An examination of the relationship between social interactions and travel uncertainty ☆

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ABSTRACT

Recent advances in travel behaviour research hypothesise that travellers, in particular under uncertain conditions, take a number of decisions not in total independence but as members of a social network. The travel decisions could relate to a range of choices including transport mode choice and time of departure. This paper seeks to provide an answer to the following question: Do travellers, both prior and during travelling, refer to their social network when taking travel decisions in uncertain conditions?

An internet-based survey was conducted with over 2000 respondents in the two United Kingdom cities of London and Glasgow. Respondents were asked to name those within their social network and to provide information on their contacts including age, gender, relationship length, car availability, and the type and frequency of social interaction.

Insights are also provided from the analysis of relationships between an individual's socio–demographic characteristics, their ego-centric social network, their social interactions and the location in which they live, through the use of clusters analysis, and how this links to two key travel behaviour aspects: who respondents would turn to in particular for advice on travel decisions, and who (and why) they would contact, if they were experiencing an uncertain situation while travelling. It is shown that the first named member of the social network member is a key person for individuals facing travel uncertainty, and that individuals will turn to others, often within their social network, for emotional as well as decision-making support. In addition, older people, those with a lower number of contacts, and those living in smaller households are more likely to decide by themselves in uncertain travel situations.

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1. Introduction

There has been increasing recognition within travel behaviour research of the importance of both social (e.g. interactions between individuals) and spatial (e.g. the influence of the locations where individuals live) environments in shaping preferences and choices (Dugundji and Walker, 2005). There are a number of reasons why social, as well as spatial, influence should be considered when analysing transport situations. First of all, social motifs often generate the need of travelling (Carrasco and Miller, 2009; Farber and Paez, 2009; van dern Berg et al., 2012), and travel behaviour and mobility are therefore motivated and shaped by the need of interacting with other people as well as their locations in the geographical space. Secondly, exchanging information with other individuals

in the social space has been identified as an important strategic tool for travellers, together with personal experience and information from transport operators (Avineri and Prashker, 2006; Denant-Boemon and Petiot, 2003), for general travel decisions, and when facing uncertainty due to day-to-day variability in the performance of the transport systems (Bonsall, 2004), as travellers often react and cope with uncertainty not individually but as members of a social network (Barton, 2011; Schwanen, 2008). This can happen in case of minor congestions or partial road closures during road works, as well as during severe disruptions caused by adverse weather conditions.

Social networks are therefore an important source of information and decision support for individuals in the planning of activities and related trips, as they represent relatively low-cost choice heuristic solutions. Their support to decision-making can materialise in various way. Travellers may either simply conform to the behaviour of others (observed or unobserved) or directly ask for suggestions when choosing a departure time, a route, a mode or a vehicle. Neglecting the consideration of social interactions in the analysis of the way travellers generally behave, and perceive and react to uncertainty can therefore leave aside important

aspects that need to be considered, especially when transport operators and local or national authorities have to deal with various types of disruptions.

Social influence on individual behaviour may come from the overall society, and therefore based on simple observation or belief, or from a more restricted group of individuals the decision makers have contacts with. These groups have often been defined in the existing studies in accordance with general information that has rather reflected data limitation than research purposes (Soetevent and Kooreman, 2007), as a proper identification of the individuals likely to have a considerable impact on choices can be complex. In many cases, data and resource limitations have forced researchers to define reference groups using common sample characteristics as a proxy of reference and therefore limit their analysis to anonymous rather than named networks. For this reason, in recent years, economic choice theory, and transportation research, have begun to borrow the sociological concepts and methods of Social Network Analysis (SNA) (Carrasco et al., 2008; Carrasco and Miller, 2009; Sunitiyoso et al., 2011).

This paper seeks to provide an answer to the following question: Do travellers refer to member(s) of their social network when taking travel decisions in uncertain conditions? The transport-related behaviour examined in this paper relates to two aspects of travel decision-making: who respondents would turn to in particular for advice on travel decisions, and who (and why) they would contact, if they were experiencing an uncertain situation while travelling. As mentioned above, understanding this process is of particular importance to transport policy-makers for two main reasons. First of all, transport operators need to know how their users may react to uncertainty in order to better shape their contingency plans. Second of all, it is important to understand how information travels amongst users (and non-users) in order to better plan both marketing and emergency communication efforts.

The paper is organised by firstly providing a background to the SNA approach and the implications for a travel behaviour survey conducted in the two United Kingdom cities of London and Glasgow. Secondly, the methodology behind the survey is presented. Thirdly, the survey results are analysed and discussed. Within this section background spatial/socio-demographic information and social network characteristics are presented, a cluster analysis is performed on these spatial and social elements, and then these results are applied to the survey questions relating to travel both generally and in uncertain situations. Finally, some conclusions are drawn.

