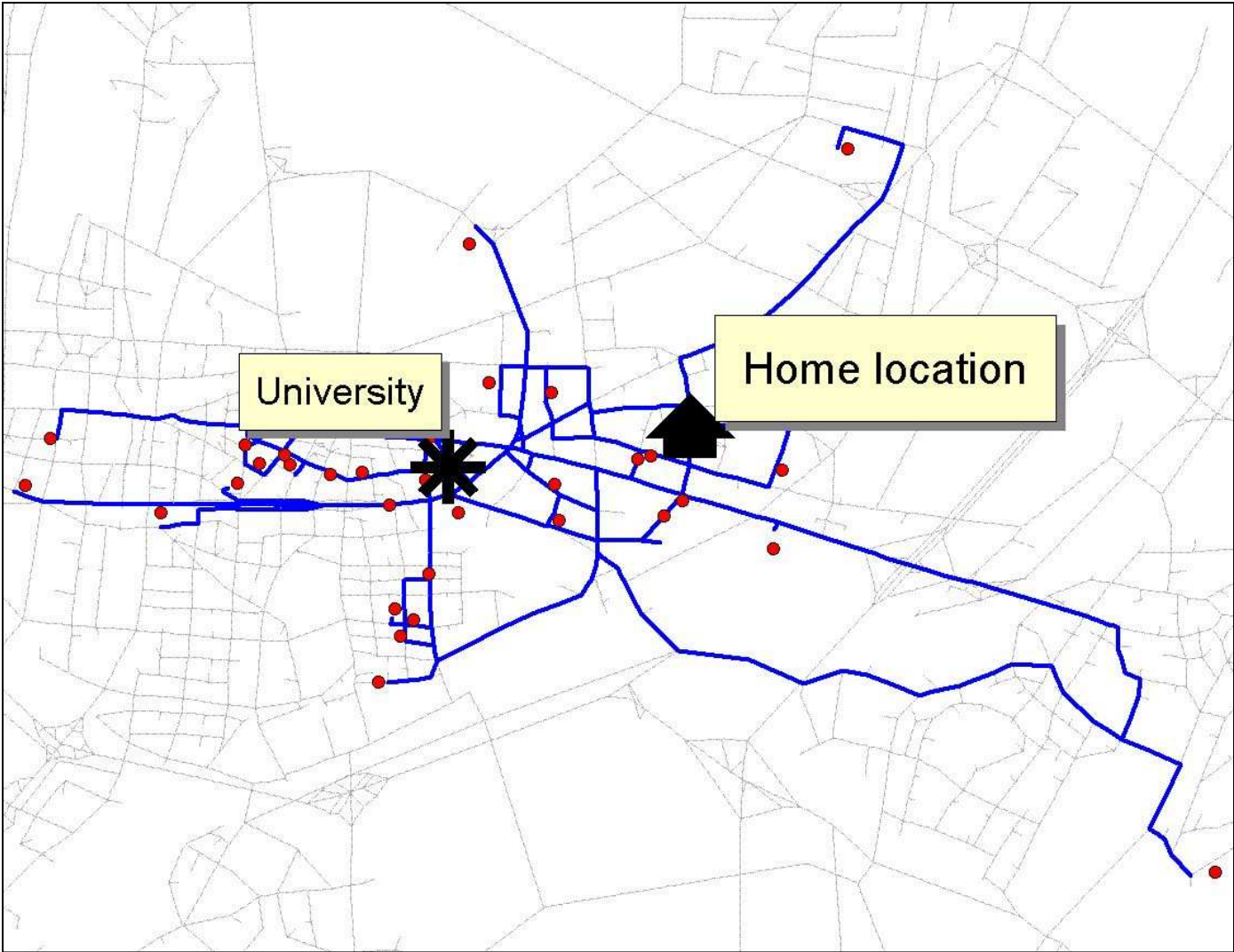
Bean



Cassini



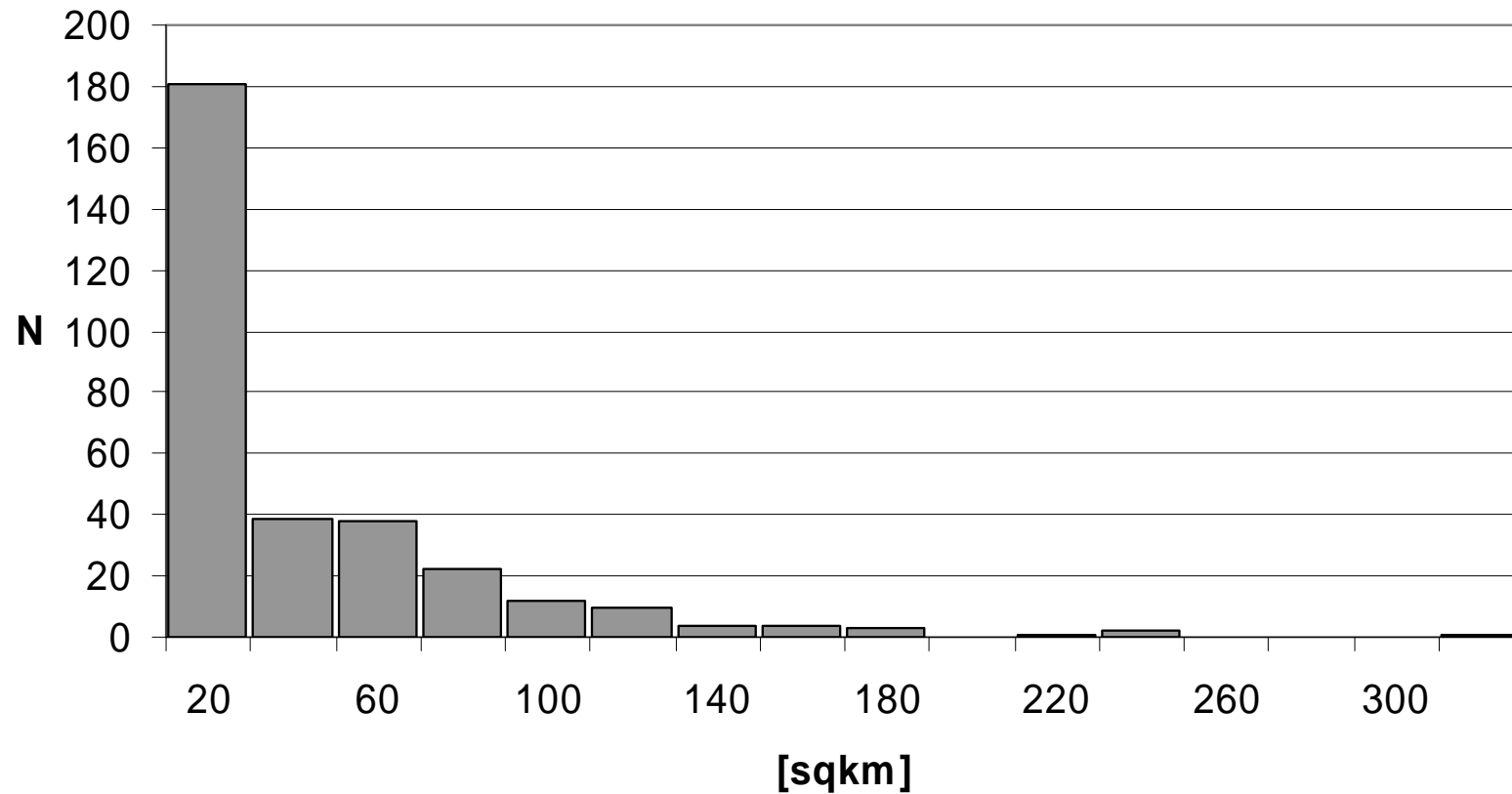
# Measurement approaches: Shortest path network





# Activity space size variation: 95% CE\* (Mobidrive)

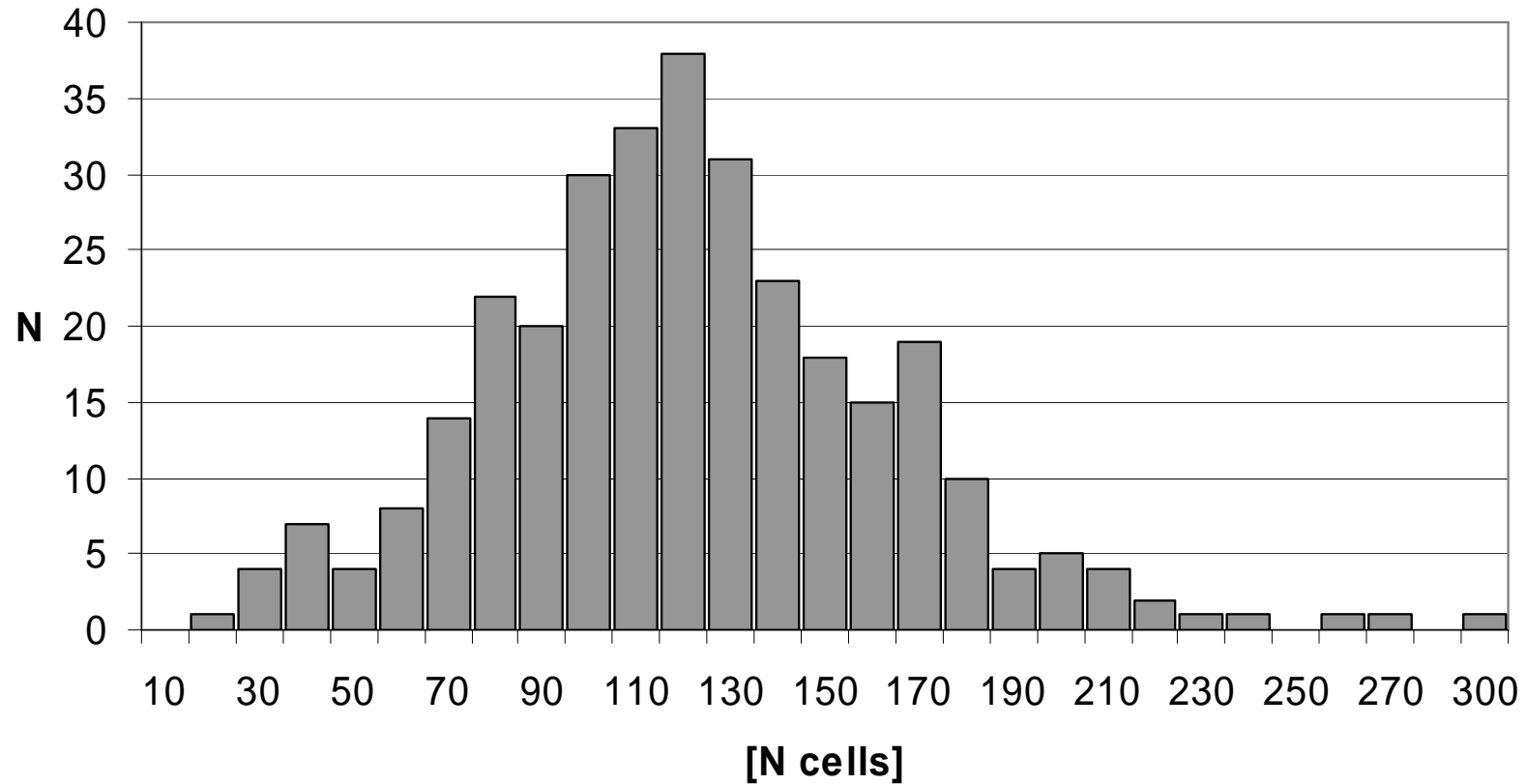
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\* Local trips only

