Preferred citation style

Social networks and travel: Frequencies, modes and distances

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

Scherer, 2004
Trends: Swiss Suburbanisation since 1970

Adapted from Botte, 2003
Research questions about „social networks“

• How many persons belong to them?

• How disperse are the locations of the contacts of a person or firm?

• How quickly has the dispersion changed?

• How quickly will it change in the future?

• How and how often are people in contact?
Methodological questions

• How can we measure this dispersion?

• Do the measure relate to other concepts of interest?

• How can we explain the observed patterns?
Concepts

Activity space
Mental map

Activity repertoire

Personal world

Biography

Projects

Household locations
Social network geography
Mobility tools

Learning
What are the challenges?

Personal world and social network geography:

- Measurement
- Measures

Mobility biographies:

- Retrieval and reconstruction
- Measures
Biography of a male architect, early-30ies
Measurement

Personal world as „mental map“ and „activity repertoire“:

- Sketching
- Think aloud protocols
- Spatial tasks

Personal worlds as „activity space“ of visited locations:

- Diaries
- GPS/GSM tracing
- Data traces (payments of all kinds, CCTV, phone and pc use)
Measurement

Social network geographies:

• Name generators

• Traces of contacts (email, SMS, IM, internet chat, letters, phone records, etc.)

• Diary – based prompting
Contacts and contact frequency – emails to kwa (Outlook)
Administrative data: Weekly meeting of service clubs
Example of a social network geography

Female, 28, 4 moves,
Measures

Requirements:

• Low dimensional (scalar)

• Describe size, orientation and spread

• Consistency with behavioural possibilities (theoretical intent)

• Ease of calculation
How to measure?

Parametric:
- 95% confidence ellipse (form and type of distribution)

Semiparametric:
- Inclusion geometries (form of geometry)
- (Weighted) shortest path networks (structure of path)
- (Percentage) Minimum convex polygons (convexity)
- Kernel density estimator (form of estimator)
- Mean harmonic home ranges (form of estimator)

Non-parametric
- Observed path geometries
Measures: Confidence ellipse

Regression line

Arithmetic mean

"Outlier"
Measures: Inclusion geometries

Find:

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

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%
Measures: Inclusion geometries

Rai et al., 2007
Items to capture the social network geographies

• Name generators

• Name interpreters
  • Type and length of contact
  • Frequency by mode of contact
  • Home location
  • Second homes

• Detailed descriptions of face-to-face contacts
Items to characterise the mobility biography

- Home and second home locations
- Work and school locations
- Household composition
- Mobility tools
- Main mode (to work/school)
- (Major holidays)
- Personal income
- Household income
Response burden and response rate

Ex-ante estimate of response burden [Points]

Response rate [%]

- No recruitment, but telephone motivation call
- No recruitment, no telephone motivation call
- Recruited during a prior CAPI interview
### Zürich experiment

<table>
<thead>
<tr>
<th>Phase</th>
<th>Pretest</th>
<th>Main study</th>
<th>Share [%]</th>
<th>Share of telephone contacts [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>150</td>
<td>4'200</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Wrong address</td>
<td>0</td>
<td>56</td>
<td>1.3%</td>
<td></td>
</tr>
<tr>
<td>Not reachable by phone</td>
<td>36</td>
<td>1'486</td>
<td>35.3%</td>
<td></td>
</tr>
<tr>
<td>Telephone contact</td>
<td>113</td>
<td>2'714</td>
<td>64.6%</td>
<td>100%</td>
</tr>
<tr>
<td>Recruited</td>
<td>14</td>
<td>318</td>
<td>7.5%</td>
<td>11.7%</td>
</tr>
<tr>
<td>Face-to-face interviewed</td>
<td>13</td>
<td>305</td>
<td>7.3%</td>
<td>11.2%</td>
</tr>
<tr>
<td>Written form returned</td>
<td>13</td>
<td>294</td>
<td>7.0%</td>
<td>10.8%</td>
</tr>
</tbody>
</table>
Data available

- ifmo:
  - “Persons with whom you had contact”
  - (f-to-f frequency, location, mobility biography)

- DfT:
  - Family, non-local friends, most important persons
  - (location, frequency by mode, mobility biography)

- COST 355 (Zürich):
  - Important people, people with leisure contacts
  - (location, frequency by mode, mobility biography)
Contacts (COST 355 only)
### Poisson regression of the number of social contacts

<table>
<thead>
<tr>
<th>Variable</th>
<th>beta</th>
<th>significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>17.921</td>
<td>.000</td>
</tr>
<tr>
<td>Female</td>
<td>-.359</td>
<td>.024</td>
</tr>
<tr>
<td>Technical college</td>
<td>-2.903</td>
<td>.000</td>
</tr>
<tr>
<td>University</td>
<td>2.523</td>
<td>.000</td>
</tr>
<tr>
<td>Age</td>
<td>-.010</td>
<td>.022</td>
</tr>
<tr>
<td>Age squared/100</td>
<td>.001</td>
<td>.005</td>
</tr>
<tr>
<td>-2L – test statistic</td>
<td>620.9</td>
<td>.000</td>
</tr>
</tbody>
</table>
Share of local contacts among all contacts

The graph shows the distribution of contacts within the same zip code. The x-axis represents the share of contacts within the same zip code, ranging from 0.00 to 0.80. The y-axis represents the percentage, which ranges from 0% to 10%. The histogram indicates that the majority of contacts are within the same zip code, with a peak around 0.40, followed by a decline and another peak at 0.80.
Current patterns: Distance to contacts (COST 355 only)
Distances and contact frequency

