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Social networks, ICT use and activity-travel patterns
Data collection and first analyses

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Key words: Social networks, social interaction, ICT, activity-travel, communication diary

Abstract: New information and communication technologies (ICT’s), gain importance and are changing people’s daily lives. With the introduction of new ICT’s, alternatives for face-to-face contacts and physical presence are provided. In that sense, ICT may offer a substitute to physical travel. Other potential relationships between telecommunication and travel are neutrality, complementation or modification. The relationship between ICT and activity-travel patterns has received a substantial amount of attention recently. However, a link with the wider activity patterns of individuals and households and environmental characteristics is missing in existing studies. The spatial and mobility impacts of social networks are not well known either. However, social networks are crucial to an understanding of travel behaviour. The most important part of travel demand for non-work purposes in terms of distance travelled is for socializing with network members. Hence, individuals’ social network characteristics are relevant for their propensity to perform social activities. The study of social networks can provide new insights to understand the generation of social activities and travel involved. In order to increase our understanding of the interrelationships between properties of the built environment, ICT-use, social networks and activity-travel patterns, these links should be the starting point for analysis. This paper presents a data collection instrument that was developed to study these links and the results of an application of the instrument in a survey among a large sample of households in the Eindhoven region, and discusses the implications of the findings for planning support models.
1. INTRODUCTION

The rapid development and spread of new information and communication technologies (ICT’s) such as the Internet and mobile phones, is changing people’s daily lives. The areas that are affected most by ICT are communication and transportation (Muhammad, 2007). Urban and transport planners need to take these changes in communication and travel patterns into account as they impose new demands on urban environments and transportation services. However, existing models of transport lag behind the new developments.

Traditionally, transport generation was predicted as a function of characteristics of the built environment in response to changes in land-use. However, over the last decade, models of transport have started to require more temporal and spatial detail. Furthermore, it is recognised that social and recreational activities are important components of trip generation that have specific drives. To better understand the demand for transport and infrastructure, the impact of topics such as ICT and social networks has to be studied.

One possible effect of ICT on travel is substitution of trips by electronic communication. With the introduction of new ICT’s, alternatives for face-to-face contacts and physical presence are provided and thus ICT may offer a substitute to physical travel. The research into the substitution of travel by electronic communication has been going on since the energy crisis of the early 1970s (Mokhtarian, 1990). The substitution effect attracted most attention, but other relationships such as neutrality, complementarity or modification are possible as well (Mokhtarian, 1990; Salomon, 1986). Although the relationship between ICT and travel patterns has received a substantial amount of attention recently, not many studies focus on leisure or social travel. Furthermore, a link with the wider activity patterns of individuals and households and environmental characteristics is largely missing.

In addition, the spatial and mobility impacts of social networks are not well known either (Axhausen, 2005; Carrasco et al, 2006). Datasets focusing on the social interactions in the transportation context are sparse and if available, they usually focus on small numbers of people. However, social networks are crucial to an understanding of travel. Socializing with network members causes the most important portion of travel in terms of distance travelled (Schlich et al, 2004; Wellman et al, 2006). Travel behaviour is influenced by someone’s social network characteristics, as they are relevant for his or her propensity to perform social activities (Carrasco & Miller, 2006). Thus, the study of social networks can provide new insights into the generation of social activities and travel involved.
To clarify the interrelationships between properties of the built environment, ICT-use, social networks and social travel patterns, these links should be the starting point for analysis. This paper describes these complex interrelationships as well as a data collection effort to study these links.

The outline of the paper is as follows. The next section describes the relevant concepts, theories and trends from the existing literature. Section 3 describes the data collection instrument that was designed to study these links. In section 4 an application of the data collection instrument in a survey held among a large sample of households in the Eindhoven region is described. Section 5 presents the first analyses conducted to examine the quality of the sample and data. In the final section the implications of the findings for planning support models are discussed.

