# ELICITING SOCIAL NETWORK DATA

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## INTRODUCTION

Individual decision making has been a main focus in transportation modeling since the 1970s. Only very recently the awareness has emerged that many individual transportation related decisions are directly and indirectly influenced by other people, the persons belonging to someone's social network. One of the most prominent direct effects of social networks is related to the desire of individuals to meet the people of their social network, as these people fulfill basic human needs like love, care, recognition, security, pleasure, arousal, competition, etc. (Arentze and Timmermans, 2008). Hence, the desire of individuals to meet the people from their social network members results in travel. There is evidence of growing importance of the share of leisure travel, especially related to long distance travel (e.g. Axhausen and Frei, 2007).

Social networks may also influence travel decisions in a more indirect way by exchanging information and opinions. Individuals may learn about new travel alternatives from information provided by members of their social network. This information exchange in social networks may affect short term travel decisions (Han et al., 2007), but may also affect long term travel decisions (Ettema et al., 2007). For example, people may receive information from their social networks on new residential locations or job opportunities that in the end may result in a housing relocation or a new job at another location, which may structurally influence travel.

Another way how social networks may indirectly influence transportation decisions of individuals is by affecting perceptions, preferences and attitudes. This may, for example, play a role in decisions to adopt a new technology or alternative transportation modes. Individuals may compare their attitudes and perceptions to those of their social network members. As the new technology or new mode is seen as an oddity or the general attitude towards it is negative, the influence of the social network *may act as a constraint/barrier*. Conversely, as the new technology or mode becomes more widely adopted and a social norm in the social network or society at large, *social influence could become a facilitator*. In general, one's own knowledge relative to the network members that adopt a new technology or mode, the strength of their ties and their credibility may all influence an individual's attitudes and behavior. Understanding how social influence in social networks works, may also be important for programs that intend to change travel behavior or attitudes, like for example, car reducing programs (e.g. Sunitiyose et al., 2007).

A final effect of social networks is that social network members may facilitate activities and travel. For example, by taking care of the children or animals or watching the house, social network members facilitate that individuals can engage in activities that may induce travel. In this context, also lending transportation vehicles and ride-sharing by network members may facilitate travel (e.g., Lovejoy and Handy, 2007) can be mentioned.

Hence, it is argued that social networks influence transportation related behavior and hence, by studying the social networks of individuals we will be better able to understand travel behavior. Social network analysis conceives social structure as a social network, that is, a set of actors (nodes) and a set of relationships connecting pairs of these actors (Tindall and Wellman, 2001). The actors included in a social network may represent different entities, such as groups, organizations, nations, but most often are persons; and *ties* represent any type of relationship or flow of resources among the actors. The core concern of the social network paradigm is to understand how social structures facilitate and constrain opportunities, behaviors and cognitions (Carrasco et al., 2008).

Although the acknowledgement of the need to study social networks in relation to travel behavior is growing, there is not much experience with collecting social network data in the transportation field yet. This paper aims to contribute to this literature by providing an overview of network elicitation techniques, mostly developed and applied in other fields of research, especially, in sociology. The pros and cons of these elicitation approaches will be discussed as well as some applications in transportation research. This paper ends with drawing some conclusions and discussing issues for further research.

## EGO-CENTERED SOCIAL NETWORKS

A social network is the collection of all nodes and ties of a population. Studies focusing on complete networks often start with a complete list of all network members. In principle all network members are then asked to report on the relationships with the other network members. This whole network approach is feasible if one studies social networks that are naturally bounded, for example, small communities, neighborhoods, associations or work organizations. However, social networks of persons relevant for travel behavior are generally not geographically or otherwise delineated a-priori. Hence, as the nodes and ties of a population are generally not all known beforehand or because different populations are difficult to distinguish, it is usually impractical to collect data of a complete network. An alternative is to collect data on personal or so-called ego-centered networks. This involves that data are collected of a sample of individuals (*egos*) on the persons with whom they have relationships (*alters).* Thus, in these studies, the ego typically is the sole informant on characteristics of the social network members, their characteristics and the ego-alter relationship. The challenge in the ego-centered network approach is to compose the social network of each ego.

