

6<sup>th</sup> Conference on Applications of Social Network Analysis

## Collecting data on leisure travel: The link between leisure contacts and social interactions

Matthias Kowald<sup>a,\*</sup>, Andreas Frei<sup>a</sup>, Jeremy K. Hackney<sup>a</sup>, J. Illenberger<sup>b</sup>, Kay W. Axhausen<sup>a</sup>

<sup>a</sup> Institute for Transport Planning and Systems, ETH Zurich, Wolfgang-Pauli-Str. 15, 8093 Zurich, Switzerland

<sup>b</sup> Institute for Land- and Sea-Transport, TU Berlin, Salzufer 17 – 19, 10587 Berlin, Germany

---

### Abstract

The aim of a new survey project is to collect data on the link between leisure contacts and leisure activities. The paper introduces briefly into former studies that applied the methods of social network analysis in transport planning. Using these projects as starting points the methodology and background of the new project are presented in detail. This is followed by first descriptive analyses checking how representative the data are for the Swiss population. The paper finishes by giving an outlook on further work and next steps to analyze the data.

© 2010 Published by Elsevier Ltd. Open access under [CC BY-NC-ND license](https://creativecommons.org/licenses/by-nc-nd/4.0/).

*Keywords:* egocentric networks; name generator; snowball sample; sociogram; activity diary

---

### 1. Introduction

In recent years there has been an increasing interest to use the methods of social network analysis in the field of transport planning. While these projects have been good starting points for new explanations, the link between transport planning and social network analysis is still in its early stage.

The paper describes a survey project undertaken at the IVT (Institute for Transport Planning and Systems) of ETH Zurich and the ILS (Institute for Sea- and Land-Transport) of TU Berlin. As most social network studies in transport planning use an egocentric approach this project tries to go one step further by iteratively combining the isolated network components with the help of an ascending survey strategy, called snowball sample.

The paper briefly discusses the interest of transport planning in the methods of social network analysis and gives an overview of recent work in this field. Afterwards sampling strategy and instrument of the new project are presented. It is discussed in detail what is new in this project and what the researchers are aiming for. First results from the ongoing survey give information about the feasibility of the sampling strategy and the validity of the survey instrument. In addition some descriptive analysis provide an overview of the survey population. The paper finishes with an outlook and ideas for future work.

---

\* Corresponding author. Tel.: +41 44 633 39 43; fax: +41 44 633 10 57.

E-mail address: [kowald@ivt.baug.ethz.ch](mailto:kowald@ivt.baug.ethz.ch).

## 2. Transport planning and social network analysis

Leisure travel is of high importance for transport policy. Looking at the 2005 Swiss Microcensus on Travel Behaviour shows that leisure activities have the highest share of all trip purposes, 41%, and also the highest share for kilometres travelled per person and day, 44.7%. In the category of time spent on trips, leisure activities again have the highest share with 51.5% (ARE/BfS, 2007). As such, leisure travel is the dominant travel segment.

Transport planning aims to understand and model out-of-home movements of the population (see Ortuzar and Willumsen, 2006). People's everyday travel decisions, e.g. in terms of mode and destination choice, but also in distances and generalized costs of time and money, are included in this definition. Instead of focussing on the segment of leisure travel most recent work in transport planning concentrated on daily commuting or peak hour traffic, such as traffic for work or educational purposes. On the one hand this segment causes many problems for transport system managers (see Larsen et al., 2006) and on the other hand finding explanations for leisure travel is much more challenging because it is less driven by constant needs but is "performed very sporadically and (...) influenced by changing conditions like weather, traffic conditions, etc." (Schlich et al., 2004: 221).

Leisure travel is often described as being driven by social motivations: To visit friends or relatives or to join them in activities. Leisure travel can therefore also be described as social travel (see Larson et al., 2006). Explanations for individual leisure travel decisions need to focus on the actors' social contacts as "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" (Axhausen, 2005: 90). This can be done by using the methods of Social Network Analysis (SNA). Here interacting actors, e.g. individuals, groups or companies, and the relational ties between them are at the centre of the investigation. This focus allows to observe in which way social structure, emerging from the actors' interactions, provides opportunities for or constraints on individual activities (see Wasserman and Faust, 2007; Scott, 2007; Jansen, 2003).

## 3. Recent work

In recent years there have been a number of studies on travel behaviour using the methods of SNA. To give a brief overview some illustrative examples are discussed below.

Combining two quantitative questionnaires and a qualitative guided interview, data on communication practices, geographies of travel, and friendship as well as family networks were collected by Larson *et al.* (2006). By implementing data on travel, communication and meetings into an analysis of the social network of 24 respondents from Liverpool, Manchester and Lancaster the geographical spread of social networks and the consequences for either social live and travel pattern have been analysed. In addition the efforts, strategy and technology used to arrange physical meetings have been investigated with the help of this dataset (Larson *et al.*, 2008). By establishing the link between social networks, locations and travel the main conclusions of this project are the necessity to understand the biographies and mobilities of most people as embedded in social networks and therefore being connected to other persons rather than being individualized. As most respondents live their social live in a nationwide or even international rather than in a local frame, leisure travel can, especially in comparison to business travel, not be seen as unnecessary and avoidable. Resulting from that conclusions it is suggested to use not only the traditional approach of transport planning, focussing on travellers as economic agents interacting in market situations but in addition to understand them as network-based actors enabling and constraining each other in their individual actions (also see Axhausen, 2008).