2. KEY CONCEPTS, THEORIES AND TRENDS

This section describes theories and trends from the existing literature on the relationship between ICT and travel (for social purposes), on social networks and on social interaction diaries.

2.1 The relationship between ICT use and travel for social purposes

Drawing on the work of Salomon (1986) and Mokhtarian (1990), four different kinds of relationships between ICT and activity-travel patterns can be distinguished:

1. **Substitution**: as telecommunication increases, the number of trips decrease.
2. **Complementarity**: (also referred to as enhancement or generation) is the opposite of substitution, implying that as telecommunication increases, the number of trips also increase.
3. **Modification**: telecommunication results in modification of aspects or trips, such as time, route, destination or transport mode.
4. **Neutrality**: telecommunication has no effect on trips.

In the literature on travel behaviour, the relationship between ICT and activity-travel patterns has received a substantial amount of attention. However, most studies focus on the substitution of work-travel or travel for shopping. The effect of ICT on travel for leisure or social activities has received relatively little attention so far (Mokhtarian, Salomon & Handy, 2006), even though it is the fastest growing segment of travel (Axhausen, 2005). In our study the focus is on social travel.
It is highly probable that the effect of ICT on leisure and social travel differs from the effect on travel for other activities, such as work or shopping. According to Mokhtarian, Salomon & Handy (2006), complementarity and modification are more likely than substitution for leisure or social activities, because ICT-based alternatives to these activities (if available) are rarely satisfying substitutes.

This is confirmed by Senbil and Kitamura (2003) who studied the relations between telecommunication and travel for the three types of activities distinguished by Chapin (1974): mandatory (work and work-related) activities, maintenance activities (grocery shopping, eating, household maintenance, etc.) and discretionary activities (leisure, sports, hobbies, etc.). Senbil and Kitamura (2003) used a simultaneous equations model on a data set compiled from a survey in the Osaka area to examine the relation between telecommunications and travel. They found substitution effects for work activities; for maintenance activities the effect appeared to be neutral; and for discretionary activities they found complementary effects.

The complementary effect of ICT on social activities was found by Tillema, Dijst & Schwanen (2007) as well. Using survey data collected among 662 respondents in the Netherlands they examined the interaction between face-to-face and electronic contacts and their implications for travel behaviour. Using bivariate correlation analysis, they found a positive correlation between frequency of face-to-face contacts and electronic communication, suggesting a complementary effect. Tillema, Dijst & Schwanen (2007) argued that the actual outcome of these relationships varies according to mode of communication.

Mokhtarian & Meenakshisundaram (1999) used a communication diary to gather data on three types of communication: personal meetings (and related trips), transfer of an information object and electronic communication. Using a structural equations model, they examined the relations between these types of communication. The relationship between electronic communication modes and personal meetings or trips is not significant in either direction, suggesting neutrality instead of substitution or complementation.

Although the link between (social) activity-travel and ICT has been discussed in many studies, social network characteristics are rarely included. The Connected Lives project has been the first study linking social networks, ICTs and activity and travel behaviour (Wellman et al, 2006). Findings of this study suggest that ICTs are a catalyst for social activities, regardless of the spatial dispersion of social networks.
2.2 Social networks

The composition of individuals’ social networks is crucial for an understanding of social-travel patterns, because social interaction (and the travel involved) can emerge from the individuals’ social networks (Carrasco et al. 2006). The composition of a social network includes personal characteristics of all network members, the strength of the ties, the spatial distribution of the network members and communication patterns (frequency and type of media used) (Larsen, Urry & Axhausen, 2005; Carrasco et al. 2006).

Social networks have been studied for many years. In those studies, different approaches were employed (e.g. community studies and the social capital approach; the small-world approach; and social network analysis).