![Graph showing distances and contact frequency](image)

- **Type of relationship**
  - Others
  - Friends
  - Family
  - Work mates

**Axes:**
- Y-axis: Mean great circle distance (km)
- X-axis: Frequency of face-to-face meetings

- Scale intervals:
  - Y-axis: 0, 10, 100, 1000, 10000
  - X-axis: -1, 2-3, 4-6, 7-12, 13-24, 25-52, 53-204, 205+
Contact frequency by mode (subsample)
## Regression results

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Asynchronous</th>
<th>Phone</th>
<th>Face to face</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>72.965</td>
<td>36.008</td>
<td>86.358</td>
</tr>
<tr>
<td>Female</td>
<td>3.452</td>
<td>6.254</td>
<td>16.197</td>
</tr>
<tr>
<td>Age</td>
<td>-.960</td>
<td>-.048</td>
<td>-.408</td>
</tr>
<tr>
<td>Age squared/100</td>
<td>.046</td>
<td>.001</td>
<td>.019</td>
</tr>
<tr>
<td>N.A. (education)</td>
<td>24.760</td>
<td>11.524</td>
<td>13.322</td>
</tr>
<tr>
<td>Compulsory education</td>
<td>28.878</td>
<td>-7.000</td>
<td>23.267</td>
</tr>
<tr>
<td>Apprenticeship</td>
<td>20.509</td>
<td>-2.343</td>
<td>21.021</td>
</tr>
<tr>
<td>High school diploma</td>
<td>47.046</td>
<td>12.792</td>
<td>37.586</td>
</tr>
<tr>
<td>Technical college</td>
<td>13.005</td>
<td>.989</td>
<td>7.203</td>
</tr>
<tr>
<td>Other type of contact</td>
<td>-25.119</td>
<td>-7.276</td>
<td>-10.352</td>
</tr>
<tr>
<td>Friend</td>
<td>19.537</td>
<td>9.675</td>
<td>-5.366</td>
</tr>
<tr>
<td>Partner</td>
<td>102.554</td>
<td>116.324</td>
<td>170.790</td>
</tr>
<tr>
<td>Family</td>
<td>-17.047</td>
<td>15.959</td>
<td>.854</td>
</tr>
<tr>
<td>No income given</td>
<td>22.176</td>
<td>9.424</td>
<td>-5.389</td>
</tr>
<tr>
<td>Under 2000 sFr/Month</td>
<td>4.700</td>
<td>-5.210</td>
<td>-3.807</td>
</tr>
<tr>
<td>2000-6000 sFr/month</td>
<td>16.306</td>
<td>10.128</td>
<td>4.595</td>
</tr>
<tr>
<td>Female * No income given</td>
<td>-10.784</td>
<td>12.189</td>
<td>-7.773</td>
</tr>
<tr>
<td>Female * under 2000 sFr/month</td>
<td>-10.340</td>
<td>9.419</td>
<td>-23.420</td>
</tr>
<tr>
<td>Female * 2000-6000 sFr/month</td>
<td>-19.475</td>
<td>-15.959</td>
<td>-35.384</td>
</tr>
<tr>
<td>Ln(Great circle distance)</td>
<td>-1.279</td>
<td>-2.506</td>
<td>-10.561</td>
</tr>
</tbody>
</table>
Market share by contact mode

- Share of face-to-face meetings [%]
- Share of phone calls [%]
- Share of asynchronous messages [%]
Example geography of a 35 old female
Distribution of the social geographies (subsample)

95% Confidence ellipse of the social network geography

Japan: 378; U.S.A: 9'629 [10^3 km^2]
### Tobit results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>St. dev</th>
<th>Beta</th>
<th>Standardised beta</th>
<th>Sign.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data_ifmo [y/n]</td>
<td>0.26</td>
<td>0.43</td>
<td>2.309</td>
<td>0.184</td>
<td>0.048</td>
</tr>
<tr>
<td>Male [y/n]</td>
<td>0.57</td>
<td>0.50</td>
<td>2.293</td>
<td>0.212</td>
<td>0.021</td>
</tr>
<tr>
<td>Age [years]</td>
<td>44.72</td>
<td>18.92</td>
<td>-0.078</td>
<td>-0.277</td>
<td>0.002</td>
</tr>
<tr>
<td>University degree [y/n]</td>
<td>0.28</td>
<td>0.45</td>
<td>2.286</td>
<td>0.192</td>
<td>0.047</td>
</tr>
<tr>
<td>Car ownership [y/n]</td>
<td>0.52</td>
<td>0.50</td>
<td>3.842</td>
<td>0.358</td>
<td>0.000</td>
</tr>
<tr>
<td>Annual or monthly public transport ticket [y/n]</td>
<td>0.90</td>
<td>0.32</td>
<td>6.585</td>
<td>0.398</td>
<td>0.000</td>
</tr>
<tr>
<td>Number of relocations [n]</td>
<td>5.87</td>
<td>2.74</td>
<td>0.634</td>
<td>0.325</td>
<td>0.000</td>
</tr>
<tr>
<td>N</td>
<td>117</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.48</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Conclusions: Measurement

- Combined face-to-face interviews as a expensive but practicable survey method

- Size of social geographies can be explained to some extent with the biographies and the socio-demographic characteristics of the respondents