The dissertation of Carrasco (2006) at the University of Toronto focuses on the social dimension of activity-travel by using an egocentric social network approach. The main questions of the project are how data on personal interactions help to explain the generation of joint activities and how these interactions are spatially distributed (also see Carrasco *et al.*, 2008). By assuming social activities as emerging from the spatial network of persons, 350 participants in the East York area of Toronto have been asked about contacts being of high emotional importance to them. The data were collected with a questionnaire. In addition, personal interviews were conducted with a 25% subsample of the original survey population. In the centre of these interviews stood a sociogram, an extension of the traditional name generator technique, which asked the respondent not only to mention social acquaintances but also

to structure them in the way they are known to and interacting with each other visually (Hogan *et al.*, 2007). The data analysis of the respondents' personal and their ties' relational characteristics showed those factors that are influencing the generation of social activities. Also there have been findings on the spatial spread of living and meeting points and, in connection with the geographical distance between persons, the mode used to stay in contact (Carrasco *et al.*, 2008). Besides, surveying a larger sample than Larson *et al.* the study is very local. Both teams, Carrasco *et al.* and Larson *et al.* highlight the relevance of the social influence on the individual travel behaviour and point out the need of further research.

To collect data on social interactions and travel behaviour simultaneously a three-day interaction diary has been used by Silvis *et al.* (2006). The respondents were asked to write down all trips and social interactions in terms of purpose, mode, and participants. In addition some questions, mostly on socio-demographics, were asked for each participant. Whilst the study did not use a questionnaire but a diary, this has not been the only special feature. Another characteristic was the sampling strategy. By collecting data on social interactions the team tried to use face-to-face meetings as the base for recruitment. Starting with three participants these persons were asked to give a postcard to each person they interacted with physically. On the postcards was a text asking for voluntary participation being easily possible by contacting the researchers. Within a two-month timeframe 24 participants were recruited on three levels reporting 505 trips and 972 social interactions. Besides problems with the sampling strategy and the survey instrument, a high item-non-response, a low response rate, there are hints of selection bias, that is the selectivity with regards to persons the respondents handed out the postcard to. A first result from the study has been that the recorded trips made for social purposes have on average been longer than those for other purposes. Second the number of social interactions has been correlated to the number of social trips. Third the number of reported trips has been positively correlated to the number of reported repetitive social contacts. In general two kinds of activity travelling behaviour have been differentiated: One group of respondents undertaking a large number of short trips to meet a large number of people individually and another group making few long trips to meet many people at one place simultaneously. As the sample size has been very small the study has an exploratory character. To improve the generalizability of results a larger database and additional research is needed.

307 respondents of a random sample participated in an interview aided network questionnaire focussing on individual mobility biographies and the geographical distribution of emotionally important contacts done by Frei and Axhausen (2007). In addition the study retrieved the communication modes used by the respondents and their acquaintances to stay in contact (Axhausen and Frei, 2007). In conclusion the analysis shows nearly two thirds of the acquaintances living within a 25 kilometre radius from the respondents home locations. The findings are very similar to those of Larson *et al.* People mix local ties with those they have in a nationwide or even international frame. To focus on the link between mobility biography and the geographical spread of spatial networks a structural equation model was estimated (Ohnmacht *et al.* 2008). The analysis of the mode used to stay in contact showed a correlation between the share of these modes and the geographical distance between the respondents and their acquaintances. Similar to the study of Carrasco *et al.* the project has been very local in terms of survey population, but it did not collect data on the acquaintances' characteristics. Those data would be useful to draw a more detailed picture of the link between individual travel decisions and influences coming from the personal network.

Besides these starting points, the study of the link between social networks and leisure travel is still in an early stage. There is a strong need for further research. The issue of social network evolution is often mentioned when discussing the implications for further research. To know where, when and in which context two acquaintances have met the first time and how they stay in contact nowadays could be of great use to estimate long-term models and understand the connection between individual mobility biographies, the geographical spread of social networks, the evolution of social activities and the participants in these activities. To be able to generalize the data there is a need of a large database, both in terms of participants and in terms of the geographical frame of the study. Data on the characteristics of the respondent and their contacts are needed as well as data on mobility biographies and daily activities. Besides, the response burden should be low to have a high participation rate.

#### **4. Collecting data on combined egocentric networks**

The new survey-project of ETH Zurich and TU Berlin tries to fulfil some of the criteria mentioned above and take the next step in investigating the link between social networks and leisure travel. Like earlier studies it follows an egocentric network approach, asking persons, called ego, about certain social contacts, the alters (Wolf, 2004). Unlike former projects these egocentric networks should be connected to each other to get a better picture of the

geographical spread and their social topology. To reach this aim an ascending sampling strategy, called snowball sample, is used.

