


Social networks and travel

Some hypotheses

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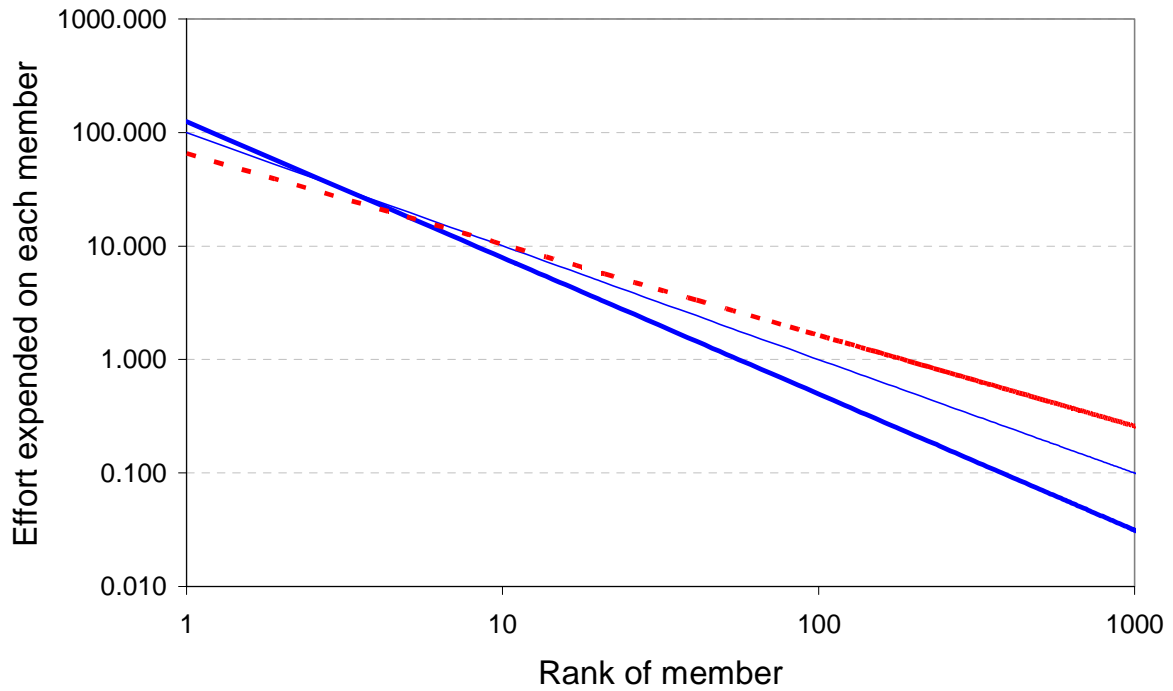
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Social networks and travel: Some hypotheses

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Soziale Netze und die Verkehrsnachfrage: Einige Hypothesen

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Kurzfassung

Die Verkehrsplanung hat klare Erwartungen dazu, wie sich wachsende Einkommen oder sinkende generalisierte Kosten auf das Verkehrsverhalten auswirken. Für die beobachteten Veränderungen in der räumlichen Struktur der Sozialen Netze gibt es keine entsprechenden Hypothesen. Dieser Aufsatz versucht solche zum ersten mal zu formulieren. Anhänge vertiefen die Diskussion mit Beiträgen zur Modellierung und Erfassung der sozialen Netze.

Schlagworte

Soziales Netz, räumliche Verteilung, Verkehrsverhalten

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Working paper

Social networks and travel: Some hypotheses

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Abstract

Transport planning has clear expectations of how rising income or sinking generalised costs of travel will influence travel behaviour. There are no such expectations for the observable changes in the spatial structures of the social networks. This note tries to formulate such hypotheses for the first time.

Appendices round the note off discussing possibilities to measure and model the spatial structure of social networks.

Keywords

Social networks, spatial spread, travel behaviour, leisure travel

Preferred citation style

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The main body of this note is an attempt to organise the author's thoughts about the interactions between the spatial structure of social networks and the travel pattern of the members of these networks (See also Axhausen, 2002). The referencing is therefore not as complete, as one might wish. Certain things are assumed to be known. The appendices attached to this note discuss some preliminary results, the implications of an assumed rank-size distribution of social contacts, what survey protocols could be used and finally the elements of a utility function, if one wanted to model the processes in a choice context.