In our study the social network approach is applied. Social network analysis approaches social networks as a set of actors (nodes) and relationships connecting these actors (Wasserman & Faust, 1994). The actors can be people, groups and organizations. There are two ways to approach social networks: as “whole” or as “egocentric” networks (Carrasco et al., 2006). In studies on whole networks, all actors are known beforehand and are “regarded for analytical purposes as bounded social collectives” (Marsden, 2005). Networks that can be approached as whole networks are usually formal networks; organized communities or groups with shared interests, like school classes, clubs or the inhabitants of a neighbourhood. If strict boundaries cannot be defined, or one is concerned with behaviour on the level of individuals, the egocentric approach should be used. This will be the case in travel behaviour research. Egocentric network studies concentrate on the network of a person (ego) which consists of all the people (or groups) he or she has a relationship with (alters) (Carrasco et al, 2006).

To elicit the network composition, a name generator is used (Carrasco et al, 2006; Marsden, 2005; Degenne & Forse, 1999). A name generator is a set of questions that should help the ego to recall all alters from his or her network. Obviously it is very important to choose the appropriate questions that will elicit the network members that are relevant for the study.

2.3 Social interaction

To collect data of social interactions, different approaches can be used, such as observations, interviews and diaries (Fu, 2007). Compared with observations and interviews, diaries are less time consuming for researchers and more familiar and unobtrusive to respondents, as diaries enable people to self-record their contacts with other people (Duck, 1991; Reis and
Wheeler, 1991; Fu, 2007). However, since diary keeping is demanding for respondents, the diary log needs to be straightforward and intuitive to use. Respondents need clear guidelines as to what kinds of contacts and what kinds of contacted persons they should record.

3. DATA COLLECTION INSTRUMENT

To capture the link between properties of the built environment, ICT-use, social networks and social travel patterns, we developed a data collection instrument. The instrument consists of a two-day paper-and-pencil social interaction diary and a follow-up questionnaire.

The social interaction diary consists of three parts. In the first part the respondents were asked to record all their social interactions during two days. Social interactions are defined as all forms of contact: a joint activity, a conversation (either face-to-face, by telephone or online), a letter, fax, SMS (text message) or an e-mail. Interactions at home with members of the household are not included, nor are interactions as a customer or work-related interactions.

Every social interaction could be recorded on a separate page. The interaction pages include questions on the type of interaction, with whom the interaction took place, the time, the location, and the purpose of the interaction. Furthermore, the respondents were asked if a trip was replaced, generated or modified by the interaction. Figure 1 shows an interaction page. To prevent technical respondent burden, the interface of the diary was kept as simple as possible. The respondents were asked to record their social interactions as shortly as possible after they occurred. However, they also received an additional interaction worksheet which they could use during the day to remember their interactions, in case it was impossible to take the booklet along.

In the second part of the interaction diary the respondents were asked to fill in a page with questions about every person they interacted with during those two days. As can be seen in Figure 2 these questions include age, gender, social category, distance and frequency of interactions of different types (face-to-face, telephone, e-mail, etc.).

The third part of the interaction diary contains a questionnaire on personal characteristics and activities of the respondents (age, gender, household composition, level of education, income, occupation, sports and hobbies, involvement in clubs or unions, use transportation modes, time pressure), characteristics of the environment (urban density, facilities in residential location and their access to and use of ICT (computer, Internet, (mobile) phone).
INTERACTION 1

1. Type of interaction:
   □ Face-to-face
   □ Mobile phone call
   □ Land line phone call
   □ Instant messenger
   □ Send/read e-mail
   □ Send/read SMS text
   □ Other: ..........................................

2. Time, from ........... till ...........

3. With whom did you interact?
   Use a unique name (or initials) per person.
   1 ..........................................
   2 ..........................................
   3 ..........................................

4. In case of more than 3 others
   number:
   .............men .............women

5. Who took the initiative for the interaction?
   □ I did
   □ (one of) the other(s)
   □ Together
   □ Not applicable

6. Was the interaction:
   □ routine
   □ prearranged
   □ coincidentally

7. Purpose of the interaction
   (choose 1 main purpose)
   □ Joint activity, namely
       ..........................................
   □ Pay a visit
   □ Receive guests
   □ Talk/chat
   □ Short question/message
   □ Make an appointment
   □ Give information/advice
   □ Receive information/advice
   □ Discussion
   □ Other, namely
       ..........................................