# Activity space size variation: Kernel densities\* (Mobidrive)

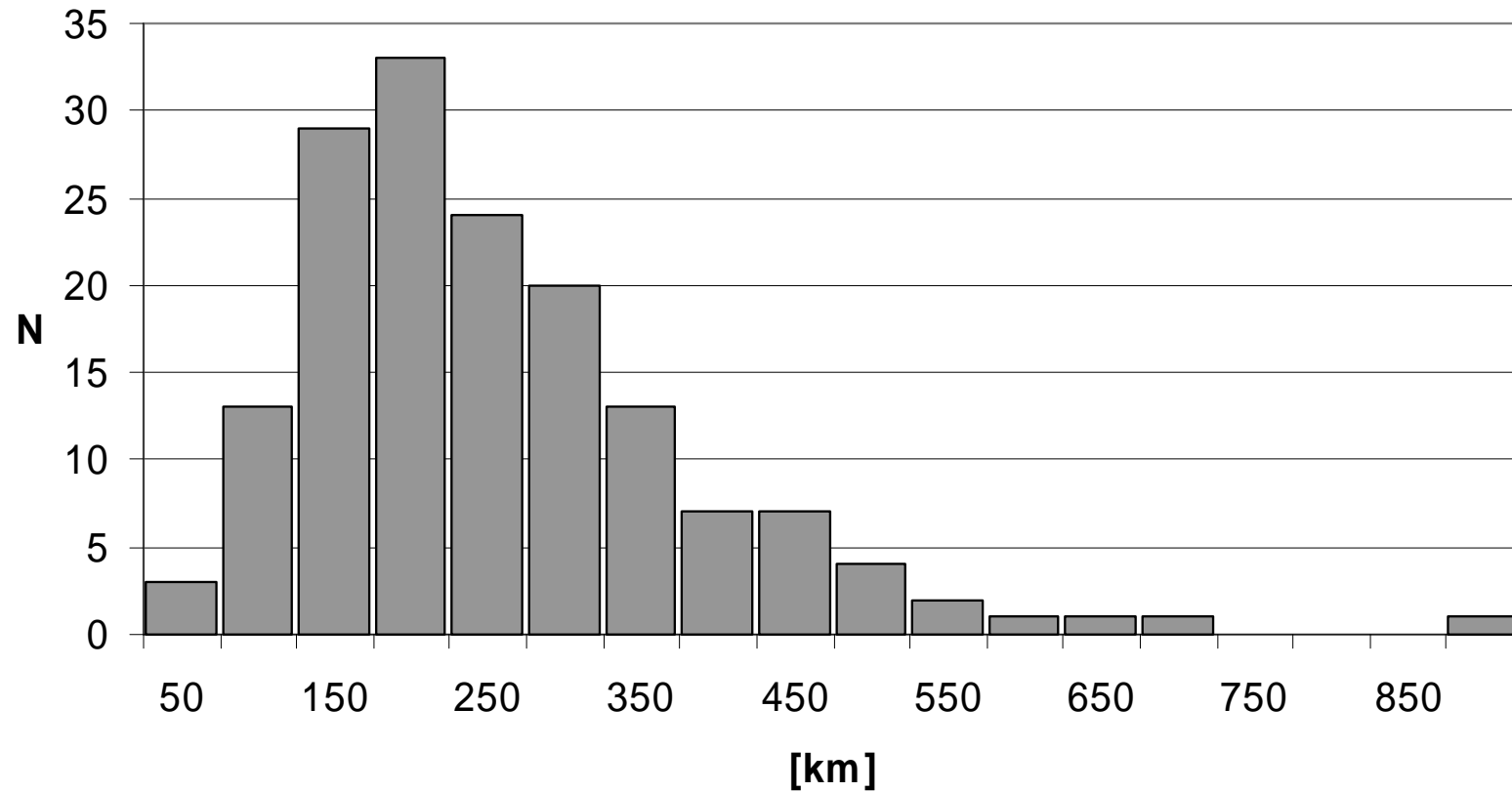
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\* "Visited area", grid cells with positive Kernel densities value [500\*500m]

# Activity space size variation: Shortest path network

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\* Observed O-D-relations, Mobidrive, Karlsruhe subsample

## Survey development: Objects of interest (cross section)

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- Name, type and membership of the networks (groups)
- Name and type of the contacts (strength of the link)
  
- Home location of the contacts
- Places, dates and duration of meetings with the networks (or subsets)
  - Role, cost and cost allocation of the meeting
  - Cost, cost allocation and duration of associated trip
  
- Channel, dates, size of other interactions with the contacts
  - Cost of interaction and its allocation
  - Location of the persons during the interaction

## Survey development: Objects of interest (panel/retrospective)

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- Mobility biography:
  - Home locations
  - Work/school locations
  - Mobility tools (car, season tickets, cycles, licences)
  - Income
  - Household structure
- All of the cross-sectional items across time

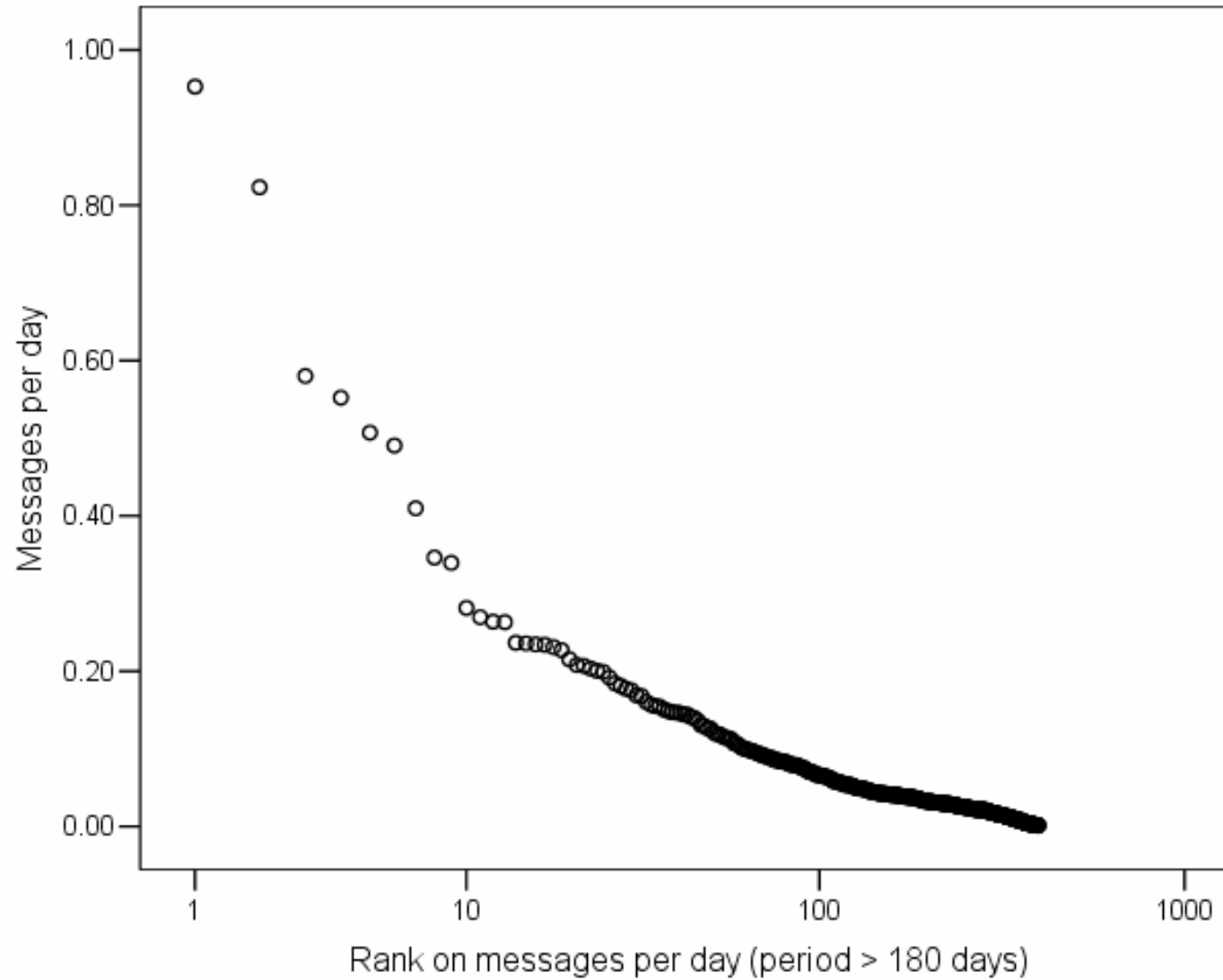
# Survey development: Sources

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- Memory:
  - Interviews
  - Paper/web-based self-administered questionnaires
- Records:
  - Diaries and agendas
  - Personal phone books/email lists
  - Email and letters (collections)
  - Phone bills / Income tax returns / credit card bills
  - Photo albums / personal web pages
  - Minutes and yearbooks
  - Databases, such as [www.google.scholar.com](http://www.google.scholar.com)
- [Observation]