1 Motivation

Leisure travel is the fastest growing segment of travel in terms of the share of trips and the share of miles travelled (see for example ARE and BfS, 2001). Many transport planners in Europe, but also elsewhere are concerned about this growth, as the growth of this type of travel, often considered inessential, is threatening sustainability targets, mostly formulated as a reduction in the miles travelled. As recent survey evidence shows leisure travel is mostly social travel - to meet friends, relatives, acquaintances, contacts: indeed, a surprisingly small share of leisure is solitary (Schlich, Simma and Axhausen, 2003; Axhausen, Zimmermann, Schönfelder, Rindsfuser and Haupt, 2002). Accordingly, the distribution of these friends, relatives, acquaintances and contacts across space, or better space-time becomes crucial to an understanding of leisure travel and its potential for further growth. More precisely, it is the spatial structure of the social networks¹ which is crucial, as the flows of information, prestige, affirmation and resources in the social networks, to which a traveller belongs, will direct the direction and amount of travel.

The literature on social networks in sociology is vast². However, sociologists have been more interested in the topological structure of the networks, and are generally not very interested in the actual physical location of the nodes (persons) at anyone point in time³. The literature on migration is different in this respect, especially the literature on chain migration (see MacDonald and MacDonald, 1964; Grieco, 1988 and 1996 for references), but does not concern

¹ A social network is a set of persons, who are linked directly or indirectly through other members of the set at a to be defined intensity and quality of contact.

² Looking at a small selection of books and papers (Wellman, 1996, 1999, 2000 and 2001; Franzen, 2000; Hampton and Wellman, 2001; Sobel, 2001, Burt, 2000; Törnqvist, 1970) and some web-searching.

³ But see work by geographers on urban contact fields, e.g. Moore and Brown, 1970.

itself with the effects of the migration on daily or annual travel patterns in the wake of the migration.

Transport planning and even more so transport modelling has ignored the social dimension of travel in the past. There is therefore no empirical literature to fall back on. The general lack of detailed address geocoding of previous travel diary data makes these large data sets less useful than they could be, as they cannot be used to trace the development of the spatial visiting and meeting patterns in detail.

It was therefore necessary to formulate hypotheses to guide the limited empirical work undertaken so far and to stimulate future work⁴.

2 Community as social network structure

The planning and the transport planning literature, in particular, is full of the terms community, neighbourhood and their cognates (Axhausen, 2000 and references there), but it is mute about the social structure of these stipulated units. It is therefore necessary to read between the lines to make an assessment about the social structure assumed to underlie them. Most authors assume a structure, as it is associated with rural villages and proletarian or lower middle class areas up to World War 2. These structures are idealized to be natural and unchanging⁵. My reconstruction of this image of these ‘everybody-knows-everybody’ communities is the following:

- The members of the social networks live in close spatial proximity
- The memberships in the various functional networks overlap strongly, e.g. family, work, political party and civic associations, social clubs, churches, sport clubs, etc.
- The networks are stable over time
- Contact to the outside is limited

What is undoubtedly true is that these pre-war neighbourhoods in which this idealization is rooted had qualities that were based on their walking scale, the relative expense of motorized public and private travel and business structures that were mostly small scale and localized –

⁴ See Schlich, Simma and Axhausen (2003)

⁵ The claim that gated communities can build communities in the social sense shows the power of such images among the promoters and buyers of real estate. The image of the pedestrian city is based on similar ideas.

the Department stores and the Sears-Roebuck catalogue notwithstanding. By necessity, a walking environment frequented by everyone produces face recognition, frequent chance meetings and interaction, meetings or avoided meetings based on the knowledge of the routine public behaviour of others and maybe even trust in the reasonableness of everybody's behaviour. A set of small local stores with long-time staff or owners provide a matrix for much of this interaction.

As an aside, it should be pointed out, that permanent and seasonal migration, the church, pilgrimage, local and long-distance trade and the conquest of its peripheries have linked local Western European communities into a larger whole since the emergence of Western Europe from the ruins of the Roman Empire (see for example McCormick, 2001; Bartlett, 1993; Weber, 1976 or Braudel, 1967). The cost, danger and effort of travel reduced the amount of travel in the past, but not as much as we would expect. The experience of travel was shared by all social strata in different guises (e.g. servant, soldier, sailor, traders, journeyman, etc). While leisure travel was reserved to those who could afford it, it entailed a large amount of travel for those for which it was work, e.g. the servants, the cook, or for the chaperone and guide of the traveller. Their understanding of world was changed along with that of the *Bildungsreisenden*⁶.

It is unclear, how much of the community idyll or ideal was left at the start of industrialization given the enormous mobilization which Europe had experienced since the overseas expansion of the 16th and 17th century⁷. The modernisation of agriculture and the development of large scale industry and large cities should have put an end to the remainder of face to face, small scale society - but did not. The structures of localism found in the village and rural life re-established themselves in the city in new forms, as the new urban arrivals were then still limited by the absence of motorized transport and still required social networks to manage a mostly hostile and unpredictable environment, both in terms of the health and the economic risks involved.