#### 4.1. *Surveying egocentric networks*

Surveying egocentric networks is, if the survey instrument is not a diary, usually done by giving one or several stimuli to the participants. This name generator technique has two aims: First it helps ego focussing on those contacts of the personal network that are of interest for the study and second it helps ego to remember these contacts at all. As it is a well documented phenomenon of the human brain to remember concrete facts much better when receiving a specific stimulus, an unsupported collection of social contacts is not recommendable (see Pool and Kochen, 1978). Because of this it is a challenge to find a proper stimulus for the name generator when using the egocentric network approach. In the early years of the methodology it has been usual to give a certain context and therefore to design name generators asking for 'friendship-', 'work-', or 'family-'related alters. The main problem of this role-relation approach is the context-stimulus being interpretable in different ways, e.g. friendship is not a homogenous concept between different cultures or even within one culture between different social milieus. Besides this problem, the concept of a global name generator can lead to difficulties in the data analysis as a person can be a friend as well as a co-worker or family member (Hill, 1988). Most of today's name generators deal with concrete stimuli to avoid these difficulties. Often used are the interaction approach, to identify contacts ego is interacting with, the affective approach, focussing on the value of ties, e.g. contacts whose opinion is of importance for ego, or the exchange approach, pronouncing e.g. the supportive exchange between ego and alter (see Marin and Hampton, 2007). Another recommendation in designing a name generator is to use more than one question to give ego the chance of mentioning alter he has forgotten when answering the first question. Most name generators are aiming to focus ego on a specific subsample of the personal social network and do not try to survey the whole network. An instrument aiming for the whole personal networks is described in McCarty *et al.* (1997). The alters provided are no random sample but selected by ego in two ways: First ego has to remember them and second ego has to mention them. If ego for some reason does not want to name a certain alter there is not much that could be done to change ego's mind. It is therefore of high importance to survey those contacts ego is willing to name as completely as possible. By giving ego the chance to think about the contacts of interest for the study once again and to mention them, the amount of data bias being implied in a use of the name generator technique is decreased (Marin, 2004).

#### 4.2. *The iterative combination of egocentric networks*

To sample connected egocentric networks in a large geographical frame an ascending sampling strategy is used. Taking a so called snowball sample means to combine egocentric networks by asking the alters of a few ego-seeds to participate in the study, too. By definition a snowball sample is "A technique for finding research subjects. One subject gives the researcher the name of another subject, who in turn provides the name of a third and so on" (Vogt, 2005: 300; also see Goodman, 1961; Gabler, 1992). Whilst snowball samples are most often used to collect information on hidden populations, e.g. drug users and other special populations (see Salentin, 1999; Atkinson and Flint, 2001; also see Heckathorn, 1997), they can also be applied to sample large connected egocentric networks (Coleman, 1958). Using this sampling strategy for a defined number of iterations shows how connected egocentric structures are spread geographically. Unlike the studies of Carrasco (2006) and Frei and Axhausen (2007), sampling unconnected egocentric networks in a local frame, a snowball survey is started in a local frame and continues with the persons mentioned and their specific home locations.

The project aims to sample at least 500 respondents with 60 starting seeds, found by a random mechanism in the canton of Zurich, by using three to four snowball-iterations. The snowball technique does not generate random samples. It is known to have several sources of data bias. All persons, despite the random seeds, on iteration level one to iteration level n are selected by the egos arbitrarily or intentionally. The structure of the network is therefore also biased by the egos' choice. "Of all possible paths, the ones actually traced by a sample of respondents depend in part on their decisions about sending chains onward – for example, their decisions to pass rumors to certain acquaintances but not to others" (Erickson, 1979: 277). To be able to compare the participants on the iteration levels with the random seeds and check if there are differences, the random sample is of high importance (for further information on bias in snowball samples see Kowald *et al.*, 2008). To reduce the amount of selection bias in the

project the control over the snowball process is retained by the researchers. Unlike the study of Silvis *et al.* (2006) described above the egos are asked for the names and postal addresses of their alters. On the next iteration level these alters are contacted by the IVT and not asked to contact the IVT themselves. In spite of the bias problems from the snowball method, the data are valid and inferences are possible for several topics, e.g. for the characteristics of Ego and Alter, the chain of contact, the chain process in terms of who is naming whom, and the network as a whole (Erickson, 1979). The team of TU Berlin is working on methods of data weighting and extrapolation to estimate and limit the amount of bias from the snowball process (for further information see Illenberger *et al.*, 2008). To get an idea whether the sampled network structures are representative for Switzerland, the results of the survey will be compared to data from the Swiss Environmental Survey which also includes some items on personal networks (Diekmann *et al.*, 2009).

### 4.3. Social contacts and daily activities

Using the methods of social network analysis in the field of transport planning aims for explanations on the phenomenon leisure travel. Besides collecting data on personal networks and the characteristics of the embedded individuals another data-source providing relevant information can be “capturing the social content of activities and of their participants” (Larson *et al.*, 2006: 130). To be able to collect data on both items, personal networks and daily activities, using a bipartite survey instrument is part of the survey strategy.