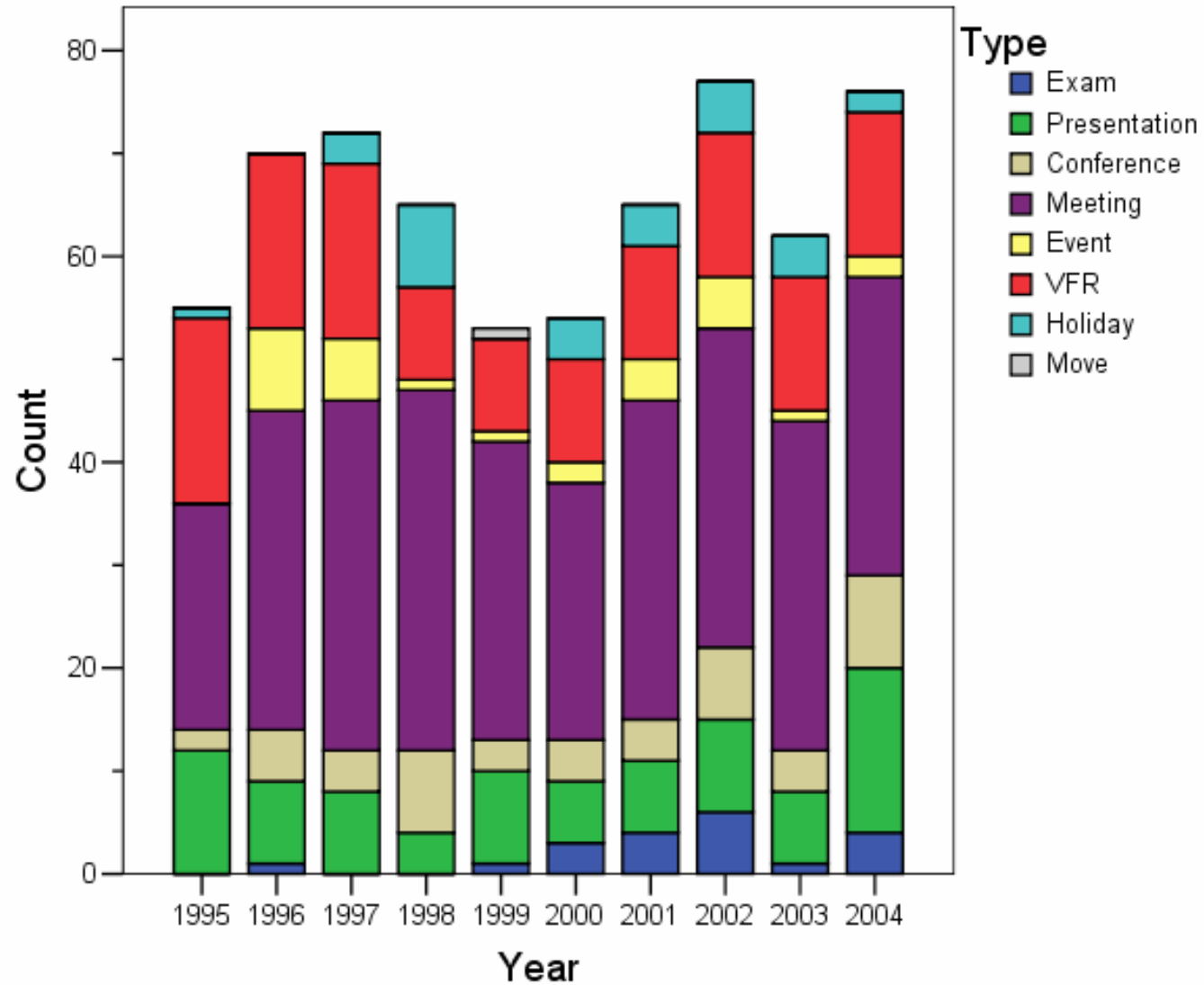
## Example: Contact frequency – emails to kwa (Outlook)

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## Example: long-distance travel (kwa) (agenda/tax returns)

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# Survey development: Current possibilities

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In the short term:

- Mixture of qualitative and quantitative analyses
- Face-to-face structured interviews (supplemented by written questionnaires)
- Quota-based samples

In the medium term:

- Paper-based questionnaires with personal interaction
- Representative samples

# Survey development: Future possibilities

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## Longer-term diaries:

- Social content of activities
- Including name generators
- Including a life-course element

## Traces of 3. Generation and other communication services:

- Automated screening of electronic records
- „Buddy“-services
- Merger with geocoding (GSM or GPS)

## Current work

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(BMW) ifmo:

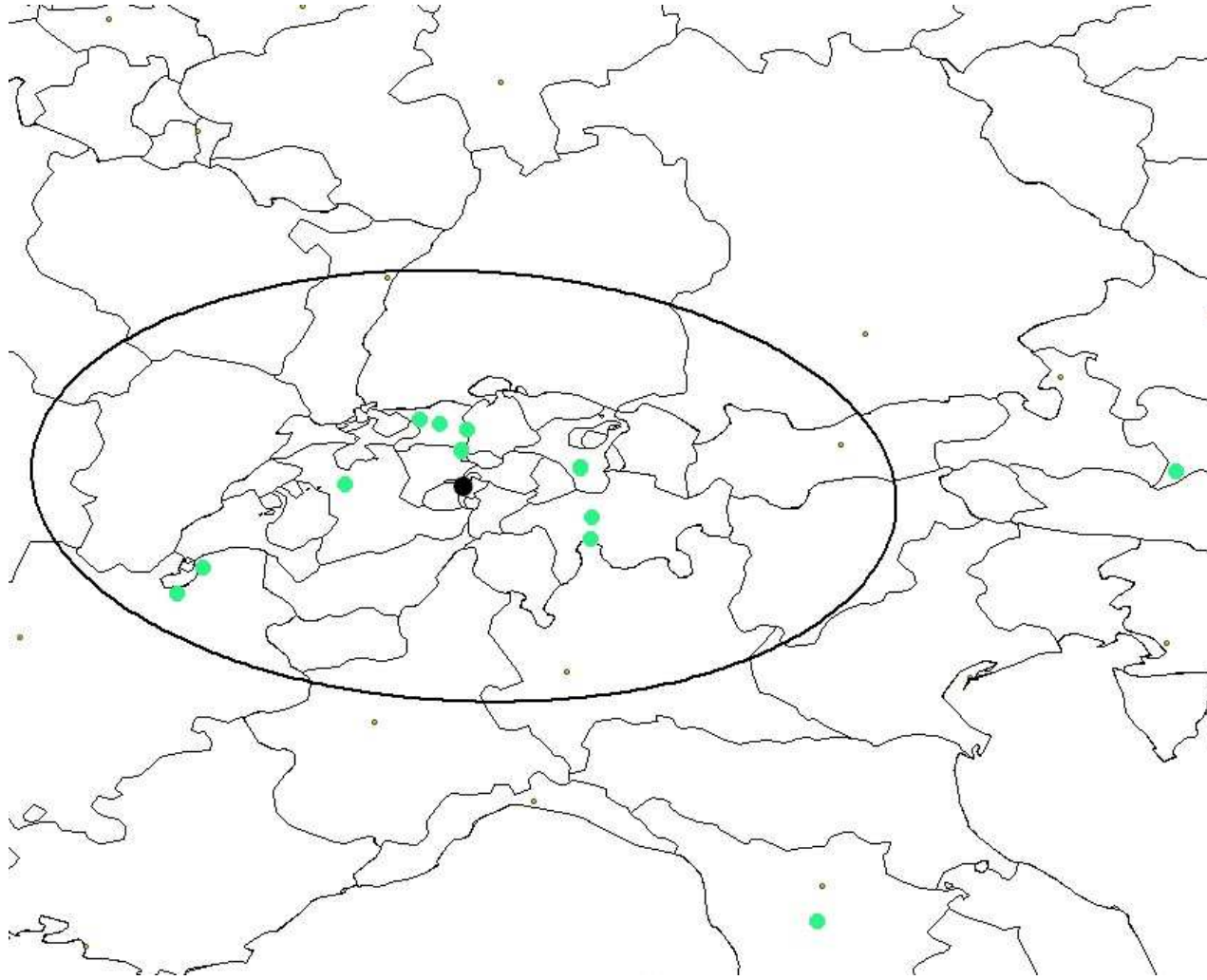
- 30 interviewees in Berlin and Zürich
- Quota-guided recruitment
- 2.5h duration
- £ 50 incentive

Dft Horizons (with Urry and Larsen, Lancaster):

- 24 interviewees drawn from three growing industries in the North-West of England
- 2h duration plus written elements
- £ 50 incentive