Campbell and Lee (1991) stated that 'the task of identifying network members is not as simple as asking respondents "Who do you know?"'. Research by Freeman and Thompson (1989) and Killworth et al. (1990) demonstrated that adults in the U.S. and Mexico can name up to 1,500 acquaintances. In order to elicit manageable lists of persons with whom the respondent (ego) has had more than passing contact, stringent bounds are necessary in asking about network members. A variety of constraints have been used in name generating questions. Among others, Lee and Campbell (1991) distinguish the following types of constraints. A first constraint often applied is that the content of a relationship or the role is defined in a name generator. For example, egos are requested to name their neighbors or to name the persons with whom they feel emotionally close. A second constraint used is a geographic boundary, where respondents are asked to name only those persons living within a stated area, such as a neighborhood or municipality. A third constraint is that ego is requested to name only those persons with whom they had a certain type of contact or exchanged help or support within a defined past time frame (for example, 6 months or a year). In addition to narrowing the pool of possible alters, time frames are presumed to enhance respondent accuracy in reporting ties to others. A final constraint that is sometimes applied is that egos are limited to only a certain number of alters, for example, only to list the first five persons who fit the criteria of the name generator in question. Applying different constraints or combinations of them has led to a range of different questions to elicit the social network, called name generating questions.

## NAME GENERATORS

In his overview of methods used to delineate personal networks, van der Poel (1993) distinguished four approaches: the interaction, the role relation, the affective and the exchange approach. Mainly following van der Poel (1993), each of these four approaches and their merits and limitations for travel behavior research will be discussed in the following.

### Interaction approach

The *interaction approach* uses interpersonal contacts as the criterion of inclusion. It simply asks people to keep a record of all contacts they have had during a certain period of time. Sometimes a quicker but less reliable method is used, namely asking to recall all the contacts of the last week or another specified period of time.

An advantage of this approach is that a contact or interaction can be clearly defined by the researcher. For example, 'talking to each other face to face' will probably be interpreted in the same way by all respondents and may therefore result in a fairly objective measurement. A main disadvantage of the interaction approach however is, that it does not take into account the content of the relationship. A mere contact, for example, a colleague with whom one discusses a work-related problem only, or the baker or cashier in you work location restaurant with whom one has contact nearly every day does not necessarily imply interactions across various contexts and therefore does not necessarily imply a personal relation that may be relevant for travel related behavior. Hence, it may be concluded that applying this method without using any further constraints very likely generates too many persons that are not relevant for studying an ego's travel attitudes and behavior.

For recording interactions for a certain period of time some studies used contact diaries. In this approach, respondents are requested to record all contacts they have during a day over a certain period of time and often also provide information on the relationship they have with each person contacted. For example, in a pilot study Fu (2005) requested three respondents to complete such a diary for a period of 3 to 4 months. He concluded that this provided very rich information on all of ego's contacts, both on weak and strong ties and about persons an ego sees on a daily basis, but also those that live far away with which one has contact less frequently. Furthermore, it provided information on the dynamics of the social networks. However, filling out these diaries for such a long period of time took respondents about 45 to 60 hours to complete,

which requests too much effort for most respondents, unless substantial compensations are used, making this method very costly. On the other hand, using shorter time periods has the disadvantage that a sample rather than a full network is revealed in each case. Nevertheless, if the sample of ego's included in the survey is large enough, a sampling procedure like this may still yield useful data for relevant analyses.

**Role approach**

The formal or role approach requests the ego to name all alters of a particular chosen role, such as close kin, neighbor or friend. This approach assumes that individuals are primarily influenced by the people with whom they have a culturally circumscribed role relationship that is accompanied by a specific set of expectations, obligations and rights (Kleiner and Parker, 1976). In many studies the research was limited to one or a few of these role relationships, for instance the family, relatives, neighbors and friends; other, such as for example, pure business like contacts were ignored (e.g. Laumann, 1973; Litwak and Szelenyi, 1969; Sudman, 1988)

However, by including some role relations while excluding others, one implicitly assumes that some roles are important for, in our case, travel behavior while others are not. In reality, the relevance of particular role categories tends to differ between persons. For example, not all respondents will have meaningful relationships and are substantially influenced by their relatives. Some of them may even have lost all contact. Others don't know their neighbors. Furthermore, despite that role relationships are culturally circumscribed there is still a large variation between individuals in the actual content of these relationships. In particular, in the literature it is widely discussed that the definition of friend varies widely in different segments of a population, for instance, between working-class and middle-class people (e.g., Burt, 1983). Hence, asking respondents to name their friends will produce answers that will be difficult to compare across respondents. Finally, this method overlooks those relationships that are not defined normatively but may nevertheless influence travel. For example, a fellow member of an organization may influence an individual's choices to travel to a meeting.