8. What did you do right before and after the interaction?
   before                       after
   Work    □    □
   Study    □    □
   Housework □    □
   Eat/drink □    □
   travel    □    □
   Other, nl:........... □    □
   Other, nl:........... □    □

9. Where did the interaction take place?
   □ Home (go to question 13)
   □ Residence of other person
   □ Work
   □ School
   □ Shop
   □ Café, bar, restaurant
   □ On the road
   □ Other, namely:
       ..........................................

10. Were you at this location specifically for the interaction?
    □ No (go to question 13)
    □ Yes

11. How far is this location away from your home?
    .............km

12. How did you get here? (Choose 1 transport mode)
    □ (1) car as driver
    □ (2) car as passenger
    □ (3) moped
    □ (4) bus/tram/subway
    □ (5) train
    □ (6) bike
    □ (7) walk
    □ (8) other

13. Did this interaction save you a trip?
    □ no
    □ yes: .............km (one way), per .............(choose the number of one transport mode, see 12)

14. Did you make an appointment during this interaction for which you will make a trip?
    □ no
    □ yes: .............km (one way), per .............

15. Did you modify a trip during this interaction?
    □ no
    □ yes time/route/destination/transp. mode

Figure 1. Interaction page
**PERSON 1**

1. **Name/initials:** ……………………………………  
   (Make sure this name corresponds with the name on the interaction page)

2. **Age**  
   □ 0-9  
   □ 10-19  
   □ 20-29  
   □ 30-39  
   □ 40-49  
   □ 50-59  
   □ 60-69  
   □ 70-79  
   □ 80 or older  
   □ Don’t know

3. **Gender**  
   □ Male  
   □ Female

4. **Category**  
   □ My partner  
   □ My father/mother  
   □ My child  
   □ My brother/sister  
   □ Other relative  
   □ Housemate  
   □ Neighbour  
   □ Colleague  
   □ Fellow student  
   □ Union/club member  
   □ A friend  
   □ An acquaintance  
   □ A stranger

5. **How strong is your relation?**  
   □ Very strong  
   □ Somewhat strong  
   □ Not so strong  
   □ Not strong at all

6. **How long have you known each other?**  
   □ Not  
   □ Less than 1 year  
   □ 1 to 2 years  
   □ 2 to 5 years  
   □ 5 to 15 years  
   □ 15 years or more

7. **How far away does this person live?**  
   □ Same house  
   □ 0-1 kilometre  
   □ 1-2 km  
   □ 2-5 km  
   □ 5-15 km  
   □ 15-30 km  
   □ 30-60 km  
   □ 60-100 km  
   □ 100-200 km  
   □ > 200 km, namely ………………km  
   □ Don’t know

8. **Does this person use the below mentioned communication modes?**  
<table>
<thead>
<tr>
<th>Communication Mode</th>
<th>Yes</th>
<th>No</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telephone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-mail</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instant messenger</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. **How often do you interact with each other in the below mentioned ways?**
<table>
<thead>
<tr>
<th>Interaction Way</th>
<th>Never</th>
<th>Less than once a month</th>
<th>Once a month</th>
<th>2 or 3 times a month</th>
<th>Once a week</th>
<th>2 or 3 times a week</th>
<th>Face-to-face</th>
</tr>
</thead>
<tbody>
<tr>
<td>By telephone</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By sms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By e-mail</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By instant messenger</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Figure 2. Persons page*
4. **SAMPLING AND RESPONSE**

In total, 1500 interaction diaries were printed. They were distributed in January-March 2008 in the region of Eindhoven, a medium-sized city in the south of the Netherlands. People aged 15 or over could participate.