# Example of a social network geography

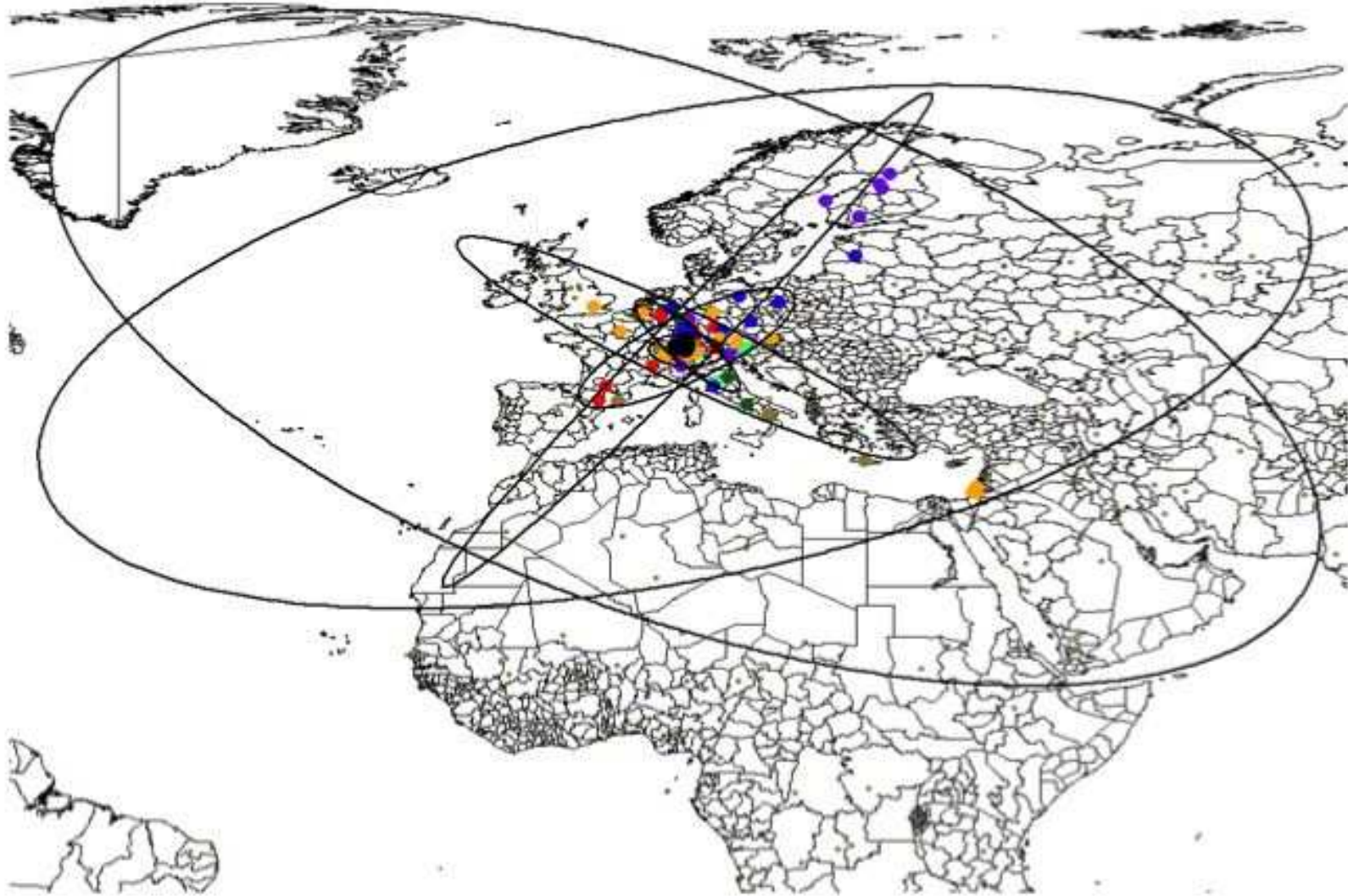
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Female, 28,  
4 moves,

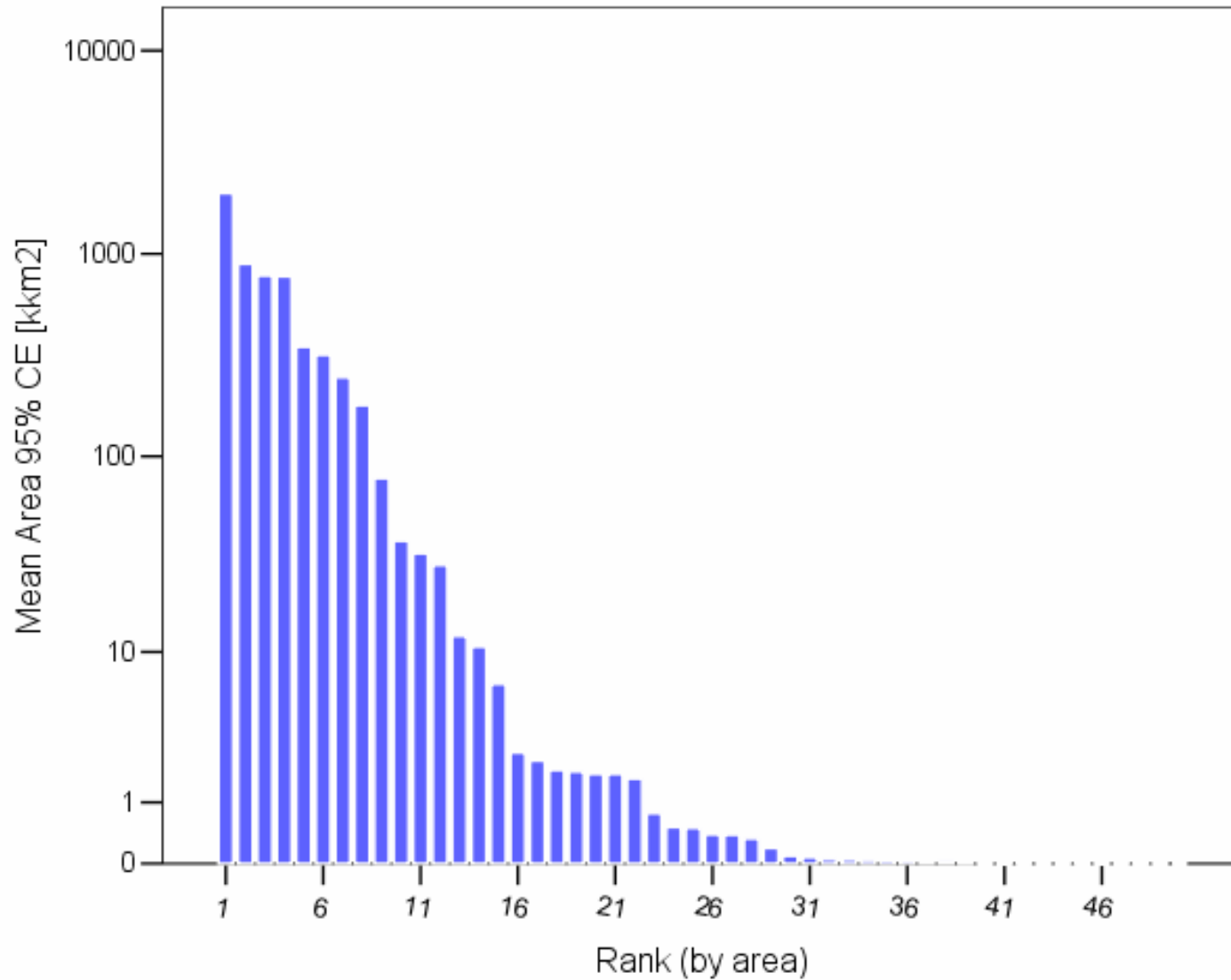
# More examples

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# Distribution of the social network geographies (95% CE)

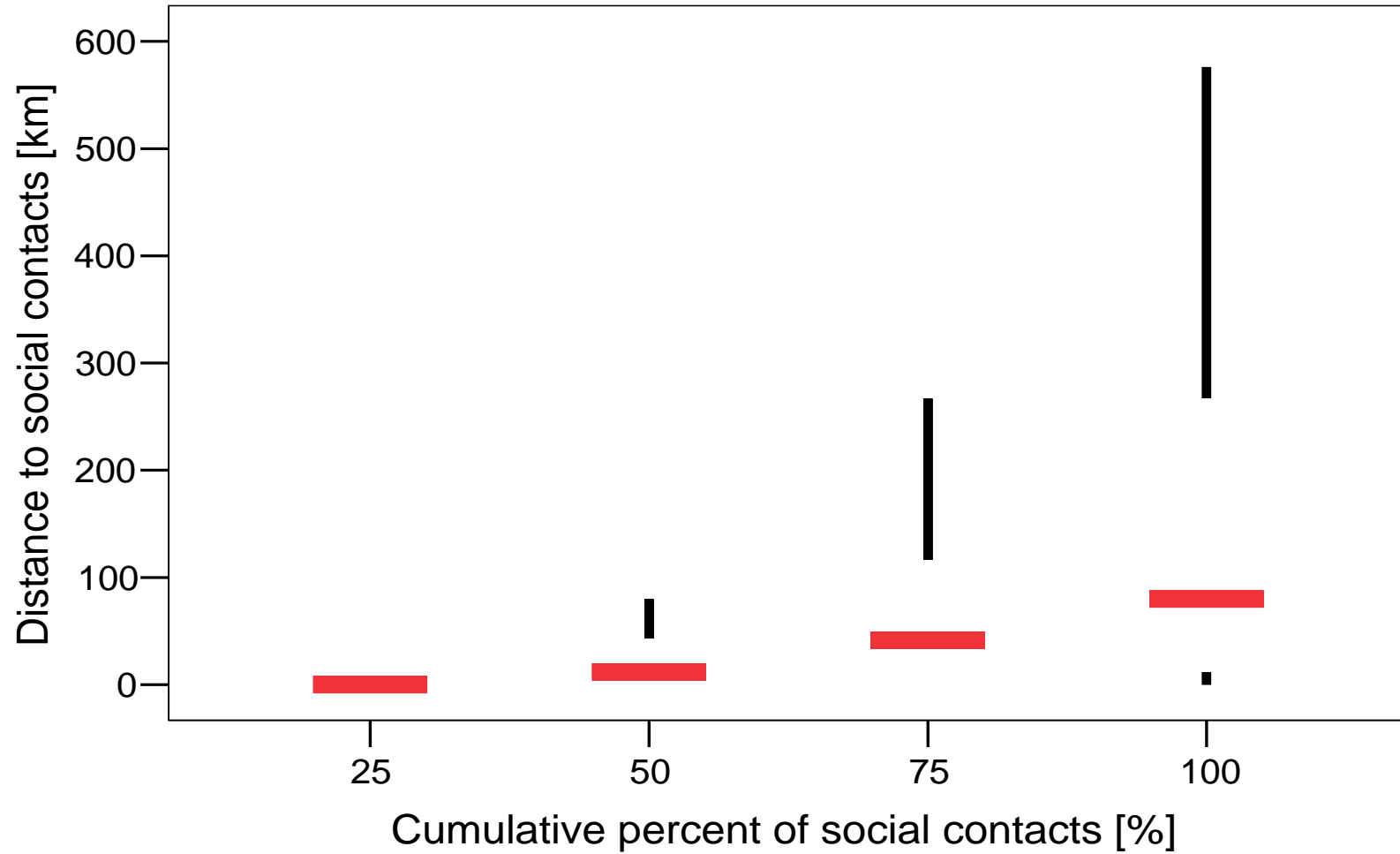
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Both  
samples