To conclude, this approach potentially leads to a lack of control over revealing those contacts that are relevant with respect to travel behavior. On the one hand, it may generate names that are irrelevant and, on the other hand, it may overlook some contacts that are relevant. Hence, the role approach does not seem a complete and efficient way of eliciting the part of the social network relevant for travel behavior research.

**Emotional or affective approach**

The emotional or affective approach assumes that social relationships are defined as a personal bond based on positive feelings or care between ego and alter. Hence, the subjective value a relationship has for a person is the starting point of this approach. People are asked, for example, to name the persons with whom they have a close personal relationship (Wellman, 1979) or the ones who are especially important to them (Kahn and Antonucci, 1980).

In the field of transportation, the study by Carrasco et al. (2008) applied the affective approach drawing upon the earlier work of Wellman (1979). In this study, respondents were asked to name the persons who live outside their household, with whom they felt very close and somewhat close. Very close people consist of those persons with whom the respondent discusses important matters *or* regularly keeps in touch with, *or* are there for them if they need help. Somewhat close people were described as those persons who are more than just casual acquaintances, but not considered to be very close. The authors state that the choice of eliciting only persons outside the household was made to simplify the name generating process, but that information about household characteristics from other parts of the study partially helped to gain some insight in the household dynamics. Furthermore, the authors emphasize that their approach directly identifies which ties are strong and which are weak. Furthermore, by excluding the people who are only casual acquaintances, they concentrate on social travel.

The main advantage of the affective approach is that the importance of a relationship is determined directly by the individual itself. However, this is at the same time a major disadvantage as the researcher does not know which criteria are being used in these subjective evaluations of the importance of relationships. As different people may use different criteria, it is difficult to compare the personal networks thus delineated. Finally, by excluding less intimate relationships, such as colleagues and acquaintances, some alters that are relevant for travel behavior may be completely ignored. For example, although I may not have a personal bond with my parents in law, social norms require that I visit them once in a while. In sum, although this seems an attractive elicitation approach which is also appealing to respondents, the resulting networks may be difficult to compare across respondents and relevant persons may not be included.

**Exchange approach**

A final elicitation approach is the exchange or transaction approach, which defines social relationships in terms of clear and concrete transactions or flows of recourses. This approach has its roots in the theory of social exchange (e.g. Homans, 1961). A basic assumption is that "people who are sources of rewarding interactions will be particularly important in shaping respondents' attitudes and behavior" (McCallister and Fischer, 1978). These rewarding interactions are operationalised resulting in a set of specific criteria for delineating the personal network. Examples of questions asked are "With whom do you talk about personal worries?" "With whom do you engage in social activities (like inviting home for dinner, or going to a movie)?" and "Who, if any, helped you with household asks in the last three months?".

The basic premise of the exchange approach is that persons with whom we maintain exchange relationships and therefore interact on a regular base are meaningful and important for us and therefore these persons belong to our social network. In order to increase the possibility that persons identified have a personal relationship with the respondent, diverse interactions across several behavioral and situational domains need to be present in the list of name generating questions. Name generating questions used therefore often cover a wide variety of socio-emotional, instrumental and informational exchange relation situations. In order to insure that elicited networks are comparable across respondents, those questions need to be as straightforward as possible, leaving little room for different subjective interpretations. Hence, this elicitation technique explicitly uses the actual content of the interactions as a delineation technique and therefore provides one the full flexibility to tailor the delineation method to the specific focus of the study at hand.

The study in the transportation field by Frei and Axhausen (2007) may be regarded as an application of the exchange approach. In this study, two name generating questions were formulated. The first name generator asked for persons with whom the respondents "discuss important problems, with whom you stay in regular contact or which you can ask for help". Hence, this name generator combines three exchange name generating questions in a single question. The authors argue that this question identifies the "very close" or "most important" network members and, hence, the core network. The second name generator asked for persons with whom the respondents spend leisure time every now and then. The authors state that this generator targets weaker ties, which they believe are relevant and play an important role in explaining leisure travel that makes up the largest share of long distance travel.