2. The Social Network Analysis (SNA) approach and implications for a travel behaviour survey

Sociological theory defines social networks as the sum of personal networks, which represent the group of persons (alters) with whom a given individual (ego) considers having a link of any nature and has contacts with over a lifespan (Degenne and Lebaux, 2005). Social networks have two main components: actors (persons, groups, organizations) who interact with each other, and relationships. The latter can be derived, for example, from control, dependence, competition, and information exchange (Carrasco and Miller, 2009). The main objective of SNA is then to explore these links between people and organizations, their formation and their dynamics (Larsen et al., 2009). The ties forming social networks appear and disappear and have a considerable variability in their intensity over a life time, and choices made by their members in different situations have also an important

effect on their structures and dynamics (Bidart and Degenne, 2005; Feld et al., 2007).

In practical terms, in sociological analysis, various survey techniques have been used to identify personal and social networks and assess their structure and dynamics. Among these techniques, the name generator appears to be one of the most popular tools. Other methodologies involve identifying social contacts by using personal sources (like social media contacts, email address books) or institutional sources (like memberships to clubs, mailing lists etc.). In transport settings in particular, travel diaries have been used to identify social contacts (Axhausen, 2008).

The name generator technique identifies the social network members through in-depth interviewing techniques whose purpose is to identify, for example, the people with whom respondents discuss important matters, the people they really enjoy socialising with, and the people they have the most contacts with (Carrasco and Miller, 2009; Marin and Hampton, 2007). Interviewees reveal first a set of alter names and then information about their characteristics in order to assess the nature and magnitude of the relationship (Carrasco et al., 2008).

The identification of members and the consequent assessment of the size of the network and the nature of the relationships are only the first steps in the definition of the structure of a network. When the purpose of SNA is to identify social activities (i.e. travel) that can be performed by the various members individually or in group, it is also necessary to assess the potential activity level between alters (Carrasco and Miller, 2009). The activities the individuals undertake in both their social and geographical spaces have an important impact on the probability of meeting another individual. Then, the probability of beginning a social interaction depends on the size of the agents' current networks and their need for information. The agents' utility depends on the similarities with the other agents and how the interactions with them satisfy their social and information needs. Trust and credibility play an important role as well (Arentze and Timmermans, 2008).

3. Methodology

An internet-based survey instrument was developed through two workshops (March 2010, January 2011) attended by a number of experts in both travel behaviour and SNA, and two pilot tests (November/December 2010 and April 2011) on a combined sample of 170 respondents. The main survey was distributed between August 2011 and February 2012, to over 2000 respondents, split equally between the United Kingdom cities of London and Glasgow. Quotas were set for age, gender and socio-economic characteristics of respondents.

Internet surveys have been a popular tool amongst researchers in recent years. They possess considerable cost and time advantages over equivalent mail, phone or face-to-face surveys. However, they seem to generally produce lower response rates and fail to cover those segments of the population which are not connected. In particular, internet respondents are generally more educated than other types of respondents (Olsen, 2009). It has to be observed though, that recent studies in the environmental economics literature, for example, have provided evidence that internet surveys do not seem to produce biased results with respect to face-to-face interviews (Hatton MacDonald et al., 2010; Lindhjem and Navrud, 2011).

Glasgow respondents were sampled from the entire urban area of the city. Due to the large population size of London, spatial information could be examined by focusing on selected sub-areas. The London respondents were sampled from four sub-areas (represented as London Borough areas) selected according to the following criteria: one from each of a North-East-South-West quadrant, a

balance of Inner/Outer sub-areas, a range of deprivation levels,[1] and no neighbouring sub-areas.[2]

The survey contained a Social Network Analysis section, a stated preference experiment on long-distance travel, a section exploring experience of travel under weather uncertainty, and environmental attitudes, in addition to the usual questions relating to personal/household demographics (for more information about the survey please also see Zanni and Ryley, 2013).

In the initial analysis, the following background spatial and social characteristics of the sample are examined:

- Spatial – individual: Respondent lives in London or Glasgow. The London sample can be split further into the four London sub-areas.
- Social – individual: Background socio-demographic characteristics of the sample (age, gender, income, household composition, life stage).
- Social and spatial – network: Characteristics of the individual's social network and links with alters (number within social network, live within the same neighbourhood, length and type of relationship, frequency of communication).

In order to assess respondents social networks, a simple name generator was used, as survey participants were asked to provide the list of persons "they have regular contact with, and/or who are the most important to them, and/or those they would want help to discuss personal matters, and/or those they can trust, and/or those they really enjoy socialising with". Respondents were able to name people living with them. This was undertaken in order to reflect the importance of household members in both travel decisions and support while travelling. For each of the contacts, respondents were then asked to first indicate whether the particular person lived with them, the type and length of relationship, and the type and frequency of contacts (by various means like face-by-face, phone, text messages, email and chat). Respondents were also asked to indicate which of their contacts they turned to for advice on travel decisions, and, in particular, who (and why) they would contact if they were experiencing an uncertain situation (like a service delay or cancellation) prior or while travelling. Fig. 1 shows a screen shot of one of the Social Network Analysis questions.