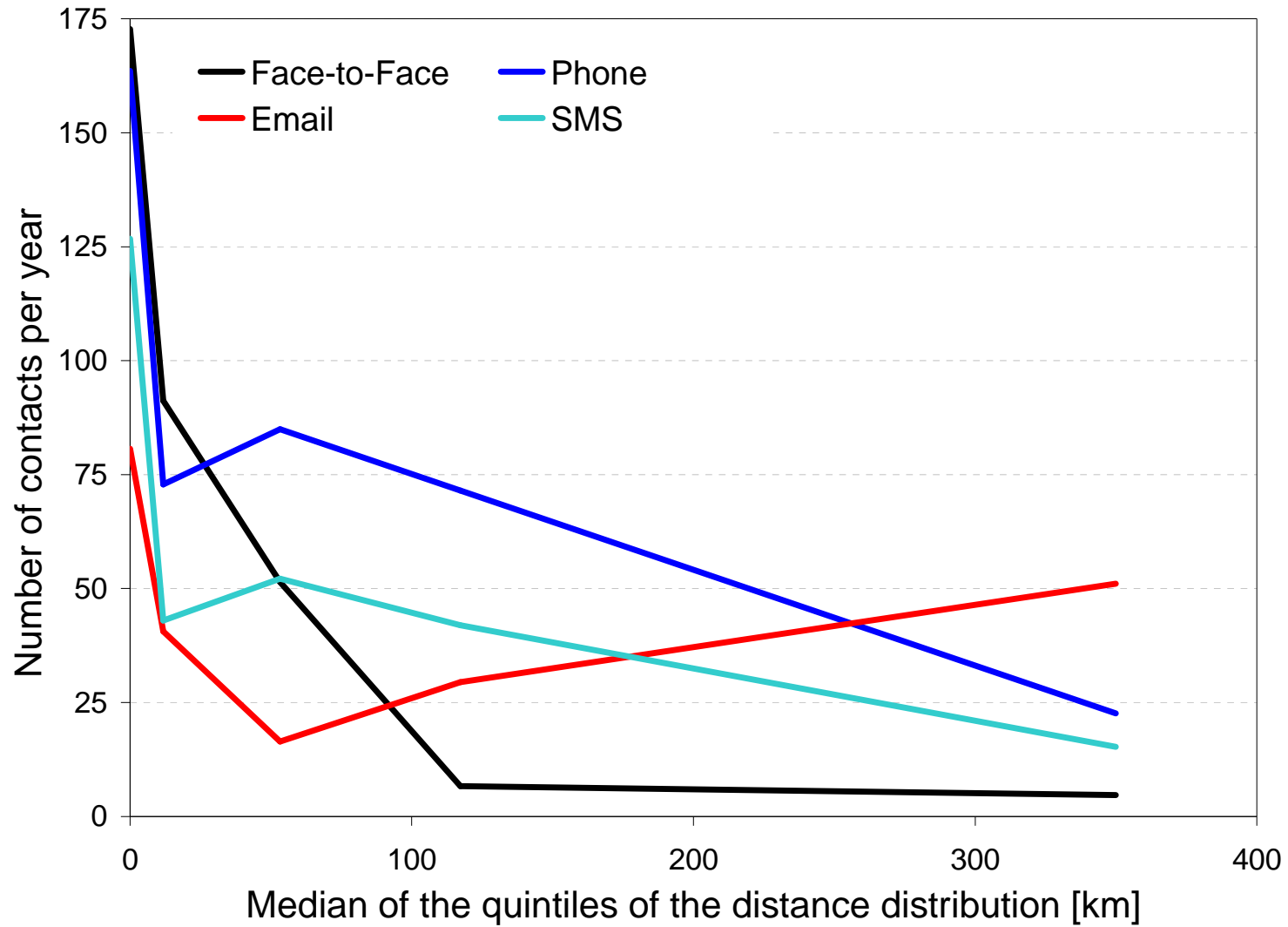
# Distribution of the interpersonal distances (Horizon)

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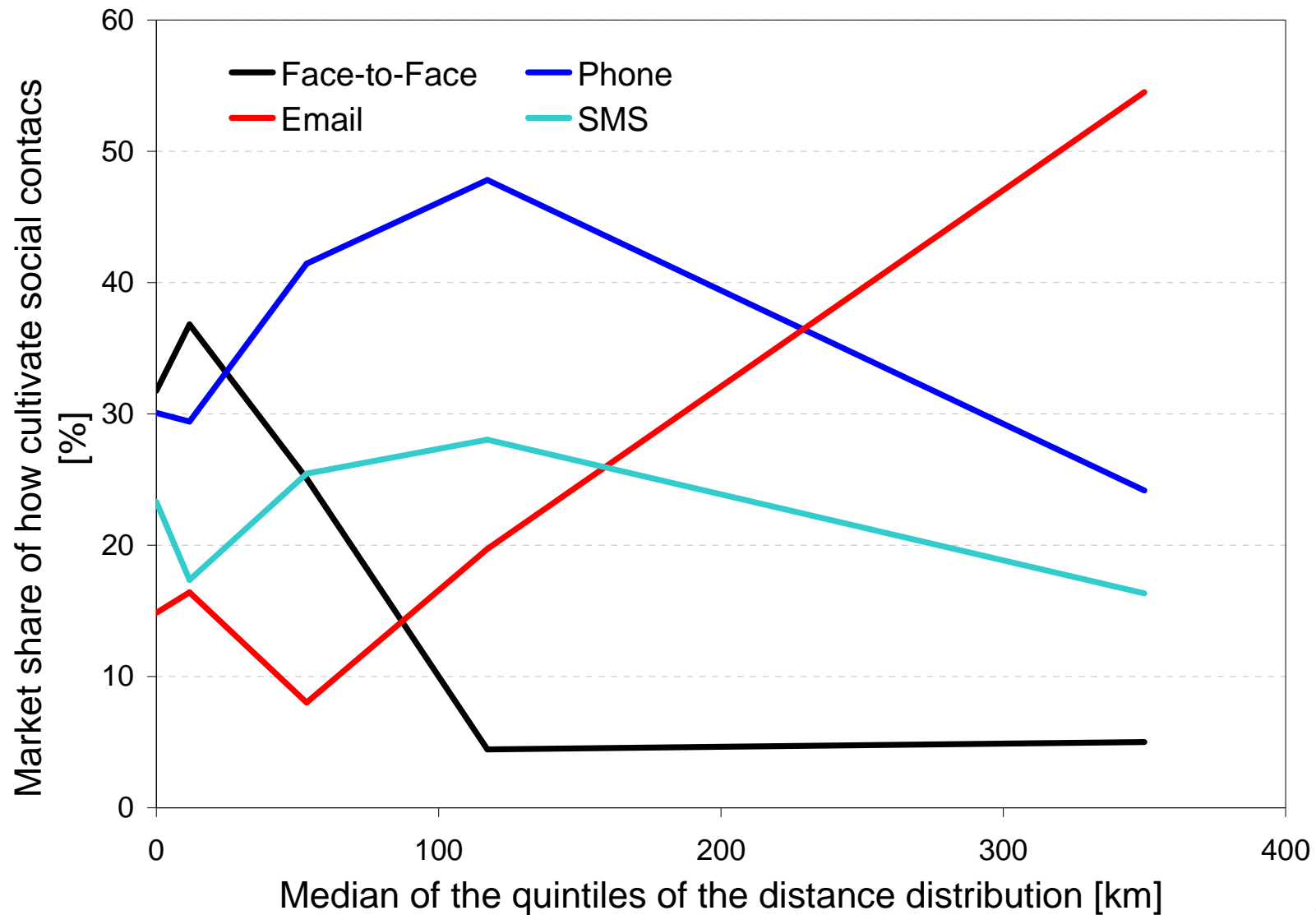
# Channels of communication by distance (Horizon)

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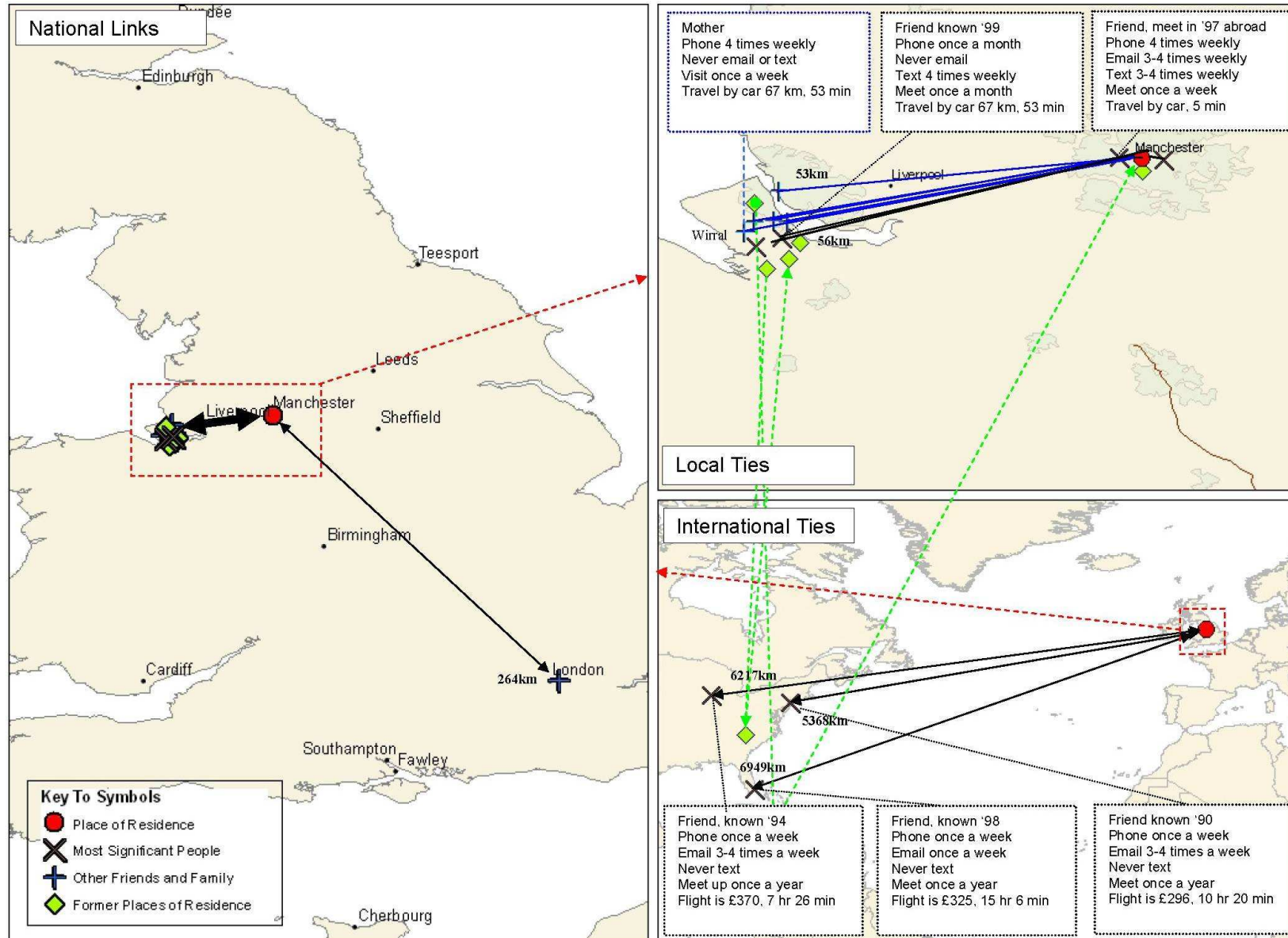