The sample was stratified by urban density. In the Netherlands, five classes of urban density are distinguished:

1. very high density (2500 or more addresses per km$^2$);
2. high density (1500 to 2500 addresses per km$^2$);
3. moderate density (1000 to 1500 addresses per km$^2$);
4. low density (500 to 1000 addresses per km$^2$);
5. very low density (less than 500 addresses per km$^2$).

The aim was to collect equal numbers of diaries for the five classes of urban density.

To recruit respondents, a personal approach was employed. A team of 12 students went by people’s homes to ask them if they were willing to participate in this study. If they were, they were given an explanation and they received a diary, which was collected approximately one week later. This personal approach was employed to increase respondent’s participation.

Out of 3699 people who answered the door, 1648 (45%) accepted a diary. Out of these 1648, 747 useful diaries were returned. This results in an overall response rate of 20%. This is shown in Table 1.

The data on social interaction were collected using a two-day interaction diary. The respondents were asked to keep the diary for two days in a row. They were allowed to choose the days of the week themselves. Theoretically this is not the best operational decision as respondents may report their social interactions for less active days to reduce respondent burden. However, this decision was made nevertheless as we had some serious concerns about the sample size. Fortunately, as indicated by Table 2 the distribution of diary days by days of the week is not severely biased. In total 1489 diary days were recorded (5 respondents kept the diary for only 1 day).

Table 1: response rates

<table>
<thead>
<tr>
<th>Urban density</th>
<th>People approached</th>
<th>Diaries accepted</th>
<th>% accepted</th>
<th>Diaries completed</th>
<th>% completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>659</td>
<td>344</td>
<td>52%</td>
<td>136</td>
<td>21%</td>
</tr>
<tr>
<td>2</td>
<td>894</td>
<td>334</td>
<td>37%</td>
<td>154</td>
<td>17%</td>
</tr>
<tr>
<td>3</td>
<td>735</td>
<td>318</td>
<td>43%</td>
<td>159</td>
<td>22%</td>
</tr>
<tr>
<td>4</td>
<td>798</td>
<td>351</td>
<td>44%</td>
<td>159</td>
<td>20%</td>
</tr>
<tr>
<td>5</td>
<td>613</td>
<td>301</td>
<td>49%</td>
<td>139</td>
<td>23%</td>
</tr>
<tr>
<td>Total</td>
<td>3699</td>
<td>1648</td>
<td>45%</td>
<td>747</td>
<td>20%</td>
</tr>
</tbody>
</table>
Table 2: Diary days (n=747)

<table>
<thead>
<tr>
<th>Day of the week</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>104</td>
<td>92</td>
<td>196</td>
<td>13%</td>
</tr>
<tr>
<td>Tuesday</td>
<td>125</td>
<td>104</td>
<td>229</td>
<td>15%</td>
</tr>
<tr>
<td>Wednesday</td>
<td>124</td>
<td>119</td>
<td>243</td>
<td>16%</td>
</tr>
<tr>
<td>Thursday</td>
<td>97</td>
<td>125</td>
<td>222</td>
<td>15%</td>
</tr>
<tr>
<td>Friday</td>
<td>100</td>
<td>87</td>
<td>187</td>
<td>13%</td>
</tr>
<tr>
<td>Saturday</td>
<td>111</td>
<td>94</td>
<td>205</td>
<td>14%</td>
</tr>
<tr>
<td>Sunday</td>
<td>67</td>
<td>102</td>
<td>169</td>
<td>11%</td>
</tr>
<tr>
<td>Missing</td>
<td>19</td>
<td>19</td>
<td>38</td>
<td>3%</td>
</tr>
<tr>
<td>Only 1 day</td>
<td></td>
<td>5</td>
<td>5</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>747</td>
<td>747</td>
<td>1489</td>
<td>100%</td>
</tr>
</tbody>
</table>

5. FIRST ANALYSES

In this section the first analyses are described in order to examine the quality of the sample and the data. Tables 2 - 6 show the sample compared to the population of the Netherlands (Bureau of Statistics Netherlands, 2008).