With over 2000 respondents, the travel behaviour survey dataset contains a larger number of egos than is typically undertaken (e.g. Kowald et al., 2012) and therefore is very rich in terms of ego-centric social network information. However, given the broad nature of the data collection effort, covering a range of topics and methodologies, it was not possible to conduct follow-up alter-based surveys, so-called snowball sampling techniques, to collect information on social networks (Kowald et al., 2009) and therefore verify the information about the alters reported by the respondents, or to assess the likely influence of social network members based on information such as trust, credibility, and the relative power of their members.

Given the large number of individuals within the dataset, together with the range of social and spatial variables, it was considered appropriate to classify the information into manageable subgroups. Cluster analysis is applied to the dataset to establish homogeneous groups of respondents, for both the London and Glasgow sub-samples, in advance of the travel behaviour analysis. It is a useful approach before exploring relationships between the cluster groups and travel both generally and in uncertain situations.

Cluster analysis is a suitable approach to classifying the data as it performs objective data reduction and recognises the inter-relationships between the variables (Hair et al., 2005), and has been used in a range of travel behaviour research examples (Anable, 2005; Campbell et al., 2012; Ryley, 2006). Using an appropriate algorithm (Wards methods in this instance), the sample is sub-divided into a small number of mutually exclusive groups based on similarities and differences between individuals. Unlike discriminant analysis, the groups are not pre-defined. Due to the nature of cluster analysis, a non-parametric test, there are no strict assumptions, although the variables must be independent. It is acknowledged that the cluster analysis technique generates suggested groups rather than definite solutions, and that although analysis should be undertaken without any pre-conceptions of the user, the results do depend on their judgment.

Relationships between the cluster analysis groups generated, together with the background social and spatial information were examined against the transport-related information within the survey questions for travel both generally and in uncertain situations. This was undertaken in order to look for a link, within and across clusters, between general travel behaviour, socio-economic characteristics, and reaction to uncertainty. General travel refers to car availability and frequency of using certain travel modes (motor car, public transport), whilst travel in uncertain situations concern two components: who respondents would turn to in particular for advice on travel decisions, and who (and why) they would contact, if they were experiencing an uncertain situation while travelling. The reasons why the respondents would contact a specific person are provided in an open-ended question and a coding framework was generated for the most popular responses. The framework covered elements such as the experience, knowledge and personality of the traveller, as well as the nature of the relationship, for examples as a spouse/partner or family member.

4. Results and discussion

4.1. Summary of the sample: Spatial and socio-demographic characteristics

After a number of thorough checks (on consistency across sections and engagement with the survey), the usable dataset was composed of 2027 respondents with the following geographical spread:

- 1037 from London: 248 Barking and Dagenham with Newham, 250 Barnet, 209 City of Westminster, 330 Merton with Wandsworth.
- 990 from Glasgow.

Selected background socio-demographic characteristics of the sample are:

- Gender: 41% males, 59% females.
- Age: The average age of respondents is 43 years old.
- Status: 50% of respondents are working full time, 11% part-time, 10% are retired, 6% self-employed, 6% are in education.

Most of the socio-demographic characteristics are to be expected, although there is a high proportion of female respondents

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[1] Deprivation levels were measured using the Index of Multiple Deprivation, which incorporates income, employment, health, education, housing and service provision, crime levels, and living environment indicators (McLennan et al., 2011).

[2] The neighbourhoods selected for London were Barking and Dagenham (extended during the survey to include the neighbouring Borough of Newham), Barnet, the City of Westminster, and Merton (extended during the survey to include the neighbouring Borough of Wandsworth). In terms of Index of Multiple Deprivation quintiles (when compared across the UK levels), Barking and Dagenham is in Quintile 1 (the highest level of deprivation), Barnet and the City of Westminster are in Quintile 2, and Merton is in Quintile 4.

Fig. 1. An example of a screen shot for the Social Network Analysis question asking whether the people within the social circle live with the respondent (*note*: the five named examples are fictitious).

despite the implementation of survey quota (no more 60% of respondents to be male or female).

4.2. Social network characteristics

Respondents could name up to 30 members of the social circle; 29 respondents named the full 30 members available, whilst 193 respondents did not list anyone. This is certainly a considerable number and it is acknowledged that some of these respondents, although a tiny minority, given the number of consistency checks, may have express a protest response to a question which may intrude on their privacy. The length of the survey may have also played a role here. This represented a total number of 13,022 alters within the sample. The most frequent number of contacts listed was five (219 respondents, 10.8%). Around half of respondents named between three and seven contacts (932 respondents, 46.0%); most respondents had between one and eleven individuals within their social circle (1572 respondents, 77.6%).