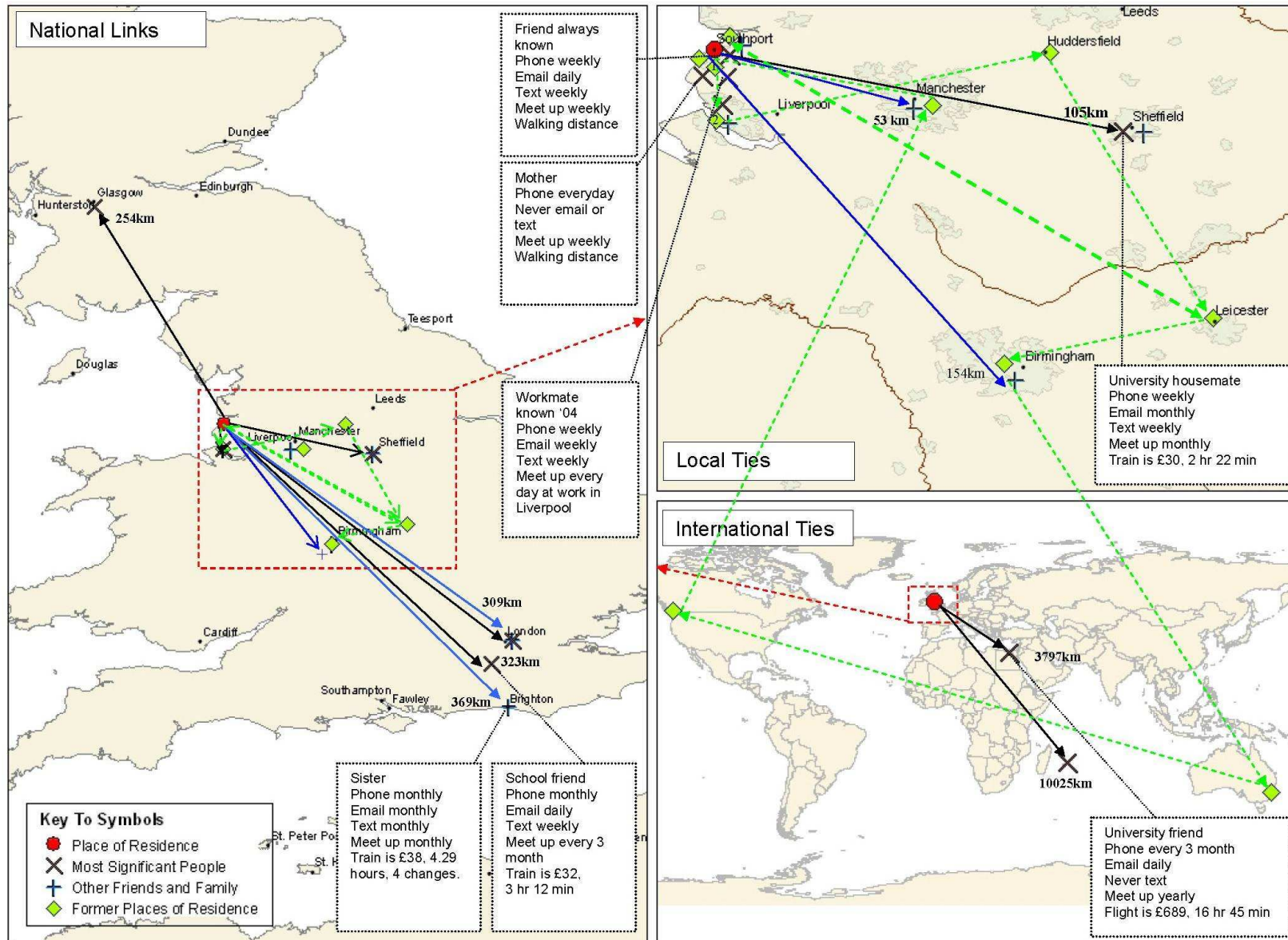
# Channels of communication by distance (Horizon)



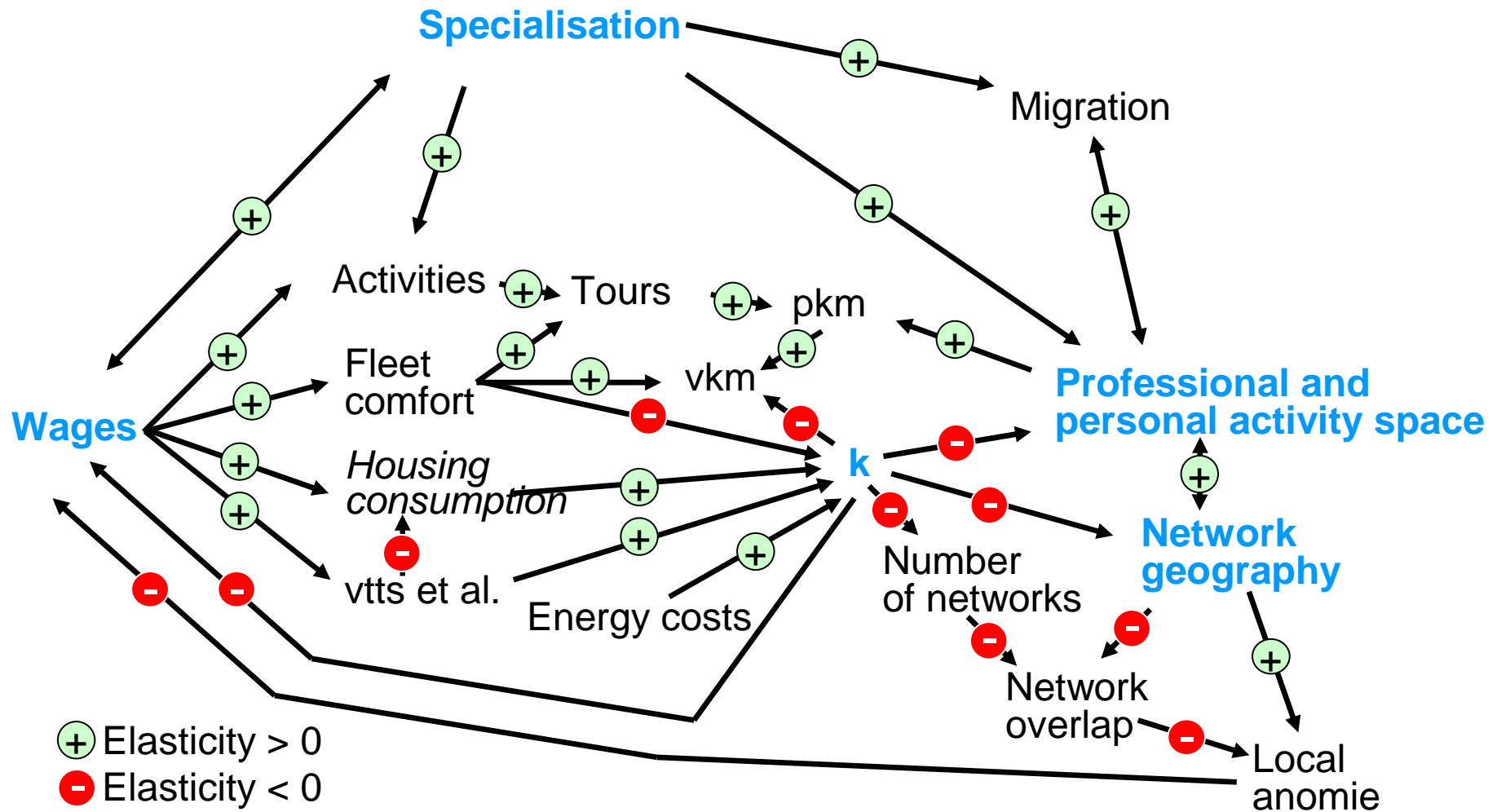
# Biography of a female personal trainer, mid-30ies