Nevertheless, the 19th century is full of examples of politicians and intellectuals thinking about the impact of the rupture of the established networks of trust and deference assumed to have existed before, or of the potential to generate something completely new – perfect - on

⁶ Contemporary writers tend to forget the presence of the large personal staff of persons of social standing in the past.

⁷ Consider for example the manpower needs of the European merchant marines and navies operating in the tropics before antibiotics or even an understanding of the basic dietary needs of the crew, e.g. scorbout.

the basis of these reformed networks (see Fishman, 1982 for spatial utopias). Existing or assumed to exist urban anomie was a central issue of early sociology (e.g. Tönnies, 1935). Mass overseas emigration was an important safety valve for the European societies in the long 19th century, but it was obviously not a course of action supported by the European nation builders of the time, which needed a native population for their dreams⁸.

The combination of the car and the suburban house appeared to the contemporaries as the solution to the perceived crises of the late 19th century city, as it allowed to generalise the benefits of the earlier street car suburbs. The promoters of this vision could be either conservative or progressive, depending on their exact vision for the suburban environment. While the promoters of the time saw suburbia as a place of firm, supportive and dense social networks, today's critics see the policies adopted then or even more strongly after World War 2 as the end of strong social networks.

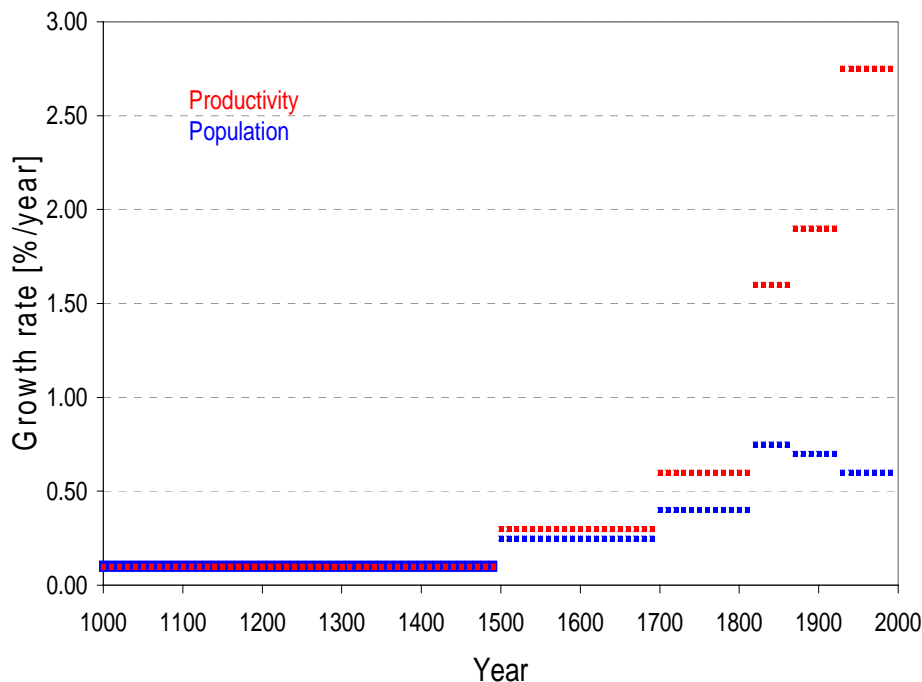
The interpretations of the processes of urban decentralization and deindustrialisation since World War 1 and certainly since World War 2 are difficult to untangle, as the forward looking hopes and ideologies of one vintage mix with the reassessments and idealization of the respective pasts of another and different vintage. Despite the difficulties posed by perceiving past planning through the 'spectacles' of the present, it is, nevertheless, obvious that western industrialized societies have consumed a substantial share of their incomes by acquiring cars and more living space in less dense environments. (See Figure 1 for the divergence of productivity and population growth in Western Europe which provided this consumption space. In addition, Western industrialized countries transformed their industrial structure by growing into the service dominated economy of today; a process which was only possible through the inclusion of the rest of the world into the production of goods, and recently routine and less routine services.

Today's two main positions with regards to the spatial results of this transformation can be crudely sketched as follows: one side argues that the capitalistic elite offered the suburbanites a Faustian deal, which they were duped into accepting - trading the material comfort of oversized houses and car dependency for the loss of localized solidarity and a healthy environment; the other side sees the process as the liberation from localized ill-health and limited social and economic horizons, which was generously and sensibly supported by democratically

⁸ The emigration project of Zionism being the obvious exception to the rule

desired public policies, such as tax-supported incentives for home acquisition, tax-deductible commuting costs, efficient funding and execution of road construction.

