

Applications of Social Network Analysis

Strong tie, weak tie and in-betweeners: a continuous measure of tie strength based on contact diary datasets

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Abstract

Contact diary, an alternative data collecting method is introduced. The brief summary of other methods collecting ego-centred network data (name- and the position generator) is followed by previous contact diary researches. (Fu 2007) Then our applied contact diary with some results is shown. Using contact diary to collect data on egocentric network one can acquire a wider and more complex personal network structure. Based on our data we model a more refined continuum of categories than the so-called “classical” strong and weak ties. Contact diary reveals more contacts and can be studied on a wider range than before.

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1. Introduction

When studying egocentric networks the analysis of tie strength is inevitable and the essential question is how the dichotomy of strong and weak ties is differentiated on the ego's level. It is clearly apparent how researchers probably for practical considerations accept the strong-weak dichotomy but still sense a kind of continuum that connects the two ends. (Böröcz-Southworth, 1995)

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To our knowledge no studies so far attempted to define the strength of contacts on a continuous scale. Most researchers simply use and apply the former knowledge on tie strength rather than to give a try to actually measure these ties. (Mathews et al., 1988, Petróczi-Nepusz-Bazsó, 2007).

Angelusz and Tardos demonstrated that with precise operationalisation strong and weak ties can be clearly distinguished. They argue against contacts and relations that are automatically classified as one type or another. At the same time by quoting Feld's study (1982) they draw attention not to fall into the mistake of 'too much abstraction' when trying to define the different contact types. (Angelusz R. - Tardos R., 1998)

1.1. Challenges in operationalisation

While trying to capture the social sphere between strong and weak ties first of all we review the variables (both predictor and explanatory) worth to involve. We found certain variables useful independent variables during the model building process and there were those which according to other researchers' experiences not worth to take into account. According to Marsden and Campbell (1984), the "point variable" that is referred to as tie strength should be treated as an intervening variable: a variable that is in-between the predictor variables (for example: type of relation, similar socio-economic background, workplace, occupational prestige) that are basically determine tie strength and the indicator (for example: frequency of contact, duration of contact, proximity, mutual trust, spaciousness of the issues involved in the conversation) variables that describe parameters according to the predictor variables. The authors point out that there are indicators such as frequency of contact, duration of contact, which are established by predictors so it is worthless to involve in the analysis. It is easy to misunderstand the relationship with the neighbors or colleague, if we consider the frequency of contact. High frequency of contact doesn't definitely mean a strong relationship. According to Marsden and Campbell closeness is the only indicator which can determine the strength of relationship because it is independent from the predictors. (Marsden, Campbell; 1984; Petróczi-Nepusz-Bazsó, 2007)

1.1.1. Ego-centric network measurements

Over the past four decades, the most important tools for measuring and describing egocentric network structures are the different types of generators.

The two most popular approaches in egocentric network research are:

- name generators based on the works by Wellman, Fischer, Burt and Marsden[†]
- position generators developed by Lin and Dumin[‡]

Although there are relevant methodological and theoretical differences between the two methods, the main purpose in both cases is to explore the resources and the system of social support grounded in the individuals' social network system. (Chua-Madej-Wellman, 2009)

[†] see also Laumann 1973; Wellman 1979; McCallister and Fischer 1978; Ficher 1982; Burt 1984; Campbell and Lee 1991; Marsden 1987, 2003

[‡] see also Lin and Dumin 1986; Lin et al., 2001; Lin, 2001; Erickson 1996, 2004

Beside the name - and the position generator we have to mention the resource generators (Snijders 1999, van der Gaag and Snijders, 2003, 2004), small world (Milgram, 1967) and RSW-reverse small world (Killworth and Bernard, 1978) surveys also intended to map egocentric networks.