# Biography of a male architect, early-30ies

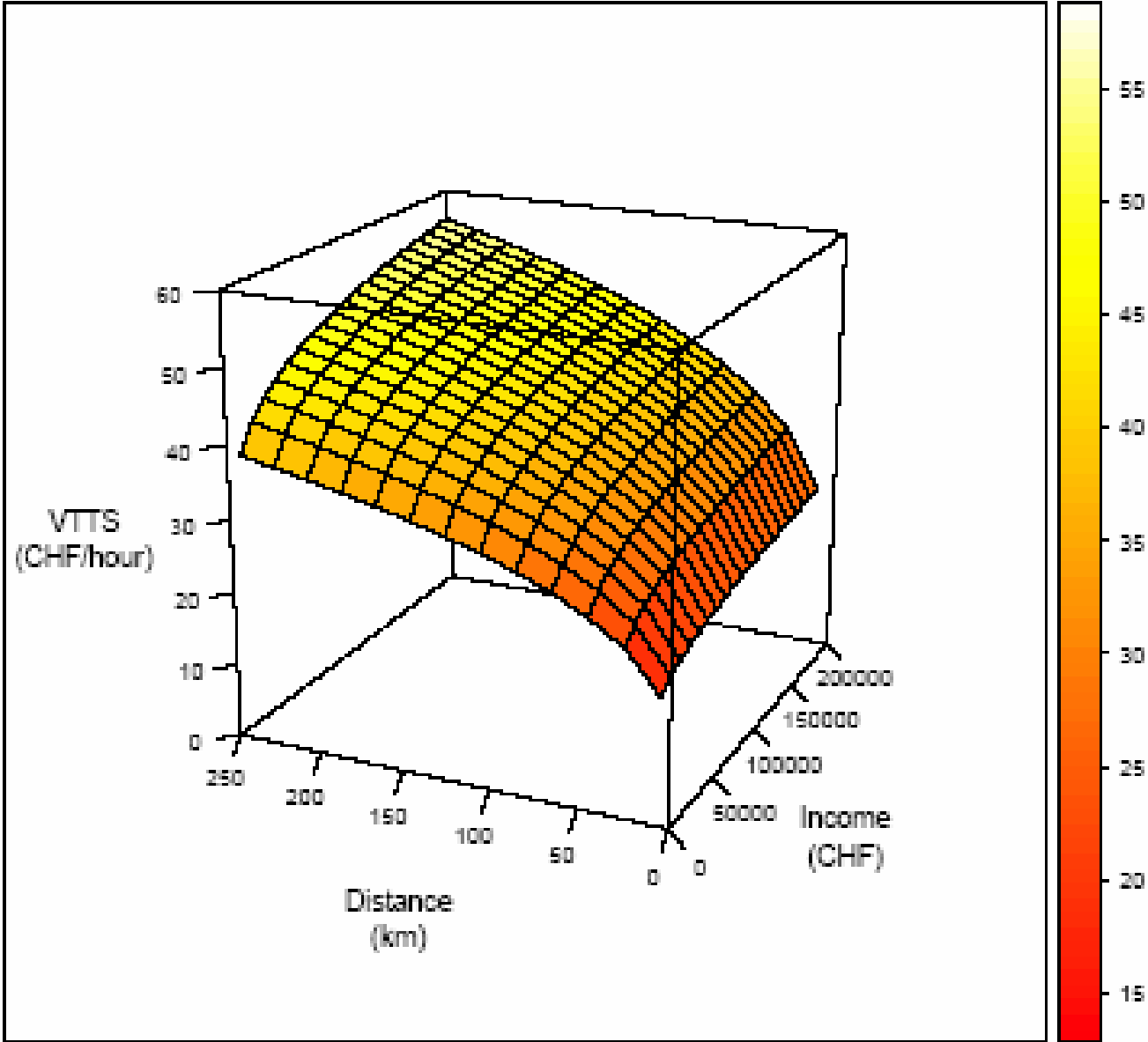


# Activity spaces and network geographies: A hypothesis



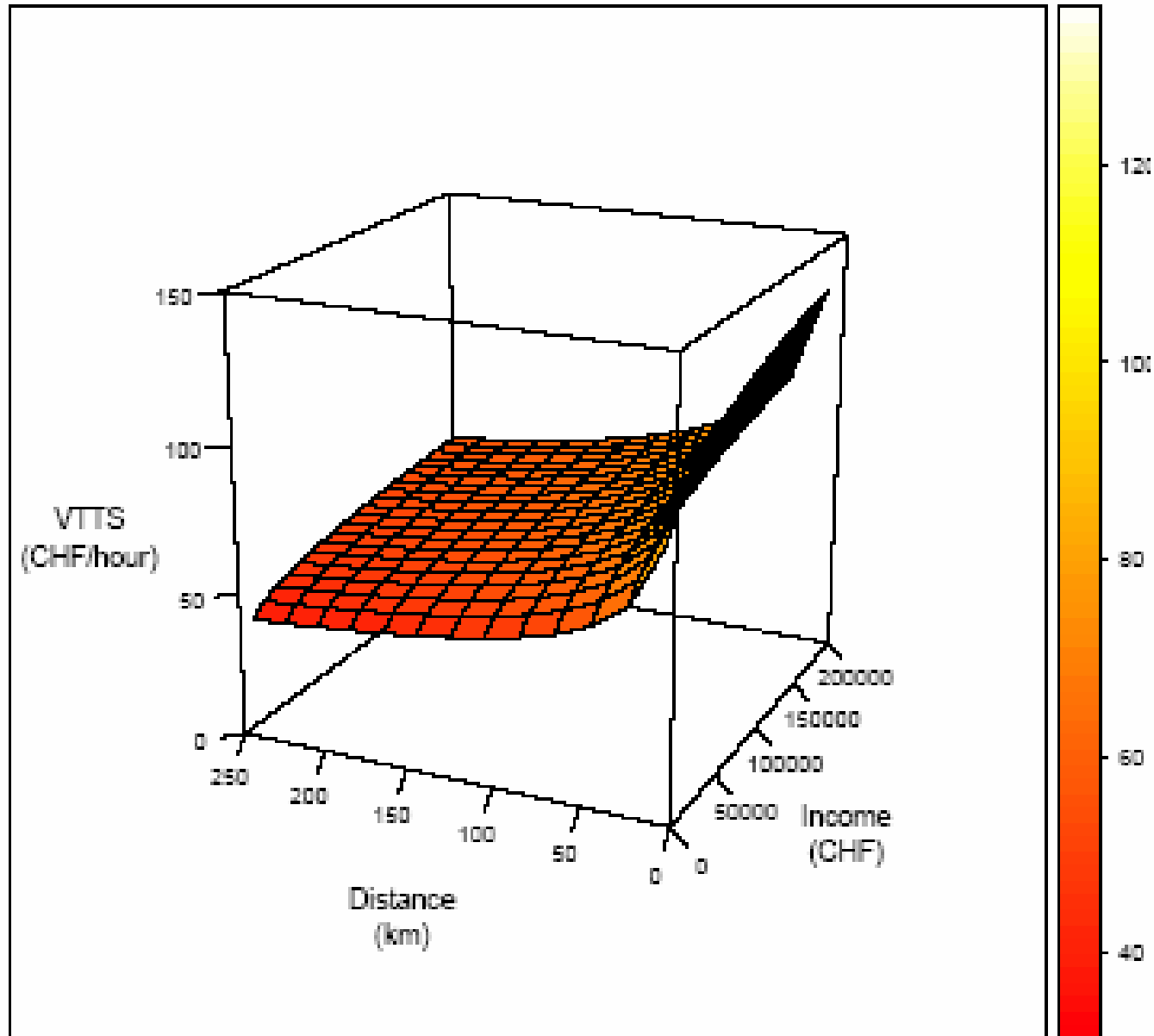
# Willingness to pay for reduction of free-flow travel time

Axhausen, Hess, König, Bierlaire, Bates and Abay, 2006

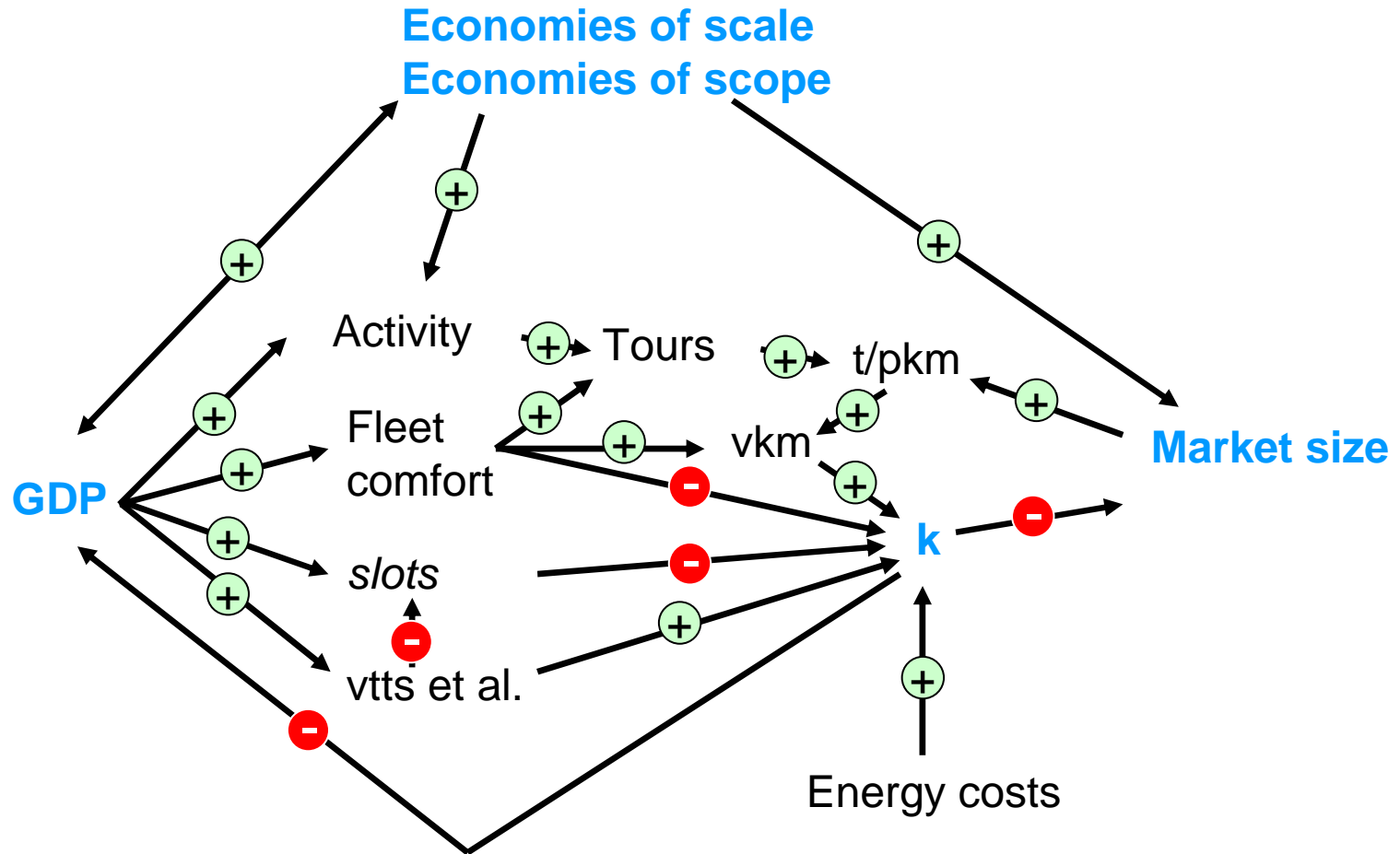


# Willingness to pay for reduction of congested travel time

Axhausen, Hess, König, Bierlaire, Bates and Abay, 2006



# Size of goods markets and productivity: A hypothesis



⊕ Elasticity > 0

⊖ Elasticity < 0

Slots: possibilities to move goods or people  
 For a given infrastructure and commercial  
 and private fleet