Table 3 shows the sample by urban density. The sample was stratified by urban density. Therefore the distribution across the different levels of density was controlled and apparently no selective response occurred. The resulting distribution largely matches the population of the Netherlands.

As can be seen in Table 4, the sample contains substantially more women than men. The sample consists of 452 women (61%) and 292 men (39%). A larger portion of women is usual in this type of study. However, this distribution is more uneven than usual. This may be related to the personal approach that was adopted.
Table 3: Urban density (n=747)

<table>
<thead>
<tr>
<th>Urban density</th>
<th>N (sample)</th>
<th>% (sample)</th>
<th>% (Netherlands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>136</td>
<td>18%</td>
<td>19%</td>
</tr>
<tr>
<td>2</td>
<td>154</td>
<td>21%</td>
<td>23%</td>
</tr>
<tr>
<td>3</td>
<td>159</td>
<td>21%</td>
<td>18%</td>
</tr>
<tr>
<td>4</td>
<td>159</td>
<td>21%</td>
<td>20%</td>
</tr>
<tr>
<td>5</td>
<td>139</td>
<td>19%</td>
<td>20%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>747</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Table 5 shows the sample by age. As can be seen, the youngest and the oldest cohorts are somewhat underrepresented, which is typically observed in most surveys.

As can be seen in Table 6, the sample contains more couples (with or without children) than the Dutch population. Single person households are underrepresented. This is probably partly related to the fact that the youngest and the oldest age groups are underrepresented in the sample and partly to the personal approach.

Table 7 shows the sample composition for level of education. The higher educated group is overrepresented in the sample, which is usual in this type of study.

Table 4: Gender (n=747)

<table>
<thead>
<tr>
<th>Gender</th>
<th>N (sample)</th>
<th>% (sample)</th>
<th>% (Netherlands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>292</td>
<td>39%</td>
<td>49%</td>
</tr>
<tr>
<td>Female</td>
<td>452</td>
<td>61%</td>
<td>51%</td>
</tr>
<tr>
<td>Missing</td>
<td>3</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>747</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Table 5: Age (n=747)

<table>
<thead>
<tr>
<th>Age</th>
<th>N (sample)</th>
<th>% (sample)</th>
<th>% (Netherlands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-24</td>
<td>53</td>
<td>7%</td>
<td>15%</td>
</tr>
<tr>
<td>25-34</td>
<td>127</td>
<td>17%</td>
<td>15%</td>
</tr>
<tr>
<td>35-44</td>
<td>172</td>
<td>23%</td>
<td>19%</td>
</tr>
<tr>
<td>45-54</td>
<td>150</td>
<td>20%</td>
<td>18%</td>
</tr>
<tr>
<td>55-64</td>
<td>138</td>
<td>18%</td>
<td>16%</td>
</tr>
<tr>
<td>65-74</td>
<td>83</td>
<td>11%</td>
<td>10%</td>
</tr>
<tr>
<td>75-84</td>
<td>20</td>
<td>3%</td>
<td>6%</td>
</tr>
<tr>
<td>85+</td>
<td>2</td>
<td>0%</td>
<td>1%</td>
</tr>
<tr>
<td>missing</td>
<td>2</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>747</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Overall, the sample differs only slightly from the population. Apart from an overrepresentation of women, the sample does not show substantial or unusual selective non-response in terms of socio-demographic variables.

6. **FOLLOW-UP QUESTIONNAIRE**

To capture the respondents’ social networks a follow-up questionnaire was used, which was mailed to a subsample of the respondents, who indicated to be willing to participate. Out of the 747 respondents, 227 (30.4%) indicated to be willing to participate in the follow-up questionnaire. As mentioned before, to elicit all the members of someone’s social network, a name generator can be used. In this study a translation of the name generators used by Carrasco et al (2006) was used. In the follow-up questionnaire the respondents were asked to record the people they feel very close to: “people with whom you discuss important matters, or regularly keep in touch with, or that are there for you if you need help”; and the people they feel somewhat close to: “people that are more than just casual acquaintances, but not very close”. To both descriptions we added: “think of household members, (other) relatives, colleagues or study mates, neighbours, club members and other friends”.