Figure 1 Productivity and population growth in Western Europe



Source: adapted from Galor and Weil (2000)

3 Impact of cheap travel and communication on the structure of social networks

We lack empirical data about the local density and overlap in respect of the geographical spread of social networks in the past. Indeed, we lack this information for today's networks. Anecdotal evidence from novels, newspapers and other such fragments is all that we have and this seems to me to be an unreliable basis for a judgment about change over time. However, we can formulate hypotheses about the impact of low cost travel and communication on the structure of social networks.

In a self-reinforcing cycle of commercial demand and technological competition between suppliers a series of technologies has been developed over the last two hundred years, which

increased the range of human interaction at decreasing generalized costs, i.e. the weighted sum of time spent, money expended and discomfort felt⁹:

- Canals
- Steamships
- Roads with all-weather surfaces
- Railways
- Telegraph
- Motorcar and truck
- Telephone
- Planes
- Electronic mail and chat over the internet
- Mobile telephony

While the early technologies sped up the delivery of written – asynchronous - messages, especially as they developed in parallel with the development of national postal services, the later technologies stressed the spoken or better synchronous messages with email being the exception. Email and its cousin's chat and SMS can act as a near substitute of the spoken word, but what is different is email's ability to project the messages at essentially zero marginal costs to large groups of respondents. Email and personal websites can act as points of chance meetings in the sense discussed above. The ability to forward email easily allows the information to travel easily: gossip without loss of the expression of original sender, if one assumes that the messages are not edited and changed.

The spatial dispersion of the population, the provision of uncrowded living spaces, the separation of home and work location, the generalization of female labour force participation and a reasonable amount of national and international migration has produced a situation, where one would have assumed, that:

- Social networks continue to be functionally defined, e.g. through family, current and previous places of work, schools attended, social, sporting, religious and civic affiliations.
- The members are spatially dispersed, as they are making use of the whole metropolitan region for their housing needs without co-ordination with the other members of

⁹ The role of military demands is ignored here, as well as technologies which were used primarily in military or in purely commercial contexts, such as two-way radio transmission between units, ships or trucks.

their various networks. Exceptions are groups, which are by definition associated with a (small) local unit, as is the case for most civic and religious groups.

- The overlap in the membership between the social networks is less likely because of the spatial dispersion.

In addition to these local networks, people maintain contacts, maybe even full networks at remote locations, of which they are/were members, because

- They lived there previously for extended periods of time, e.g. growing up, studying, job postings, etc.
- They visit regularly to be with friends or family, who have themselves moved
- They commute between these places regularly, e.g. as weekend commuters, with the town to country pattern producing different results from the quasi-forced commuting between a home location with a depressed economy and an economically active area elsewhere.

The maintenance of the (remote) networks is feasible within the time constraints of everyday live, because email and photocopying allow the cheap reproduction of messages, because the mobile phone allows using previously unusable times in transit for talking with members of the networks, because low telecommunications costs generally allow more contact time, because the reduction in working hours and working days provides more space for social time. Cheap – international – travel allows the backup of these remote contacts with face-to-face contacts at reasonably regular intervals. In sum, one would assume that the number of active contacts has increased over time.

However, one would assume that the quality of the contact changes, as the members of the various networks share less of their daily environment with the other person, which increases the need for background explanations or keeps the interaction at a more general level than previously. It seems likely, that people concentrate their efforts on fewer people, with whom they share a lot of detail, while the contacts with the others become more superficial and generic. The distribution of the contact densities should shift, as fewer people can draw on a joint experience of a specifically local everyday life. The higher time costs of catching up might be outweighing the lower money costs of the interactions. One might see this as a corollary to Becker's prediction (1976), that persons with higher incomes will make their leisure more consumption intensive to obtain a higher utility from it.

This description also implies that persons can be more selective in their choice of contacts, as they can maintain friendship independently of the spatial distance to a person. One would assume that this should lead to more satisfaction from the contacts, even allowing for the difficulties arising in the maintenance of an awareness of the constraints and possibilities of the daily life of the other, as one can rely less on chance encounters and less on the grapevine to spread news in a detailed and self-correcting way through multiple channels.