The first part of the instrument collects data on participants’ social networks. It includes four parts. First data on egos characteristics are collected. Besides socio-demographics, the questions aim for the mobility biography in terms of all home locations since birth and all locations of school, education, and work experience. The second part is the name generator, using two questions with several prompts focussing ego on leisure contacts and in addition on persons being of high emotional importance. The wording of the name generator is:

1) Please list the people with whom you make plans to spend free time. (Examples: errands, sports, club or organized activities, cultural events, cooking together or going out to eat, taking holidays or excursions together)

2) If there are other people with whom you discuss important problems, please list them here.

The space for writing down names is limited to 29 names in case of the first question and 11 names in case of the second question. Because of the importance to collect all names an ego is willing to provide additional names can be written on a separate piece of paper. Ego is also asked to use household objects and photo albums for reasons of memory jogging and remembering contacts. The third part of the questionnaire collects data on the contacts mentioned in the name generator. Beside the alters’ socio-demographics, ego is asked to categorize the kind of relation, to mention place, time, and context of the first meeting with an alter and the modes and frequencies they use to stay in contact nowadays. In terms of contact modes the questions do not only aim for physical meetings that directly cause travel, but also for electronic information and communication technologies (ICT) which can be seen as a replacement for or a complement to face-to-face meetings and spatial movements. Implying ICT-categories is expected to be of higher importance for younger participants. Of course ego is also asked to write down the postal address of each alter, to be able to continue with the snowball chain. The fourth and last part contains a sociogram. In trying to decrease the response burden as far as possible, keep the instrument simple, standardize it, and to survey many respondents without additional help, a new version of a sociogram has been developed. It asks ego to structure his or her contacts by naming those cliques of persons making plans to spend their time with one another and are therefore in close personal contact. Ego can do this by giving a name for the clique, e.g. ‘hiking group’ or just ‘family’ and write down a shortcut from the name generator to join persons. Using this design the sociogram is much simpler than the one used by Carrasco *et al.* (2006) and easier to fill out than a sociomatrix.

All respondents of the network questionnaire are asked to participate in an activity diary afterwards. This second part of the survey instrument asks for information about all trips and activities of the participants for eight days consecutively, e.g. the location/destination, joining persons and the planning background. Whilst the name generator of the questionnaire is a proxy for getting information on ego’s leisure time contacts, the diary uses another approach by focussing on ego’s actual personal network and the geographical spread of social activities in a given timeframe. Even though eight days are very short for a diary-study the aim in surveying one day more than a week is to get an impression of the amount of weekly routines. As this second part of the survey instruments implies additional response burden that rises further with each day included in the diary, eight days are expected to result in the maximum reasonable amount of response burden. Even with this amount only a subsample of the survey population from the questionnaire is expected to participate. Because of these limitations the diary study is of



exploratory character. Its data will be compared to data from other diary studies from the IVT. Besides all limitations it will provide additional information to the data from the network questionnaire. Also an analysis of the amount of bias from the snowball process will be possible because “Compared with one shot surveys or interviews, contact diaries enable researchers to minimize distortion caused by bias in recollecting, selecting, and summarizing across many events. Diaries can be more reliable than questionnaires, and they can be used as a yardstick to evaluate the validity of other techniques” (Fu, 2009).

#### 4.4. Reducing response burden and establishing trust

The sampling strategy is in the case of a snowball sample a much greater challenge than in many other sampling methods. The ability to continue with the sample is connected to the necessity of getting valid data on the egos' alters, most of all valid postal addresses that are confidential information. Besides this challenge both instruments - questionnaire and diary - imply a high response burden that gets even higher when combined in a single study.

To be able to reach as many persons as possible both parts of the survey instrument are available in paper and electronic format, and both formats are available in German and English. To reduce response burden all questions are standardized and open questions are avoided. The electronic version of the instruments uses drop down menus where possible. In addition Google-Maps is used wherever addresses are requested to give ego the chance of finding them even if they are not known fully. To calculate the response burden and predict the response rate a rating system from commercial survey research has been used (see Axhausen and Weis, 2009).

Of special interest is the initial random sample as its participants are used as starting-seeds for the snowball chain. As only a small number of seeds is needed to start the snowball process, they are found by using a stratified random sample in terms of age, gender and location of the home municipality, whether it is a city, agglomeration or rural area. The geographical frame of these ego-seeds is the Canton of Zurich as it is representative for Switzerland with the Cities of Zurich and Winterthur, smaller towns like Bülach and also rural areas. To improve the data quality the ego-seeds are asked to fill out the network questionnaire with the help of an interviewer. In providing help to possible questions, the data quality is increased and a valid database for comparisons with data from the later snowball levels is collected.