<table>
<thead>
<tr>
<th>Household type</th>
<th>N (sample)</th>
<th>% (sample)</th>
<th>% (Netherlands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single person</td>
<td>81</td>
<td>11%</td>
<td>33%</td>
</tr>
<tr>
<td>Couple</td>
<td>253</td>
<td>34%</td>
<td>28%</td>
</tr>
<tr>
<td>Couple with children</td>
<td>354</td>
<td>47%</td>
<td>33%</td>
</tr>
<tr>
<td>Single parent</td>
<td>39</td>
<td>5%</td>
<td>6%</td>
</tr>
<tr>
<td>Other</td>
<td>16</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>Missing</td>
<td>4</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>747</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education</th>
<th>N (sample)</th>
<th>% (sample)</th>
<th>% (Netherlands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>173</td>
<td>23%</td>
<td>29%</td>
</tr>
<tr>
<td>Secondary</td>
<td>229</td>
<td>31%</td>
<td>43%</td>
</tr>
<tr>
<td>Higher</td>
<td>342</td>
<td>46%</td>
<td>28%</td>
</tr>
<tr>
<td>Total</td>
<td>747</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>
These name generators were first used in the questionnaire in the interaction diary to ask respondents how many people they know whom they feel very close to and whom they feel somewhat close to. These questions were used to determine the maximum number of network members that could be recorded in the follow-up questionnaire. The answers to these questions were analysed. Figure 3 shows the cumulative percentage of social network members by strength of tie. The black line shows very close ties and the grey line shows somewhat close ties. As can be seen, the respondents’ social networks tend to consist of a few more somewhat close ties than very close ties. The majority of the respondents know 25 or less people they feel very close to (97%) and 40 or less people they feel somewhat close to (96%). Therefore the follow-up questionnaire contained questions about (a maximum of) 25 very close and 40 somewhat close social network members.

For each “alter” the respondents were asked to record gender, age, category, how long they know each other, distance between homes, which communication modes the alter uses and the frequency of interaction with the alter by different modes. These questions correspond to the questions in part 2 of the interaction diary.

Figure 3: cumulative percentage of social network members by strength of tie (N=747)
7. CONCLUSION AND DISCUSSION

Although the relationships between ICT, social networks, the built environment and activity-travel patterns have been acknowledged, knowledge of these complex relationships is very limited. In this paper a data collection effort to capture these links has been presented.

The data collection instruments consist of two parts. A two-day paper-and-pencil social interaction diary was used to collect a subsample of the respondents’ social interactions, a subset of their social network and a number of personal and residential characteristics. A follow-up questionnaire was used to capture the complete ego-network, including characteristics of the alters, such as gender, age, distance between homes, etc.

The data collection effort presented in this paper is a promising way of improving our understanding of the relationships between ICT, social networks, the built environment and activity-travel patterns. The response rates that were realized are relatively high, probably as a consequence of the personal approach and the compact and attractive format of the booklet that was used. Apart from an overrepresentation of women, the obtained sample does not show substantial or other than usual selective non-response in terms of socio-demographic variables.

The next step in the project is to conduct statistical analyses of the collected data. This will allow us to identify the factors that influence travel. As discussed, the impact of ICT especially on social travel has not been systematically included in models of transport demand. The results of the planned statistical analyses will thus not only provide a better understanding of the interrelationships between ICT, social networks and travel in different environments, but will also provide insight into elaborate current transportation models and simulation systems and will therefore contribute to an improved modeling approach.

8. REFERENCES

Fu, Y-C. (2007) Contact diaries: building archives of actual and comprehensive personal