The average number of contacts[3] was 6.4. This is lower than all of the five SNA datasets (across four countries) within Kowald et al. (2012), which had a reported average number of contacts between 11.9 and 23.9. Moreover, while some of those surveys did not con-

sider alters living with the respondents, our data collection effort did, and therefore differences are higher.

We can identify a number of possible reasons to explain the differences between our results and those from the travel-related SNA studies reviewed by Kowald et al. (2012). First of all, the difference is likely to be a function of the internet-based data collection used here, and fatigue and problems of recall may have certainly played a role. Second, nationality is also likely to have played a role. Although we are not aware of any recent study quantifying the average size of personal networks in the UK, it is noted that four of the studies reported in Kowald et al. (2012) used the same name generator and still reported personal network average sizes in four different countries ranging from 11.7 to 22.4, showing therefore a considerable nationality effect. There is also a clear difference in terms of sample size between those studies (from 87 to 743) and our study (2027), as well as the year in which the data was collected. Respondents were allowed to name members of their households, which could also have had the consequence of creating even closer networks, with respondents naming the member of the household plus the very close alters. It is also noted that the sociological literature point out that networks sizes do vary depending on the type of name generator, length and design of the survey (Bidart and Charbonneau, 2011; Marin and Hampton, 2007). We consider, however, that our questionnaire, as respondents were given the possibility to name an extra alter when asked about whom they refer to when experiencing travel uncertainty, does give a

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[3] If respondents indicating zero contacts are removed from the survey, this average becomes 7.1, and is therefore still considerably lower than what observed elsewhere in the literature.
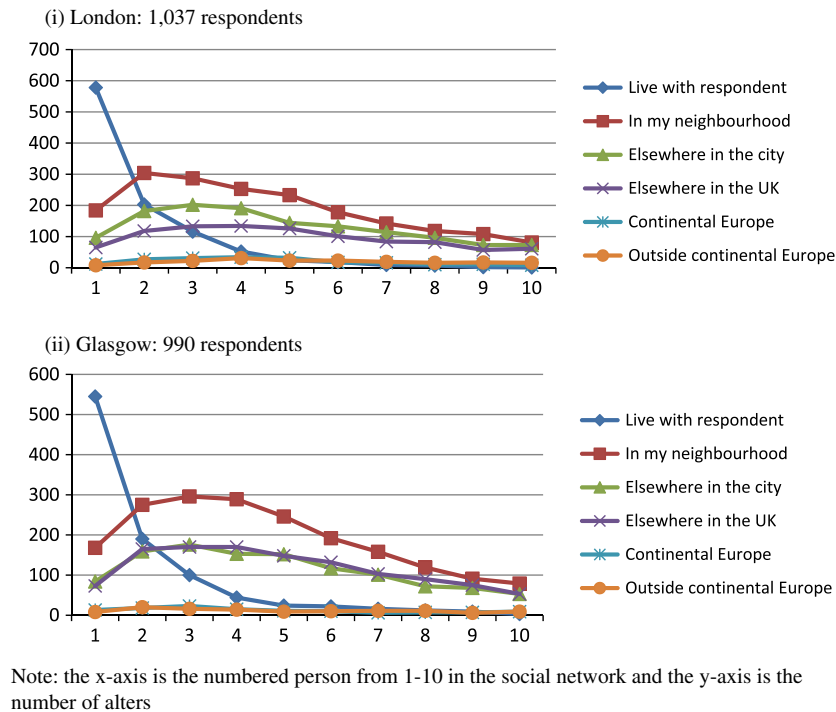
(i) London: 1,037 respondents

(ii) Glasgow: 990 respondents

Note: the x-axis is the numbered person from 1-10 in the social network and the y-axis is the number of alters

Fig. 2. A graph to show the location of members of the respondent's social network, split by London and Glasgow residents.

sufficient and more than satisfactory coverage of the people respondents considered as part of their closest social circle, at least in a travel context.

For one of the questions about their social network, respondents listed the location of those within their circle for up to their first ten members, if applicable. It is assumed that the respondents have named their most important contact in the first instance and then down to their least important one (although still part of their closest circle of contacts). Fig. 2 shows the location of individuals across the two cities.

In terms of type of relationship, the first named person in the social network (P1) is a wife/husband/partner/boyfriend/girlfriend, for more than 50% of respondents, while for 22% it is a friend, for 10% a parent, for 8% a son/daughter, for 5% a sibling and for the remainder a neighbour, work colleague or other relative. The graphs in Fig. 2 show that the first named person (P1) is someone who lives with the respondent (in 61% of cases). For those in the social network not living with the respondent, there is an importance of the surrounding neighbourhood, although this applies to a further extent to the Glasgow rather than London sub-sample.