In general, the exchange method requires formulating a bundle of concrete questions to elicit the network that can be tailored to a specific study and probably therefore is the most precise elicitation techniques. After reviewing the four approaches, van der Poel (1993) came to the conclusion that the exchange approach is the most promising one if one is interested in delineating a clearly and objectively defined part of the personal network. It is expected that respondents will, to a much larger extent compared to the affective approach, interpret the delineating questions in the same way. Differences in personal network size and composition are then true differences and not artefacts of the method used. Furthermore, the name generators in this approach can be formulated in such a way that only the relevant persons for the study's purpose are included in the network. Yet, the exchange approach is not widely employed as many researchers think it is too complicated and too time-consuming, and therefore they take refuge with one of the other methods or a combination of them. Van der Poel (1993) has however shown that a subset of 5 questions from a usually applied 10 questions set is able to trace a substantial and representative part of the total personal support network, which is easy to administer. These include questions on topics as "discussing major life changes", "help with jobs around the house", "borrowing things", "going out together" and "visiting". There is a remarkable resemblance of these five topics and those that Frei and Axhausen (2007) included in their two name generating questions. The biggest difference is that in van der Poel's instrument five different questions are posed instead of only two in the Frei and Axhausen instrument and that in the former instrument spending leisure time is more concretely operationalized as "going out together" and "visiting".

**Forgetting network members**

Many researchers eliciting ego-centered networks implicitly assume that ego has named every person which meets a certain criterion described by the name generator. Some attention has been paid in the literature to the question to what extent this is true. Based on a review of about 20 papers, Brewer (2000) drew the following conclusions with respect to forgetting to mention network members. People tend to forget a substantial proportion of their social contacts when asked to recall them. Although no good predictors of the proportional level of forgetting appear to exist, it has often been reported that the rate of forgetting increases as network size increases (e.g. Bell et al., 2007). Persons with whom ego has weak ties are more likely to be forgotten than persons with whom ego has strong ties. Non-specific prompting may encourage people to search their memories more thoroughly, and may increase the number of recalled persons by a modest

amount. One study showed that forgetting can influence the measurement of various structural properties of social networks.

The latter finding was confirmed by a more recent study of Marin (2004), who examined the extent to which persons are randomly forgotten. To that effect, she first elicited the network members of a group of 24 mainly college students applying a single question name generator (with whom did you discuss important matters in the last 6 months; see the famous GSS name generator that will be discussed later). Then she asked respondents to think of specific groups or (voluntary) jobs they were recently engaged in and to think about anyone of their family, high school or dormitory with whom they discussed important matters. On average 5.6 persons were elicited with the original name generator, while additionally 7.1 persons were listed after prompting. An analysis comparing those originally listed to those listed after prompting turned out that those with whom egos feel especially close and those alters that know more network members have a higher probability to be named in response to the GSS name generator. These results confirm that, as will also be discussed later, single name generators elicit only a subset of the population of alters and that this subset is not a random subset, but biased towards the persons egos feel more close to and those who know more of an ego's alters resulting in biased measures of structural properties of social networks. On the other hand, this study confirms the notion that the GSS name generator elicits the ego's core network. Instead of using only a single name generator, Brewer (2000) argues that applying multiple elicitation techniques generally results in fewer forgotten social network members and should therefore be applied whenever appropriate.

## NAME INTERPRETERS

Once all alters are elicited, the respondent (ego) is usually requested to provide information on each alter, i.e., information on the other nodes in the network, and on the type of relationship they have with their alters, i.e., information on the ties. For the purpose of travel behavior analysis, name interpreters may in addition include questions on locations, travel times, transport modes used, etc. Generally, such questions are called name interpreters and typically include socio socioeconomic characteristics (gender, age), formal roles ('in which way you know …."), frequency and type of contacts (face-to-face, telephone, internet), and travel related questions (distance, travel time, etc.) (Marsden, 2005). As answering name interpreters for all elicited network members may enlarge respondent burden, some researchers limit the number of alters for which this information needs to be provided. Although less methodological studies have been devoted to name interpreters compared to name generators, the studies that have been

conducted indicate that respondents are able to report on many characteristics of their alters with reasonable accuracy (Marsden, 1990).

In population-wide-network studies, there is often an interest in measuring the density of the network, that is, a measure of how well alters know each other. In ego-centered networks this tasks involves a lot of effort from respondents, because they have to provide all the information on all alter-alter relationships, a task that increases exponentially with the number of network members. To reduce respondent burden, therefore, respondents are often requested to provide responses for only a randomly chosen subset of network members, say 5 members. Averaged across respondents, this sampling procedure appears to provide a good estimate of network density.