To establish trust between the respondents and the study team, recruit as many persons as possible and get the postal addresses of the alters several additional arrangements are employed (Kowald *et al.*, 2008). The whole surveying process follows the tailored design approach, a successful method to increase the response rate (Dillman, 2000). A first measure is to emphasize to the potential respondents the value of their participation and show personal efforts from the side of the researchers. To achieve this feeling a multi contact strategy, starting with an initial letter followed by a recruiting call is employed. Second a greeting postcard has been designed to give ego the chance of alerting the acquaintances that IVT will contact them and also to ask them to participate in the study. If an ego sends the card to an alter this action is a kind of reference for the study, as the alter identifies a well known contact trusting and participating in the project. In a first pre-test the card has been shown as working well (Kowald *et al.*, 2008). The third arrangement is to send an incentive of 20 Franks with the questionnaire. Sending the money before the questionnaire is filled out and returned is a sign that the researchers have trust in the respondents. “Much research has shown that ‘token’ incentives given with the request to complete a questionnaire, a form of social exchange, consistently improve response rates. (...) However, a promise to pay people for completing a questionnaire by sending them a payment afterwards (economic exchange) does not” (Dillman, 2000: 14f.). Besides increasing response rate, a high share of persons that received the incentive mail it back when not participating in the study. To have a basis for comparisons the ego-seeds have no idea about the incentive, but do get it after filling out the questionnaire. So this data can be compared with those from the iteration levels, as it cannot be biased by the incentive. The fourth and last measure is a webpage, again in English and German, providing detailed information about the project and the researchers involved. Giving this information increases the transparency of the project.

Two pre-tests in the first half of 2009 demonstrated the sampling process and instrument as suitable. Starting with 20 initial persons the snowball continued in the second pre-test up to the third level of the social network. As all collected data are valid these information will become part of the main study. A number of small problems, mostly in connection with the name generator have been corrected. In addition, 50 more randomly sampled persons from the canton of Zurich are being asked for participation at the moment.

## 5. Descriptive statistics

Not all participants do remember the addresses of their contacts completely or correctly. Despite this problem there is a risk of sampling persons twice, e.g. an ego mentions an alter that mentions the original ego as a contact again. Therefore all addresses and names given in the name generator have to be checked. To handle the amount of work resulting from this necessity, not all ego-seeds are interviewed at the same time but the random sample is divided into three parts. The size of each subsample is designed to result in 20 seeds. The survey for the first subsample is nearly completed. Using the snowball technique 116 participants have been recruited out of 20 ego-seeds. The recruitment process is summarized in table 1.

Table 1: The process of recruitment (as on 15 July 2009)

	Whole Sample		Ego-Seeds		Iteration 1		Iteration 2	
	Abs.	[%]	Abs.	[%]	Abs.	[%]	Abs.	[%]
Sample size	844		166		250		494	
...mentioned a second time	(- 66)						(- 66)	
Wrong addresses	237		3		71		163	
Valid addresses	607		163		179		265	
...not contacted yet	74		11		3		60	
...already contacted	533	100	152	100	176	100	205	100
...not reached by phone	128	24.0	66	43.4	25	14.2	37	18.0
Participation denied	160	30.0	60	39.5	44	25.0	56	27.3
Participation agreed	188	35.3	26	17.1	79	44.9	83	40.5
Questionnaire sent without recruitment contact	57	10.7	-		28	15.9	29	14.2
Participation with interview	17	3.2	17	11.2	-	-	-	-
Participation without interview	92	17.3	3	2.0	57	32.4	32	15.6
Participation without recruitment contact	7	1.3	-	-	4	2.3	3	1.5

On average an ego mentions around 14 contacts. The egos generally provide the postal addresses of the alters. A high number of addresses is valid and can be used for further recruitment. Despite the growth of the sample size there is a counterforce from the snowball chain in form of an increasing cluster coefficient, persons mentioned by an ego that is already part of the sample.

The overall response rate is approximately 25%. It is quite low for the ego-seeds. Here the size of the random sample was too large. All 166 persons got the initial letter at the same time. When 20 persons were recruited the others were not phoned any longer. Therefore a high amount of addresses from the random sample have not been used. In the case of the next subsample this mistake was avoided by sending the initial letter only to a low number of persons. When all these persons have been asked for participation the next initial letters can be sent. Avoiding this mistake could help to increase the response rate. The 25% overall response rate is higher than what has been predicted by the rating system described by Axhausen and Weis (2009). Figure 1 compares the response rate of the present study to those from former studies of the IVT.

Focussing on data quality it becomes clear, that the snowball sample is quite representative for Switzerland. Table 2 shows the distribution of some characteristics for all participants, egos, and all persons mentioned in the name generator, alters, and the name interpreter. The data are compared to the Swiss Microcensus (ARE/BfS, 2007), which is weighted to be representative for the Swiss population.