In terms of how many of the social network members have no-one within their social circle within their local neighbourhood (aside from those who live with them), this relates to 840 individuals (41.4% of the sample), although around a quarter of these respondents did not list anyone within their social network. Of the 840 respondents without anyone in their social circle within their neighbourhood, 432 (94 of whom listed no-one within their social network) are London-based and 408 (99 of whom listed no-one within their social network) are Glasgow-based, comparable proportions.

4.3. Cluster analysis of the socio-demographic, spatial and social network information

Cluster analysis was applied separately to the 1037 London respondents and 990 Glasgow respondents. It was considered appropriate to generate similar-sized groups of between 50 and 250 individuals (between five and ten group solutions), large enough for further analysis and small enough to have a sufficient number of clusters. A hierarchical technique of clustering was applied as it is the only one to permit categorical data. Ward's method, a hierarchical clustering algorithm, has been used to identify clusters of individuals within the two samples. Ward's method calculates the sum of squares (distance) between an object in the first cluster and an object in the second cluster, which is then summed across all variables. This method optimises the production of clusters of approximately equal size. In deciding how many clusters should be formed, there is no standard objective procedure; the procedure is, instead, subjective but guided by the 'stopping rule', which involves selecting the number of clusters which most appropriately represents the dataset (Hair et al., 2005).

For the London and Glasgow samples, five socio-demographic and two social network variables were input: age, gender, status (in employment or not), children in household, ethnic origin (white or non-white), size of the respondent's social network, and the number of the members of the respondent's social network living within the local neighbourhood. An additional variable was input into the London analysis, the sub-area in which the respondent resides. The key characteristics of the final population segments, 10 for London and 8 for Glasgow, are shown in Table 1.

The cluster analysis generated distinct groups for travel behaviour data analysis including the Social Network Analysis variables relating to the number of individuals within a social network and the proportion of those within the same neighbourhood as the respondent. There is also an interesting spatial difference within the London sample, relating to Merton with Wandsworth, the area with the lowest level of deprivation.

More specifically, the London sub-sample groups include one with particularly old non-working members (group 1); a group with typical characteristics of the total sample (2); a group with few social network contacts, both in general and specifically within their local neighbourhood (3); a highly social, female group (4); a group with a strong local neighbourhood focus in the sub-area of Barnet (5); one with a high proportion of respondents with

Table 1
Key characteristics of the population segments in London and Glasgow.

Group	N (%)	Key characteristics (including % within group)
London		
1	67 (6.5%)	Particularly old (63% over 50), many non-working (40%), group with most respondents without children (90%), and group with most white respondents (93%)
2	211 (20.3%)	Group considered to have the most typical or 'average' characteristics within the London sample (i.e. without particularly high or low values for all of the variables when compared against the other groups generated)
3	155 (14.9%)	Highest male group (52%), group with the fewest contacts within their social network (85% have 0 or 1 contact) and in local neighbourhood (90% have no neighbourhood contacts), and the highest proportion of non-white respondents (32% – the remainder are white)
4	139 (13.4%)	Joint highest female group (71%), and group with the most contacts within their social network (66% have 12 or more contacts)
5	64 (6.2%)	Over half (56%) live in Barnet, many are non-working (41%), and has the most number of contacts within the local neighbourhood (all had 5 or more contacts within the local neighbourhood)
6	96 (9.3%)	Group with the highest proportion of respondents with children (47% have at least one child)
7	65 (6.3%)	Predominantly middle-aged (85% aged 25–49) and highest group for workers (83%)
8	114 (11.0%)	All live in Merton with Wandsworth and many are young-to-middle aged (41% aged 25–34)
9	70 (6.8%)	All live in Merton with Wandsworth, have low numbers of contacts within their social network (77% have 0 or 1 contact) and in local neighbourhood (81% have no neighbourhood contacts)
10	56 (5.4%)	All live in Merton with Wandsworth and is the joint highest female group (71%)
Total	1037 (100.0%)	
Glasgow		
1	100 (10.1%)	Group with most non-workers (43%), a high number of social network contacts (all have at least 9 contacts in their social network) and in the local neighbourhood (92% have at least 4 contacts within the local neighbourhood) and has the highest proportion of respondents (joint with group 5) with children (32% have at least one child)
2	101 (10.2%)	Particularly young (53% aged 17–34), and female (69%) group, with most respondents without children (83%) and a high number of social network contacts (all have at least 9 contacts in their social network), although many of these contacts are not in the local neighbourhood (70% have 0 or 1 contact within the local neighbourhood)
3	159 (16.1%)	Group with the highest proportion (joint with group 8) of white respondents (90%)
4	153 (15.5%)	Group with the highest proportion of females (70%) and workers (74%)
5	167 (16.9%)	Group with the lowest number of individuals within their social network (all have 2 or fewer contacts) and has the highest proportion of respondents (joint with group 1) with children (32% have at least one child)
6	82 (8.3%)	Group considered to have the most typical or 'average' characteristics within the Glasgow sample (i.e. without particularly high or low values for all of the variables when compared against the other groups generated)
7	177 (17.9%)	Most male-dominated group (58%), has the highest proportion in a non-white group (13% – the remainder are white) and lowest proportion of contacts within the local neighbourhood (all have 1 or fewer contacts within the local neighbourhood)
8	51 (5.2%)	Most respondents (85%) are aged 35–64, has a high proportion of workers (73%) and the highest proportion (joint with group 3) of white respondents (90%)
Total	990 (100.0%)	