It is clear that the technologies discussed support this spatial and social differentiation. The systems co-evolved to liberate the individual from the links to a particular location and its inhabitants; primarily the railroad, the car, the plane, the mobile phone, with the larger homes providing more and comfortable space for solitude and time with the self-selected company. This separation from the local often produces fear, as daily life still requires movement through the immediate vicinity of home, which has now become socially unfamiliar. The eyes on the street of Jane Jacobs (1961) do not belong anymore to familiar and trusted figures, but to strangers with unknown intentions (Putnam, 2000). The cost of this externality, this loss of general trust (Seligman, 2000), has substantial private costs ranging from extensive security systems inside the home all the way to the retreat behind the walls of a gated development guarded by private security forces. The parental urge to provide organized children's entertainment and enrichment instead of allowing children's self-organized play in the neighbourhood should also be counted among these costs. The preference for privatized quasi-public spaces in Malls, urban entertainment districts and similar places seems to me to belong to the observable reactions to otherwise untrustworthy environments.

It is unclear what impacts this style of life will have on the organization and scheduling of daily life. While fast travel and easy private communication via the personal mobile phone could lead to an increasing fluidity in the organization of leisure, in particular, this should only be true, as long as the persons involved are spatially close, otherwise the time and money cost of travel become too large for an aborted or reorganized meeting. The spatial spread implies tighter scheduling over longer time horizons, as more contacts are being maintained at different locations.

4 Implications

If I am indeed right, that our current knowledge about the spatial distribution of the members of a person's social networks is lacking, then this becomes an obvious area of research. The collection of information about the current networks will be a substantial challenge, but the various common tools which have been developed to help run these networks will help the research exercise: diaries, personal telephone and address lists, mailing lists, but also photo albums and collections of letters and emails. However, the real challenge will be the attempt to capture the change over time by looking at earlier configurations. Some respondents might have good collections of previous diaries, personal telephone books, but as a rule these will not be available. Research will have to rely on personal memories, which might have to be guided by photo albums and discussions with friends and contacts from the relevant period.

What does this mean for my original issue of leisure travel? If the hypothesis is true, that the spatial spread of social networks has increased, then a large share of the observed increase in leisure travel should be due to this trend. In the short term, one would expect leisure travel to be inelastic, as the social networks cannot be restructured quickly. It is also unclear, if it is desirable to restructure these networks at all, as they reflect the choices of the persons involved, although the social externalities identified above would provide a rationale. The proper balance between the unchosen neighbours and the chosen friends elsewhere still needs to be found, individually and socially.

5 Literature

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Appendix: Some experimental results

A recent Swiss project (Schlich, Simma and Axhausen, 2003) provided the opportunity to explore the issues raised above. In this study a sample of 75 respondents had kept a twelve week diary of their time use and their out-of-home leisure activities, for which they provided addresses and if they had non-household company. The addresses were geocoded at a zip code level, i.e. rather imprecisely.

The respondents had been asked to identify their five most important contacts and their home locations in the initial face-to-face interview. In an ad-hoc, non tested instrument, which was distributed at the end of the survey period, the respondents were asked to identify the home locations of the non-household persons they had met for their leisure activities in those twelve weeks. To make the task manageable at all, we provided them with a list of those activities, for which they had indicated the presence of non-home participants, specifying date, time, location and activity purpose.

Nearly 80% of the respondents replied. There was very little item non-response. Beyond this, we have no indication of the quality of the responses. The following graphs are based on these responses. One should take the small number of respondents and therefore the small number of cases in mind.

The distribution of the distances between the home locations shows nicely (Figure 2), that the important contacts are maintained over longer distances than those involved in daily life. It was not possible to identify whether an important contact had been involved in activity during the twelve week survey period, nor if a person has been included twice. The results are therefore preliminary. Figure 3 shows the crow-fly distances between the home locations of the respondents and their important contacts. Contacts abroad were not considered, as we did not have the ability to geocode their addresses. In all but one case were the medians lower than the means indicating the presence of important contacts outside the immediate vicinity of the study area.

The crow-fly distances to the meeting places of the leisure activities are shown in Figure 4. The sample included persons from both suburban and urban locations, which explains the rather wide inter-quartile ranges observed here. The walk category includes both a joint gentle stroll in a local park, as well as hiking in the hills and mountains around Zürich. The high median value is therefore not surprising.