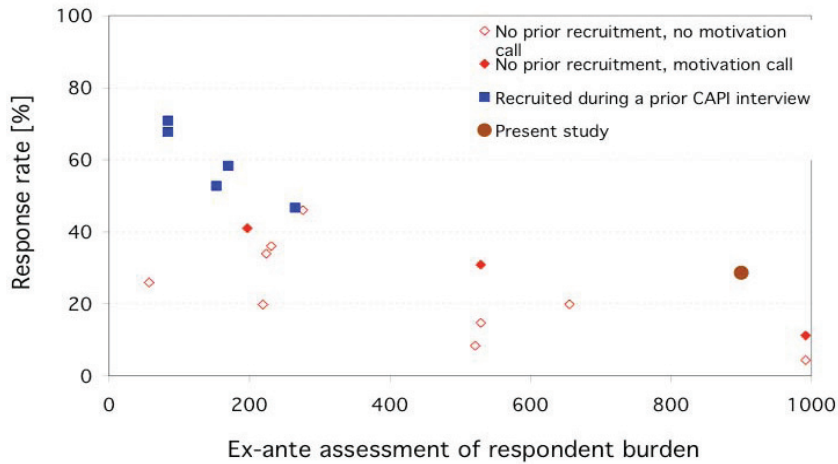


Figure 1 The link between response burden and response rate (Axhausen and Weis, 2009).

Table 2: The egos' and alters' characteristics (as on 15 July 2009) compared to the Swiss population

		Snowball: All egos (n = 115)	Snowball: All alters (n = 1649)	Microcensus 2005
Sex	Male	49.6	48.1	48.7
	Female	50.4	51.9	51.3
Civil status	Single	15.8	23.6	29.9
	Married	61.4	60.5	54.5
	Divorced	9.6	8.0	7.6
	Widowed	12.3	7.2	6.6
	Married living separately	0.9	0.7	1.4
Citizenship	Swiss	93.0	90.1	80.0
	German	1.8	5.0	2.3
	Italian	3.5	1.5	4.6
Ø age [years]	0 – 20	-	13.0	13.3
	21 - 40	32.2	33.2	31.4
	41 - 60	50.1	50.1	50.0
	61 – 80	69.9	68.4	69.4
	81 +	82.0	84.2	84.6



The largest difference can be observed in terms of age. The average age of the random sample egos is quite high (59.2 years). As the age of all alter is also high (54.4 years), this can be an indicator for a high degree of similarity between egos and alters in terms of age. To increase the quality of the sample and be more representative the data can be weighted afterwards. Another solution could be to use only younger ego-seeds for the second sub-sample. Selecting egos-seeds with certain attributes can also help to correct bias resulting from the similarity of egos and alters in other characteristics, e.g. gender or civil status.