In the transportation-related survey of Carrasco et al. (2008) the name interpreting questions were limited to only 15 sampled network members, which were randomly drawn from both the strong and the weak ties. Two sets of name interpreting questions were asked for this sample. First, this involved information about each alter's characteristics, including age, type of relationship, job and ethnic heritage. In addition, two geographic locations were recorded: alter's home location, and the most frequent place of interaction with the respondent. Second, information was gathered about the ego's communication and interaction patterns with each alter: face-to-face, socializing and media that potentially could substitute face-to-face interaction, such as telephone, email, and instant messaging. Face-to-face interaction and socializing were explicitly distinguished to allow differentiating between instrumental interactions (such as those existing in workplaces) and social interactions (visiting, hosting, going to pubs and restaurants). Finally, it was recorded who generally starts or triggers the interaction and which technology is used for this (e.g., cell phone versus landline).

In the earlier discussed transportation oriented survey of Frei and Axhausen (2007), the following name interpreters were included. First, it was asked how ego and alter got to know each other, how long the relationship exists, the frequency of contacts by different modes (face-to-face, telephone, email and sms – short message service via mobile phone), where they met the last time and the contact's place of residence. The origin of the acquaintance was categorized as family (first degree, relatives or partner), from work, from education or through others (partner or others). Furthermore, frequency of contacts was recorded and alter's address of residence (postcode, municipality, street and house number).

In order to model travel demand stemming from the social network, one would ideally include more name interpreting questions on travel involved in realizing face-to-face contacts, like for example, usual choices of transport mode, departure time, traveled route, travel party, joint social activity participation and possibly others. However, as

experience learns that collecting the responses to the typical name interpreters discussed above already results in quite some respondent burden, it may not be feasible to collect these data for all network members. Sampling from all network members may then be a solution as discussed before. Another solution is to collect these data by requesting respondents to fill out diaries, in which for a limited period they record all the contacts they had and provide the requested travel information in each case. In this way, one can collect more detailed information on specific social interactions rather than just average, typical or the last social interaction an ego has had with a given alter. Travel diary data may also be used to validate the applied network elicitation method, for example, regarding the completeness and possible biases caused by failing to reveal a network exhaustively. In this way, one can explore and compare the advantages and disadvantages of different approaches and possibly identify a way of combining different approaches that provides the best results.

## A COMPARISON OF ELICITATION METHODS

Campbell and Lee (1991) summarized the results of four studies that applied different elicitation methods. Three of these studies were well known studies at that time, while a fourth study concerned their own study. We briefly describe the methods used in these studies to elicit social networks, which also serves as an illustration of the elicitation approaches earlier described. We complete this overview with the results presented in Frei and Axhausen (2006).

The first study was the East York (EY) study by Wellman (1979). Respondents in that study were asked to name six “persons outside your home that you feel closest to.” The study of Carrasco et al. (2008) discussed earlier is a follow up of this study. Hence, this study applied the affective approach.

The second study concerned the Northern California Communities Study (NCCS; Fischer, 1982). In this study, respondents were asked to name all persons who would provide any of eight types of aid (such as watching one’s home or discussing personal matters). Furthermore, they were asked to list adult members of their households, fiancées, and others “important” to them. The first 8 names given in response to each question were recorded. This study was the first to apply the exchange approach, while also elements of the role approach are added.

The third study was the General Social Survey (GSS; Marsden, 1987). The 1985 network “module” was the first representative national survey of ego-centered networks. Respondents named all persons with whom they had (in the previous six months)

"discussed matters important" to them. Although respondents could name as many alters as they wished, no more than five names were recorded, and networks containing more than six alters were classified into a single category. Networks could include the persons with which the respondent shares a household. This study may be characterized as an example of the exchange approach with only a single name generating question. The network elicited by this method is often called the *core network.*

The fourth study was the Nashville Neighborhood Study (NNS), conducted in 1988 (Campbell and Lee, 1991). Respondents were requested to list all neighbors living in the nearest 9 or 10 houses who they knew by name, marked on the maps where these neighbors lived. They then indicated which ones they had either chatted with for at least 10 minutes or visited at home in the previous six months. Thus, this study placed neighborhood boundaries to the network members, in contrast to the other three studies that did not. This study may be classified as a combination of the role approach and the interaction approach.