Figure 2 Distribution of crow-fly distances between home locations by type of contact

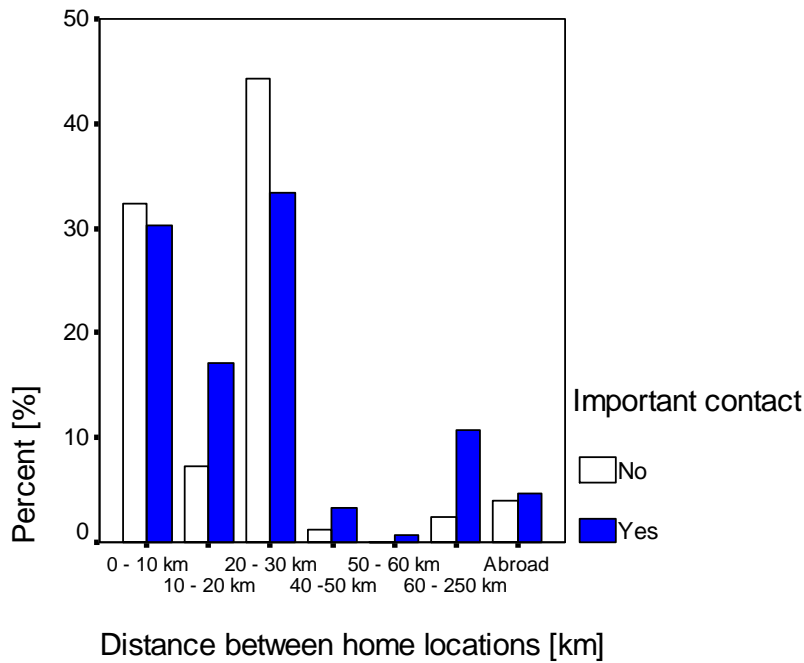


Figure 3 Crow-fly distances between the respondents and their important contacts by type

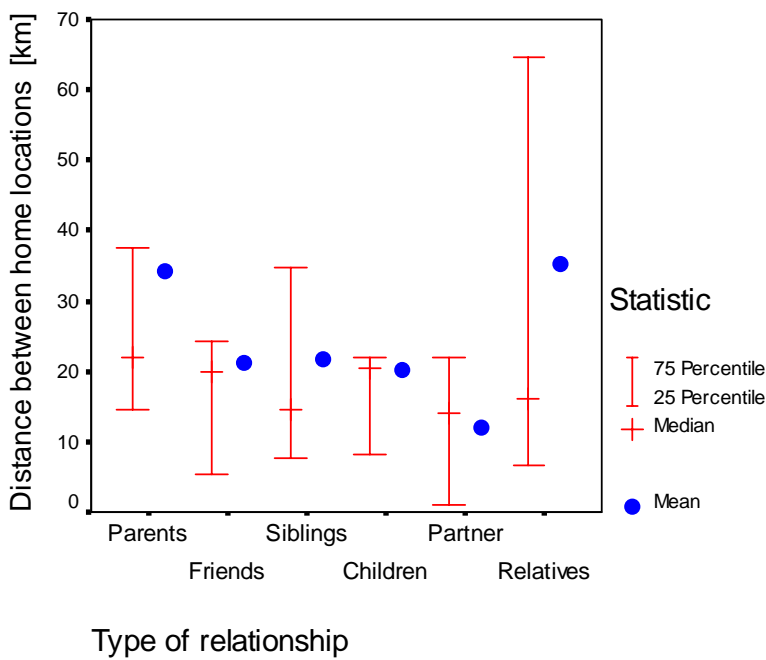
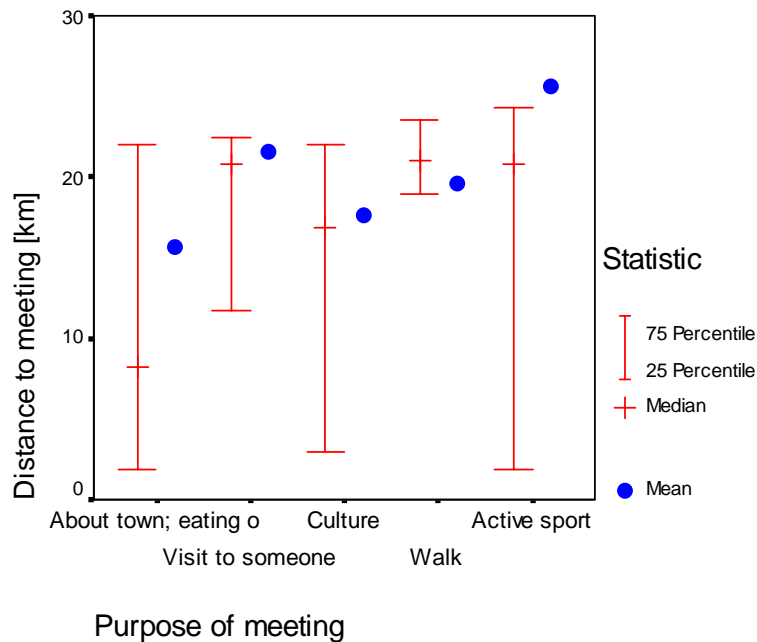


Figure 4 Crow-fly distances from the respondents homes to the locations of the leisure meetings with non-home based persons



As explained above, these results are based on too thin a data base to be really taken serious. But they are a serious and important demonstration, that it is possible to ask these questions at all. Respondents are willing to engage with such a question and to answer it seriously. Clearly, the context of this study was special, as the respondents had been keeping a long duration diary for the study, which indicates a special willingness to answer, as well as a level of trust into the survey team. One would have to test, if this is possible in different, less intensive survey contexts.