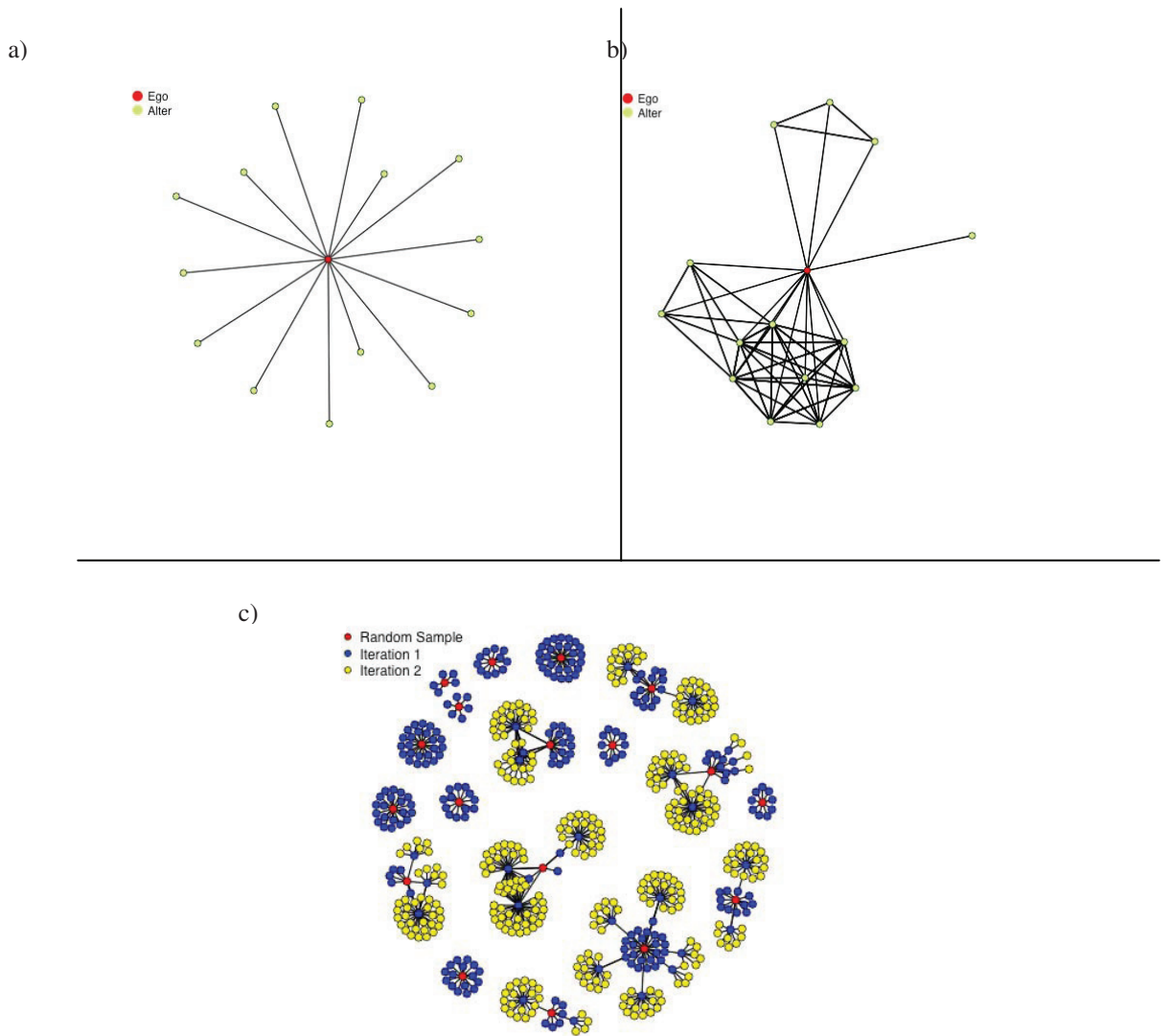


Figure 2 Three different levels of the network structure.

Figure 2 gives an overview about the different network types being collected in the study. Analysis are possible for the egocentric network components, being collected by the name generator and interpreter. On the next level of analysis the connections between the alters of an ego can be taken into account. Figure 2 shows on the top left side

an egocentric network without the edges from the sociogram (a) and on the top right side the same network with this information (b). The graph on the bottom shows all egocentric networks from the snowball recruitment process and the connections between them (c).

## 6. Perspective

The process of data collection is ongoing. The first snowball chain for the first subsample of 20 ego-seeds is at the end of iteration level 2. At the same time the interviews with the ego-seeds from the second subsample are in the field. The collected data have, as far as possible, to be compared with representative data from former studies to observe the snowball process. The first subsample showed in terms of age what can happen if the sample is circling in a specific population. It is of high importance to recognize such problems in an early stage. We plan to finish the survey in 2010.

There is much work to do in terms of data analysis. The relations between the egos and alters have to be analysed as well as their socio-demographics. The home location and mobility biography of each person has to be matched geographically as well as all places where an ego met a specific alter the first time. Also the data from the diary have to be analysed and compared to the data from the questionnaire.

## Acknowledgement

An earlier version of this paper was presented at the 9<sup>th</sup> Swiss Transport Research Conference, which took place from September 9<sup>th</sup> – 11<sup>th</sup> 2009 in Ascona, Switzerland.

## Literature

- ARE/BFS (2007). *Mobilität in der Schweiz, Ergebnisse des Mikrozensus 2005 zum Verkehrsverhalten*. Bern, Neuenburg: Federal Office for Spatial Development and Swiss Federal Statistical Office.
- Atkinson, R., & Flint, J. (2001). Accessing Hidden and Hard-to-Reach Populations: Snowball Research Strategies. *Social Research Update*, 33, 1-6.
- Axhausen, K. W. (2005). Social Networks and Travel: Some Hypotheses. In K.P. Donaghy, S. Poppelreuter, & G. Rudinger (Eds.), *Social Dimensions of Sustainable Transport: Transatlantic Perspectives* (pp. 90 – 108). Aldershot: Ashgate.
- Axhausen, K.W. & Weis, C. (2009). Predicting response rate: A natural experiment. *Arbeitsberichte Verkehrs- und Raumplanung*, 549, Zurich: ETH Zurich.
- Axhausen, K.W., & Frei, A. (2007). Contacts in a shrunken world. *Arbeitsberichte Verkehrs- und Raumplanung*, 440, Zurich: ETH Zurich.
- Axhausen, K. W. (2008). Social networks, mobility biographies and travel: The survey challenges. *Environment and Planning B*, 35, 981 - 996.
- Carrasco, J.A. (2006). Social activity-travel behaviour: A personal network approach. *Dissertation*, Toronto: University of Toronto.
- Carrasco, J.A., Hogan, B., Wellman B., & Miller, E.J. (2008). Collecting social network data to study social activity-travel behaviour: an egocentric approach. *Environment and Planning B: Planning and Design*, 35, 961 - 980.
- Carrasco, J.A., Miller, E.J., & Wellman, B. (2008). How far and with whom do people socialize? Empirical evidence about the distance between social network members. *Transportation Research Record*, 2076, 114 – 122.
- Coleman, J.S. (1958). Relational analysis: The study of social organizations with survey methods. *Human Organization*, 17, 28 - 36.
- Diekmann, A., Meyer, R., Mühlemann, C., & Diem, A. (2009). Schweizer Umweltsurvey 2007. Analysen und Ergebnisse. Report to Bundesamt für Statistik (BFS) and Bundesamt für Umwelt (BAFU), Professur für Soziologie: ETH Zürich.
- Dillman, D.A. (2000). *Mail and Internet Surveys: The Tailored Design Method*. New York: Wiley & Sons.
- Erickson, B.H. (1979). Some problems of Inference from chain data. *Sociological Methodology*, 10, 276 – 302.
- Frei, A. & Axhausen, K.W. (2007). Size and structures of social network geographies. *Arbeitsberichte Verkehrs- und Raumplanung*, 439, Zurich: ETH Zurich.
- Fu, Y.C. (2007). Contact diaries: Building archives of actual and comprehensive personal networks. *Field Methods*, 19, 194 – 217.
- Gabler, S. (1992). Schneeballverfahren und verwandte Stichprobendesigns. *ZUMA-Nachrichten*, 16, 47 – 69.
- Goodman, L.A. (1961). Snowball sampling. *The Annals of Mathematical Statistics*, 32, 148 – 170.
- Heckathorn, D. (1997). Respondent-driven sampling: A new approach to the study of hidden populations. *Social Problems*, 44, 174 – 199.
- Hill, P.B. (1988). Unterschiedliche Operationalisierungen von egozentrierten Netzwerken und ihr Erklärungsbeitrag in Kausalmodellen. *ZUMA Nachrichten*, 22, 45 – 57.