children (6); one typically with middle-aged, working members (7); and three groups (8–10) with a spatial element (within the Merton with Wandsworth sub-area), each with social characteristics in terms of age, social contacts and gender.

For Glasgow, there is a non-working highly social group both generally and specifically within their local neighbourhood with a high proportion of respondents with children (1); a young, female group, typically without children and with a high number of social network contacts although few within the local neighbourhood (2); a group with a high proportion of white respondents (3); a female, working group (4); a group with a high proportion of children but a low number of social network contacts (5); a typical group (6); a male group with few social contacts in the local neighbourhood (7); and a group consisting of middle-aged workers (8).

4.4. General travel behaviour

Prior to examining travel in uncertain situations, some background travel statistics can be presented. There is a real contrast in the sample between those who do and do not use a car. Indeed, there are three distinct groups: 32.2% of respondents who never use a car, 29.1% of respondents who use a car more than five times per week, and the 38.7% in-between (occasional car use). The primary difference between London and Glasgow figures is that although there are similar proportions in each city who never drive, there are a higher proportion of regular (than occasional) car drivers in Glasgow than in London.

The proportion of London respondents that are regular car drivers (more than five times per week) was highest (in order) in the following three cluster analysis groups: (5–50.0%), (6–33.3%) and

(3–26.5%). These groups are characterised by few social network contacts (3); location of residence, in this case Barnet (5); and a high proportion of respondents with children (6). The proportion of Glasgow respondents that are regular car drivers was highest (in order) in the following three cluster analysis groups: (8–43.1%), (1–42.0%) and (6–39.0%). Aside from the typical group (6), these groups are characterised by a non-working highly social group both generally and specifically within their local neighbourhood with a high proportion of respondents with children (1) and a group consisting of middle-aged workers (8). The only initial finding generated seems to be that the prevalence of children in the household affects higher car use, as the second highest groups in term of regular car drivers, in both London and Glasgow, have the highest proportion of households with children.

Many within the sample are regular public transport users. Just under half of respondents travel by bus (942, 46.5%) and around a quarter take the train (510, 25.2%) at least once a week. These proportions, for bus and train, are higher for the larger city of London (55.5% and 30.2%) than Glasgow (37.0% and 19.9%). London also has around half of respondents using the underground system at least one day a week (525, 50.6%). Glasgow also has an underground system, albeit much smaller with only one circular line, and there are 134 respondents (13.5%) that use it at least one day a week.

The relationship between the number of social network members that live in the neighbourhood and the level of car use (as driver) and amount of walking undertaken was also explored using a linear regression, which also controlled for city, age, gender, employment status, household size, length of residence in the neighbourhood and ethnic origin. This is to test if individuals with

fewer neighbourhood contacts will drive more (have a larger sphere of influence) and walk less. Results[4] show that being female, living in a larger household, having been living for longer in the current neighbourhood, being employed, retired, in education, or homemaker (with respect to being unemployed), and of black or 'Other' (not Indian, Pakistani, Bangladeshi or Chinese) origin (with respect to white) are positively correlated with having more members of the social network within the neighbourhood. No significant relationship could be determined between the number of social contacts in the neighbourhood and walking habits, but there was significant correlation for respondents who drive for three or more days a week. This result links with the findings for the Glasgow cluster groups presented in the previous section (regular car use associated with a highly social group both generally and specifically within their local neighbourhood) although not for the London cluster groups (regular car use associated with few social network contacts, but there was not a link to presence within their local neighbourhood). The variation may be due to the city-wide differences (between the London and Glasgow samples) and differences between the two social network variables in the cluster analysis (social network size and number living in the local neighbourhood).

4.5. Travel in uncertain situations

Results from the question relating to individuals that respondents turn to for general travel advice (respondents could name more than one person) from their social network (and a couple of other options) are shown in Table 2. The 193 people without anyone in their social network were not asked this question. Of those with a social network, most (962, 52.5% of the 1834 naming a social network) will turn to the first person within their network (P1). Another sizeable group within the survey sample are the 606 respondents (33.0%) who would not refer to anyone within their social circle when looking for general travel advice because they would take the decision themselves.