Note on Figure 3 and Figure 4: The box plots shown summarize the underlying distributions by indicating the first, second and third quartile of the distribution, i.e. the 25th, 50th and 75th percentile. This enables the quick comparison of the distributions for the different categories of contact or activities.

Appendix: The distribution of contacts

If we assume that the amount of effort, say some weighted sum of time and money, is distributed according to a rank size distribution, then the effort is distributed as follows:

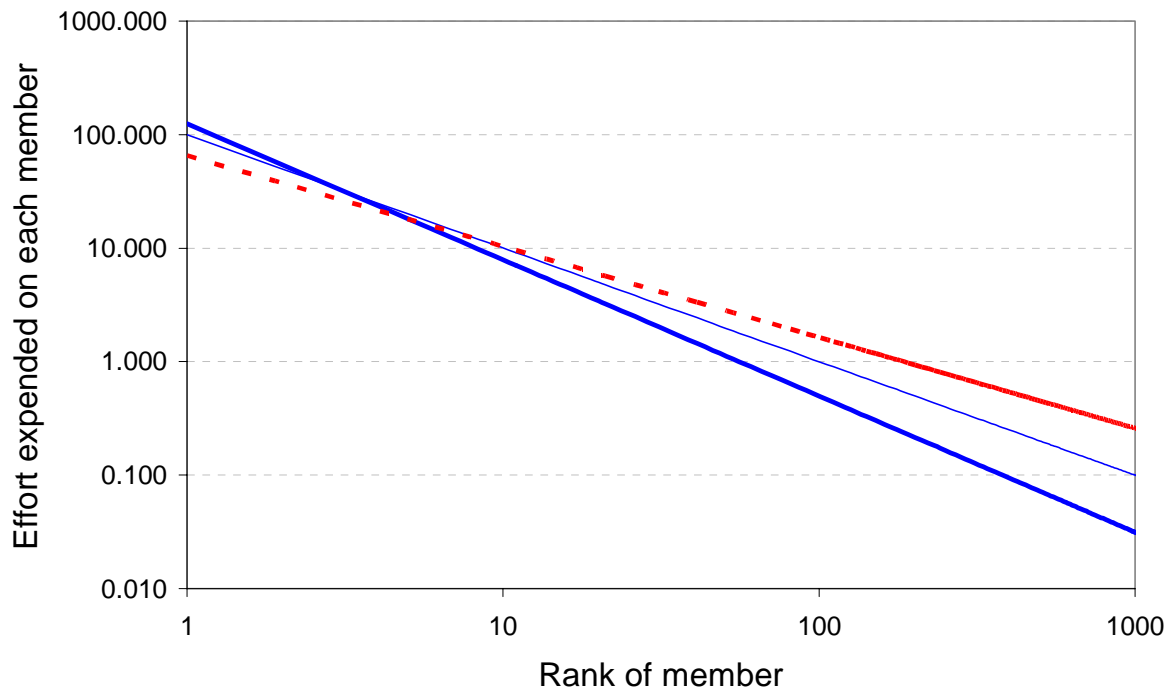
$$Effort_{n^{th} \text{ ranked person}} = Effort_{1^{st} \text{ ranked person}} (n + \beta)^{-\alpha}$$

with the parameters α and β , which would need to be determined empirically. This type of distribution, also known as Zipf's law, is fairly commonly observed in the social sciences. It implies that the effort expended on any one person drops exponentially with that person's rank, her closeness to the person at the center of the network.

Figure 5 shows three distributions using a log-log presentation, which displays them as straight lines with gradients α . The parameters were chosen to keep the total effort spent on all members equal. The thin blue line displays the original situation. If the technological situation requires an effort of ten for a fully developed relationship, then ten such contacts are possible in the original situation.

Assume that a technological change or a different distribution of the contacts in space, which allows one to rely on the grapevine to stay in contact, reduces this effort to one. The person's set of meaningful contacts rises to 100. Depending on the preferences, i.e. the relative gain in utility derived from the number of contacts, respectively the intensity of contact, the person might respond by either concentrating the effort on fewer persons closer to itself (thick blue line) or by increasing the number of contacts further (dashed red line).