- Hogan, B., Carrasco, J. A., & Wellman, B. (2007). Visualizing personal networks: Working with participant-aided sociograms. *Field Methods*, 19, 116 – 144.
- Illenberger, J., Flötteröd, G., & Nagel, K. (2008). An approach to correct biases included by snowball sampling. *VSP Working paper*, 08-16, Berlin: TU Berlin.
- Jansen, D. (2003). Einführung in die Netzwerkanalyse: Grundlagen, Methoden, Forschungsbeispiele. Opladen: Leske und Budrich.
- Kowald, M., Frei A., & Hackney, J.K. (2008). Spatial relationships and social networks: an iterative survey approach. Paper presented at the 5<sup>th</sup> *Conference on Applications of Social Network Analysis*, Zurich.
- Larsen, J., Urry, J., & Axhausen, K.W. (2006). *Mobilities, Networks, Geographies*. Aldershot: Ashgate.
- Larsen, J., Urry, J., & Axhausen, K.W. (2008). Coordinating face-to-face meetings in mobile network societies. *Information, Communication and Society*, 11, 640 – 658.
- Marin, A. (2004). Are respondents more likely to list alters with certain characteristics? Implications for name generator data. *Social Networks*, 26, 289 – 307.
- Marin, A., & Hampton, K.N. (2007). Simplifying the personal network name generator: Alternatives to traditional multiple and single name generators. *Field Methods*, 19, 163 – 193.
- McCarty, C., Bernard, H.R., Killworth, P.D., Shelley, G.A., & Johnsen, E.C. (1997). Eliciting representative samples of personal networks. *Social Networks*, 19, 303-323.
- McPherson, M., Smith-Lovin, L., & Cook, J.M. (2001). Birds of a feather: Homophily in social networks. *Annual Review of Sociology*, 27, 415 – 444.
- Ohnmacht, T., Frei, A., & Axhausen, K. W. (2008). Mobility biography and network geography: Whose social relations are spatially disperse? *Swiss Journal of Sociology*, 34, 131 – 164.
- Ortuzar, J.D., & Willumsen, L.G. (2006). *Modelling Transport*. New York: Wiley & Sons.
- Pool, I., & Kochen, M. (1978). Contacts and Influence. *Social Networks*, 1, 5-51.
- Portes, A. (1998). Social capital: Its origins and applications in modern sociology. *Annual Review of Sociology*, 24, 1 - 24.
- Salentin, K. (1999). Die Stichprobenziehung bei Zuwandererbefragungen. *ZUMA-Nachrichten*, 23, 115 – 135.
- Schlich, R., Simma, A., Rüssli, P., & Axhausen, K.W. (2002). Entwicklung eines Tagebuchs zur Erhebung von Freizeitverhalten. *Arbeitsberichte Verkehrs- und Raumplanung*, 121, Zurich: ETH Zurich.
- Schlich, R., Schönfelder, S., Hanson, S., & Axhausen, K.W. (2004). Structures of leisure travel: Temporal and spatial variability. *Transportation Review*, 24, 219 – 228.
- Scott, J. (2007). *Social Network Analysis. A Handbook*. Thousand Oaks: Sage.
- Silvis, J., Niemeier, D., & D'Souza, R. (2006). Social networks and travel behaviour: Report from an integrated travel diary. Paper presented at the 11<sup>th</sup> *International Conference on Travel Behaviour Research*, Kyoto.
- Viry, G., Kaufmann, V., & Widmer, E.D. (2009). Social integration faced with commuting: More widespread and less dense support networks. In T. Ohnmacht, H. Maskim, & M.M. Bergman (Eds.), *Mobilities and Inequality*, (pp. 121 – 144), Farnham: Ashgate.
- Vogt, W.P. (2005) *Dictionary of Statistics and Methodology. A Nontechnical Guide for the Social Science*. Thousand Oaks: Sage.
- Wasserman, S. & Faust, K. (2007). *Social Network Analysis: Methods and Applications*. Cambridge: Cambridge University Press.
- Wolf, M. (2004). Egozentrierte Netzwerke: Erhebungsverfahren und Datenqualität. *Kölner Zeitschrift für Soziologie, Sonderheft* 44, 244-273.