The 606 individuals that take the decision themselves represent an interesting group for further examination, across the cluster analysis generated groups. We provide here first some simple frequency analysis linking those who take decisions by themselves with the identified clusters, and then we look at the statistical relationship with the main socio-economic characteristics across the entire sample.

Within the London sample there were 326 respondents (34.6% of the 943 with a social network) who take travel decisions themselves. The proportion of respondents in this category was highest (in order) in the following three cluster analysis groups: (9–50.0%), (2–42.2%) and (6–39.6%). The highest group (cluster 9) does have low numbers of contacts within their social network and in the local neighbourhood. Within the Glasgow sample there were 280 respondents (31.4% of the 891 with a social network) who take travel decisions themselves. The proportion of respondents in this category was highest (in order) in the following three cluster analysis groups: (8–41.2%), (7–39.7%) and (3–35.2%). The highest group (cluster 8) are typically middle-aged workers, whereas the second-highest group (cluster 7) has the lowest proportion of contacts within the local neighbourhood.

Table 3 presents the results of a binary logit model where the dependent variable is whether respondents have said that they generally decide by themselves and the main socio-economic characteristics.

Table 2
The person respondents turn to for advice when making travel decisions.[a]

Person	Number (% of total)
No-one: has no social network	193 (9.5%)
No-one: takes the decision themselves	606 (29.9%)
Someone within their social network	1206 (59.5%)
Of which, P1 is selected	*962 (47.5%)*
Of which, P1 is not selected	*244 (12.0%)*
Someone from outside their social network (and no-one within their social network)	22 (1.1%)
Total	2027 (100%)

[a] The actual question was "When making travel decisions, who do you turn to for advice?" Respondents were provided with a list of individuals within their social network, plus an option for "Other (Please specify)" and "None of the above, I decide by myself". It was a multiple response question.

Table 3
Binary logit model: Y = Whether respondents decide by themselves for general travel behaviour (N = 1834).

Variable	Coefficient	T-value
Constant	−0.643	−1.96[*]
Size of social network	−0.047	−4.03[***]
No. of social contacts within the neighbourhood	0.007	0.3
City	0.130	1.24
Age	0.014	2.68[***]
Gender	0.333	2.99[***]
Household size	−0.261	−5.57[***]
Length of residence	0.001	1.38
Employed full time	−0.033	−0.14
Employed part time	0.031	0.11
Self employed	0.271	0.92
Retired	−0.144	−0.5
In education	0.128	0.4
Disabled	−0.278	−0.7
Home maker	−0.110	−0.34
McFadden R²	0.049	

[**] Significant at 95% level.
[*] Significant at 90% level.
[***] Significant at 99% level.

Table 3 shows that, in accordance with intuition, having a smaller social network, being older, and living in a smaller household as being the significant determinants of the probability of deciding independently. The same also applies to male respondents. No other significant relationship could be found.[5]

Results from the question relating to the main individual that respondents turn to for specific travel advice if experiencing an uncertain situation (respondents could only name one person) from their social network (and a couple of other options) are shown in Table 4. This applied to the 598 individuals that mentioned more than one person in the question about general travel advice (shown in Table 2).

The results again demonstrate the importance of P1 within an individual's social network, with just under half (47.8%) of those with more than one person that they could turn to for general advice, turning to P1 as their main contact. There is still a group, albeit small (39, 6.5%) of respondents that have a large group they would turn to for general travel advice, but if facing an uncertain situation would still decide by themselves.

The 598 respondents asked to name a specific person for travel in an uncertain situation, were then requested why they would communicate with this specific individual. There were 559 respondents who provided answers to this open-ended question; this was

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[4] A Table with estimated coefficients is reported in the Appendix. The overall fitness of the model, measured by the R^2 is fairly low. However, results do help shed more light into the relationship between the characteristics of the respondents and the number of their social contacts living in their neighbourhood. This and the remaining econometric estimations in this paper were carried out using Limdep 10.0.

[5] Convergence issues were experienced when considering the variable describing the ethnicity of the respondents, and for this reasons they were dropped from the analysis.