Figure 5 Distribution of efforts assumed to be expended on each member in the social network by rank of member



Appendix: What should one ask and how ? Some initial ideas

Population estimates: If we are only interested in the distribution of the distances across the population, it should be possible to include the relevant questions into one of the many travel diary surveys, which provide now the geocodes of the meeting places and the home locations as a matter of course:

- How many non-household members did you meet for this activity ?
- Could you please describe the type of relationship you have with each of these persons ?
- Where does each of these persons live ? (Please give as much detail as you can ! name of municipality, neighborhood, zip code, street address)

While the questions above will need already some extra motivation and explanation, this should be feasible, even in general purpose surveys.

Respondent-centered distributions: The amount of self-revelation of the respondents implied in the research goal requires careful interview and survey approaches. The results shown above indicate that one could try to generate the data of interest as a by-product of a diary study by including the questions of the section above into the diary. While this would provide a natural context, it would also require a substantial amount of extra effort to produce data, which might not be used. The need to avoid the double counting of contacts would require that the respondents indicate the name of their contacts, which they might object to. If we were to cover all of the daily live, then a twelve week diary seems impossible; but note that we have been able to conduct six week diaries successfully (Axhausen,). Such a time period would allow us to identify to important local contacts, but some of the important contacts further away would not be identified¹² and certainly many of the less important ones. The resulting distributions are likely to be biased and incomplete.

The alternative is an in-depth face-to-face interview, which has to be based on easily available records, so that the less important contacts are not overlooked. The important ones should be available without any or only with little prompting, but say from rank 20 or 30 recall becomes more difficult. Examples for those records are:

- Personal telephone lists or databases
- Personal address books or databases
- Email address books
- Lists of birthdays
- Recipients of Christmas cards; senders of Christmas cards
- Billing records for telephone services
- Agendas recording the persons met and about to be met in the year
- Saved emails
- Collections of letters and post cards (electronic, printed, hand written)
- Photo albums, scrap books etc.
- Minutes or attendance lists from meetings attended
- Membership directories of clubs and societies to which the respondent belongs

These sources should allow the respondent to construct a list of contacts, to characterize them and to indicate the amount of contact with them and the effort involved. This list makes clear, that the interview will be rather long and might become tedious, if solely focusing on the is-

¹² Those with whom the contact is maintained mainly be telephone, email and letter and the rarer visit.

sue of the distances between persons. It might be necessary to embed this part into a larger interview with a more wide ranging set of topics.

One obvious way to cross check the answers of a respondent would be to repeat the exercise with members of his or her social networks. Such snow-ball sampling would be appropriate in this context. Reusing information from the earlier interviews would reduce the effort for the later interviewees. Because of the correlations implied in a network sample, the new information will decrease after some time. It will therefore be necessary to start with a sample of respondents to provide independent starting points.

A possible wider context would be the **mobility biography**: a life-course interview, which would focus on the mobility aspects of a person's life: home locations, work locations, car owned, season tickets acquired, holidays taken, trips made, patterns of expenditure on transport. Here the social network becomes the back ground for the travel and it will be possible to motivate the collection of information about the persons visited, as a side product or as a preparation for talking about the journeys. Interestingly, this frame would also allow to trace the change in the patterns of the social networks.

Appendix: The utility derived from a contact

The utility derived from a contact is therefore dependent on the following factors:

- Personal match between the persons
- Embeddedness (similarity) of that person among all other members of the set (network)
- Potential to spend time jointly
- Mean physical distance to the meeting places
- Money spent towards the participation in the joint activities, including travel costs, but also gifts
- History of joint activities and contacts
- Joint history with shared contacts and friends

The personal match is as good as unmeasurable for a transport planner, who would need to resort to a variable effect formulation in an econometric model. Psychologists might be able to add here with more detailed measurements. The embeddedness variable could have a positive impact through a better understanding of the situation of the other and the ability to reach the

person via joint contacts and friends. It could also have a negative impact, as the person might not provide variety or independent assessments. The person might also be seen as a danger through gossip or intrusion into the private space. The variable might work differently given the various social contexts of the networks. In a work-based network it might have a negative impact, but not in a friendship-based network.

The potential to spend time jointly, the joint history and the joint contacts should all increase the likelihood that a contact is maintained, as it reflect a common investment and a better understanding of each other.

The increases in the expenditure variables should reduce the benefit from the contact. The distance variable could also be formulated as a time distance, as this is the actual resource which is being spent.