## What remains, needs to be done ?

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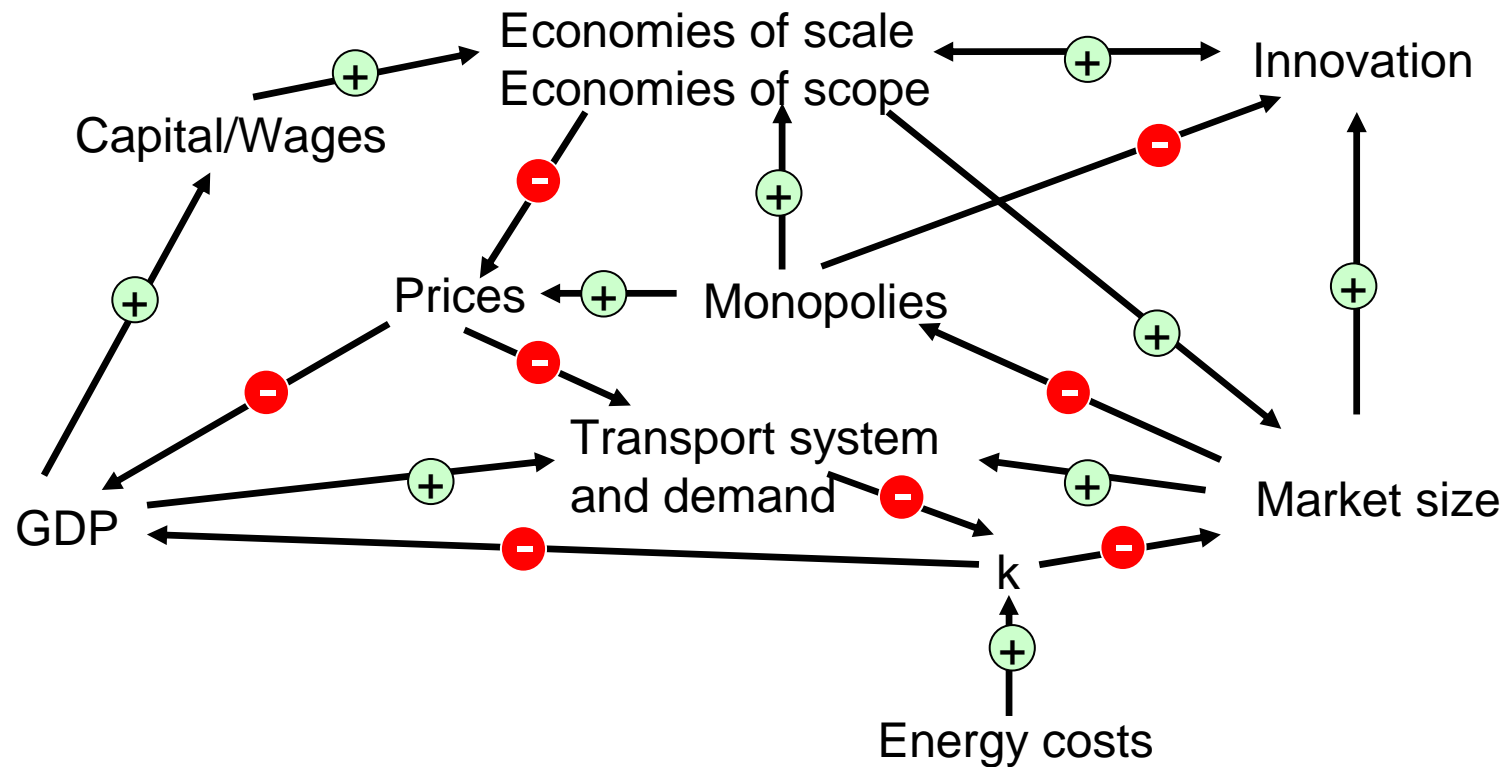
- Prove the mechanisms stipulated
- Provide the data on a representative scale
- Develop stable survey methods
- Think through the policy implications



# Appendix

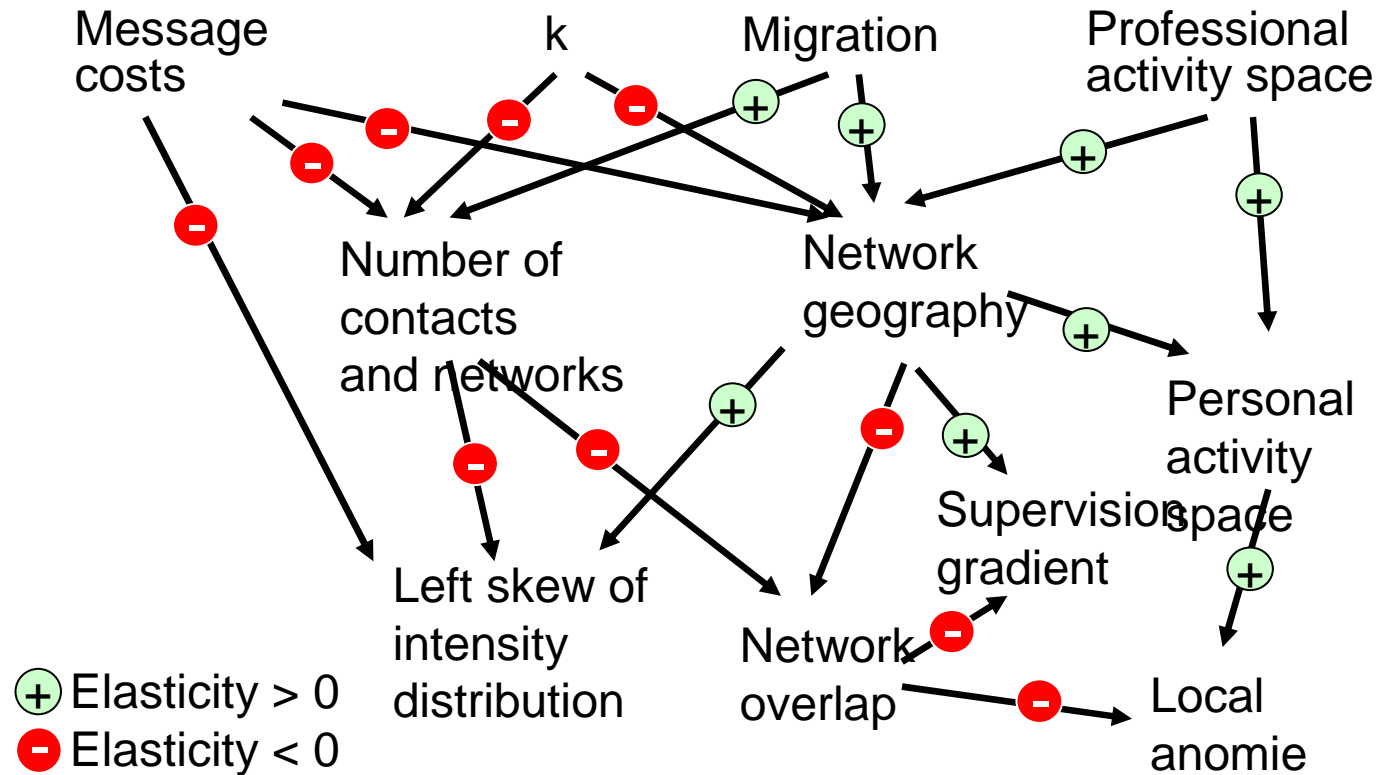
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# Size of goods markets and productivity: A hypothesis



(+) Elastizität > 0    k: Generalisierte  
 (-) Elastizität < 0    Kosten

# Generalised costs of contact and social networks



# Literatur

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- Axhausen, K.W. (2000) Geographies of somewhere: A review of urban literature, *Urban Studies*, 37 (10) 1849-1864.
- Axhausen, K.W. (2005) Activity spaces, biographies, social networks and their welfare gains and externalities: Some hypothesis and empirical results, PROCESSUS Colloquium, Toronto, June 2005.
- Axhausen, K.W., S. Beige und M. Bernard (2004) Perspektiven des Schweizerischen Verkehrs bis 2030: Module M04 und M05 Besitz von Mobilitätswerkzeugen – Fahrleistungen/Betriebsleistungen und Verkehrsleistungen, Bericht an das ARE, IVT, ETH Zürich, Zürich.
- Axhausen, K.W. und P. Fröhlich (2004) Public investment and accessibility change, in P. Marti und A. Müller (Hrsg.) Festschrift Schalcher, vdf, Zürich.
- Botte, M. (2003) Strukturen des Pendelns in der Schweiz, Diplomarbeit, Fakultät für Bauingenieurwesen, TU Dresden, August 2003.
- Carosio, A., C. Dolci and M. Scherer (2005) Erreichbarkeitsveränderungen in der Schweiz: Eine kartographische Darstellung, in K.W. Axhausen and L. Hurni (eds.) Zeitkarten Schweiz 1950-2000, Chapter 3, IVT and IKA, ETH Zürich, Zürich.
- FCC (2001) Long distance telecommunication industry, FCC, Washington, D.C.

# Literatur

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- Frei, A. (2005) Was hätte man 1960 für einen Sharan bezahlt?, MSc thesis, IVT, ETH Zürich, Zürich.
- Putnam, R.D. (1999) *Bowling Alone: The collapse and revival of American community*, Schuster and Schuster, New York.
- Rhode, P.W. und K.S. Strumpf (2003) Assessing the importance of Tiebout sorting: Local heterogeneity from 1850 to 1990, *American Economic Review*, 93 (5) 1648-1677.
- Schönfelder, S. and K.W. Axhausen (2004) Structure and innovation of human activity spaces, *Arbeitsberichte Verkehrs- und Raumplanung*, 258, IVT, ETH Zürich, Zürich.
- Schönfelder S. and Axhausen K. W. (2003) Activity spaces: Measures of social exclusion? *Transportation Policy*, 10 (4) 273-286.
- Vaze V.S., S. Schönfelder and K.W. Axhausen (2005) Optimization of continuous space representation for human activity spaces, *Arbeitsbericht Verkehrs- und Raumplanung*, 295, Institut für Verkehrsplanung and Transportsysteme (IVT), ETH Zürich, Zürich