Table 4
The main person respondents turn to for advice when making travel decisions.[a]

Person	Number	Percentage
P1	286	47.8
P2	96	16.1
P3	62	10.4
P4	28	4.7
P5	21	3.5
P6	21	3.5
P7	4	0.7
P8	7	1.2
P9	5	0.8
P10	4	0.7
Someone else within network (i.e. P11–P30)	16	2.7
Other person specified	9	1.5
None of the above, I decide by myself	39	6.5
Total	598	100.0

[a] The actual question was "And among these people, who would be the main person you would communicate with for suggestions and information (assuming they were not travelling with you) if you were experiencing an uncertain situation in a travel context (for example a long delay or a cancellation." Respondents were provided with a list of individuals within their social network, plus an option for "Other (Please specify)" and "None of the above, I decide by myself". Respondents could only provide one answer.

broken down into 663 coded answers, with the five most common being:

1. Well-travelled/experience of travelling – 162 (29% of 559 respondents).
2. Mentions spouse/partner – 109 (19%).
3. Personality e.g. good ideas/logical – 86 (15%).
4. Knowledgeable – 57 (10%).
5. Mentions family member – 42 (8%).

The reasons for turning to someone during travel uncertainty are, therefore, varied. The primary reason relates to the travel experience of the person (e.g. "He has been driving for several years and does it for a living so tends to know places"), and this appears to confirm our hypothesis of social networks members being direct source of help for travellers' decisions during uncertain conditions, but respondents also specified the closeness of their relationship with one of their social network members, whether a spouse/partner (e.g. "He is my partner, the first person I would turn to for advice") or another family member (e.g. "I always exchange opinions with my Mum"). This suggests that individuals turn to people during travel uncertainty to provide emotional as well as practical decision-making support.

A further reason relates to the characteristics of the individual that the respondent turns to, whether their personality (e.g. "She is very organised and efficient out of all my friends. She is one to turn to in times of need. She can be rational but also compassionate") or their rather more practical knowledge (e.g. "Most likely to know the weather conditions and what the roads are like") and familiarity with the sources of relevant information. Interestingly, some respondents indicated that they would contact a particular person not specifically to ask for advice but to inform them of the delay and their likely late arrival at destinations, rather than, at least as the most important purpose, to obtain information to help decisions.

5. Conclusions

This paper examined an extensive London and Glasgow travel behaviour survey of 2027 egos and 13,022 alters. As alters were not interviewed, information about them were reported by the respondents and no full social network could be mapped. However, the dataset contains information about the location of alters and some of their socio-economic characteristics, as well as data on respondent travel habits, both generally and in uncertain conditions. Travel uncertainty is an understudied topic and findings from this novel research have highlighted the role of social interactions in such situations.

The results reveal that travellers do appear to refer to their social network when taking travel decisions in an uncertain context. In the vast majority of cases people stated that they would contact the first member of the social network if experiencing an uncertain travel situation. Also, as expected, older people, those with a lower number of contacts, and those living in smaller households, are more likely to decide on their own without contacting others in such situations.

Analysis of the precise reasons why people tend to contact a certain person also revealed that in uncertain travelling situations, social networks do not function to support decision-making exclusively, but also to provide emotional support. Whether this emotional support has a specific impact on the decision-making process is a complex issue and represents an interesting avenue for future research. Experience over particular routes as well as knowledge of the relevant information sources seem to be the main way social networks members contribute to travellers' decisions. Whether these reasons are likely to apply in the future, in light of the continuous improvement of hand-held electronic devices, and both mobile and in-vehicle data network capabilities, is another interesting question. These contrasting responses have significant impacts on transport operators and policy-makers who need to cover the different population groups (for example those who cannot, for various reasons, communicate with their closest contacts during a disruption), particularly in terms of contingency planning and communication efforts both generally through marketing and in emergency situations.

Table A1
OLS regression: Y = Number of social contacts in the neighbourhood (N = 2027).

Variable	Coefficient	T-value
Constant	0.574	1.78[*]
City	−0.110	−1.04
Age	0.003	0.57
Gender	−0.407	−3.82[***]
Household size	0.074	1.83[*]
Length of residence	0.002	5.00[***]
Employed full time	0.421	1.91[*]
Employed part time	0.626	2.46[**]
Self employed	0.444	1.54
Retired	0.918	3.25[***]
In education	0.840	2.84[***]
Disabled	0.264	0.73
Home maker	0.571	1.94[*]
Car: frequently (more than 3 days per week)	0.457	3.72[***]
Car: occasionally (1–2 days per week)	−0.106	−0.68
Car: rarely (less than once a year to once a fortnight)	−0.080	−0.27
Walking: frequently (more than 3 days per week)	0.091	0.76
Walking: occasionally (1–2 days per week)	0.033	0.23
Walking: rarely (less than once a year to once a fortnight)	−0.217	−0.99
Black	1.293	2.07[**]
Asian: Indian, Pakistani, Bangladeshi	1.033	1.60
Asian: Chinese	−0.506	−1.21
Mixed	−0.250	−0.19
Other ethnicity	0.333	2.79[***]
R^2	0.064	

[*] Significant at 90% level.
[**] Significant at 95% level.
[***] Significant at 99% level.

Acknowledgements

Appendix A

See Table A1.

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