Although the samples used in the four studies differ, Campbell and Lee argue that the samples are general enough to interpret at least part of the differences they identified as effects of the name generator rather than sample characteristics. The social networks generated in these four studies were compared with respect to size, composition and range, density and cohesion, and characteristics of ties. We only summarize the findings with respect to size and composition here.

As expected, remarkable differences were found in network size. The average network size in the GSS study (discuss important matters) was 3.0, in the EY study ('feel closest to') 4.7, in the NSS study ('known neighbors') 14.7 and in the NCCS (using 11 name exchange name generators) 18.5. The abbreviated version of the latter study applied by Frei and Axhausen (2006) including only two broad name generating questions elicited on average 12.4 persons, hence, fewer persons then the full version. The difference between the GSS and EY study is mainly caused by the restriction that important matters are discussed and the applied time restriction of the past 6 months, as only 5.5% of the respondents mentioned more than 5 persons (although only the first five mentioned were recorded, there was no limitation imposed on mentioning them). These results indicate that the use of intimate name generators results in networks that are quite small. Overall, it can be concluded that the different elicitation approaches and the use of restrictions therein influences the elicited network size, were the exchange approach results in the largest and therefore most complete network.

In a comparable overview of different network elicitation approaches, Frei and Axhausen (2007) included the some results that were not included by Campbell and Lee (1991). Frei and Axhausen reported that the share of relatives was the highest in the GSS

study (0.61), followed by the EY study (0.50), the NCCS (0.44) and finally their own IVT study (0.31). This suggests that exchange methods result in larger shares of non-relatives, while the affective approaches elicits larger shares of relatives. Furthermore, the lowest shares of weak ties are found in the EY study (0.18) and the GSS study (0.23), while both exchange approaches generated larger shares of weak ties: 0.32 in the NCCS study and even 0.48 in the IVF study. In sum, these results suggest that networks elicited by the affective approach and GSS approach ("discuss important matters") are smaller and tend to be confined to relative-based intimate networks with stronger ties, often called the core network, while the exchange approach elicits more additional members resulting on smaller shares of relatives and higher shares of weak ties.

On the other hand, Campbell and Lee report remarkable similarities with respect to the composition of the networks. For example, the percentage of alters of the same sex was 58% in all 3 studies that recorded this. Average years of education was 13.1 in the NSS study and 13.5 in the GSS study. These results suggest that different name generators may produce comparable results with respect to network composition.

## CONCLUSIONS AND DISCUSSION

In this paper, we have discussed different ways of eliciting social networks and reported some empirical evidence about systematic differences in results. This discussion has shown that different ways of eliciting social networks generate different degrees and kind of biases. It is important to keep this in mind when designing a social network elicitation survey.

In transportation research, attention for social networks to date has served two purposes. First, maintaining social networks involves travel. Secondly, social networks are one of the triggers for learning new travel options and exchanging information/forming mutual attitudes. In the former case, the role approach or the exchange approach, developed with particular activities in mind, may be the most interesting elicitation method as it implies a classification of roles that can be directly linked and interpreted in terms of specific activities and associated travel. In the latter case, the emotional approach or exchange approach seem most appealing. It should be emphasized however that these qualifications are based on the general properties of the various elicitation methods and results obtained in other application domains. Systematic comparative methodological research in the travel domain is urgently required to provide empirical evidence on the usefulness of different elicitation methods.

Validating a network elicitation technique (for travel behaviour research) based on data from contact diaries of a same sample of respondents seems a particularly promising approach. A contact diary of a person can be viewed as a weighted random sample of members of the network of that person. It is a weighted sample in the sense that those members with which the respondent has more frequently contact have a higher probability of occurring in the diary. The elicited network of the same person (augmented with contact frequency information) provides an indication of the likelihood of finding the particular sample, *given the assumption that the elicitation method is unbiased*. Vice versa, this means that the likelihood of the sample assessed on that basis gives quantitative information about the extent to which the elicitation technique is bias free. The definition of what bias is depends on the research aim for which network data are collected. A contact diary can be designed in such a way that it captures exactly the categories of social interactions one is interested in. Given such a design, the elicitation technique that maximizes the likelihood of the sample could be identified as the technique that minimizes the bias in the context of the research aim. This opens the way to compare systematically and quantitatively the validity of different elicitation techniques for travel behaviour research purposes.

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