The name generator questions are usually followed by the so called name-interpreter questions. These questions describe the relation between ego and the alter named by him/her. (Marsden, 2005) These name-interpreters include data on 1) alters' personal characteristics such as – gender, age, educational level, socio-economic background; and 2) description of the ties such as – type of the relation between ego and alter (role-wise), frequency of contact, level of intimacy, duration and origin of the contact. (Chua-Madej-Wellman, 2009) Unfortunately it is still possible that important relations are left out simply because they are not part of ego's supportive network.

Based on 20 studies Brewer (2000) tried to figure out the dynamics behind how respondents recall names in their networks. He found that people tend to disregard certain relations of theirs when answering the name generator questions. Therefore he suggested that different techniques should be used at the same time to reduce the number of network members who are ignored or left out. (Such a bias tends to occur toward “stronger ties”.) According to Bell and colleagues (2007) although we don't know the exact proportion of the unrevealed network, the broader one's network is the bigger the left out part is. Marin (2004) examined who are the ones most likely to be missed from the list. Marin in his examination asked college students to answer a simple question: During the last six months whom did you discuss important matters with? (Just like the GSS core discussion network question). Then he extended this name generator with other name generators such as “think of those people with whom you did something together”. When only one name generator was asked the average number of alters was 5,6, then with assisted questions the average number of alters increased to 7,1. This study proved that simple name generators elicit only a certain number of alters. (E. Molin, T. Arentze, H. Timmermans, 2008)

1.2. Contact Diary

Name generators provide relatively detailed information on personal networks however the questionnaires are quite time consuming to fill (Fu, 2007). Although the data based on name generators are pretty informative, surveys are useful and the techniques have greatly developed in the past decades, the question still remains: what is a reliable estimate of the respondent's personal network. (Fu, 2005) Amongst others Fu also highlighted the biggest disadvantage of the different generators: they yield information on network characteristics but are less reliable estimators of one's actual personal networks. Generators are suitable for the interview setting but disregard certain contacts from the everyday life of one's actual social environment. (Fu, 2007)

To bypass such problems one alternative instrument is the contact diary where researchers ask respondents to keep daily records of all their interpersonal contacts during a given period of time (e.g. a week or 100 days). Although writing a diary is a labour-intensive task, ‘the information valuably captures a whole range of strong, medium and weak ties which may not appear in either a name generator or position generator’. (Chua-Madej-Wellman, 2009:9)

According to some researchers ‘a contact diary of a person can be viewed as a weighted random sample of members of the network of that person’. (Molin, E.-Arentze T.-Timmermans, H., 2008:14) There is a higher probability for alters to appear in a contact diary if ego has more frequent contacts with them.

1.2.1. Pioneer studies

Contact diary as a method was first applied by Gurevitch in 1961: at first 18 respondents recorded the diary in the USA. The sample was not representative, but it covered a wide a range of different occupations (from white collar worker to housewives). Respondents had to record and describe the socio-demographical background of the alters they met during those days. Gurevitch found that people who live in a ‘restricted social universe’ (e.g. blue collar workers, housewives) still have personal network compositions that ‘differed enormously’. (Pool-Kochen, 1978:23) Housewives were the most isolated: not only did they meet the same people every day but could rarely make any new contacts. (Gurevitch, 1961; Pool-Kochen, 1978; Fu, 2007)

In another pioneer study, Pool and Kochen wanted to give a precise estimation on the number of acquaintances respondents have by using diary method. They asked 27 people to list all the people they met in a notebook. They applied strict rules as to how a contact was defined. Respondents had to record all those people whom they met at least twice during the given period; ‘knowing was defined as facial recognition and knowing the person’s name – any useful name, even a nickname’ (Pool-Kochen, 1978:21) Memory and recollection were the biggest challenges. ‘It soon becomes tedious bore. Without either strong motivation or constant checking it is easy to become forgetful and sloppy. But it is far from impossible.’ (Pool-Kochen, 1978:23) One of these authors also kept a diary about his contacts for 100 days; he contacted 685 persons; with half of them he met more than once, during the given period he met them 3,1 times on average. Days were not equal: the minimum contact per day was 2; the maximum contact was 89 per day. He recorded 22.5 persons for a day during the 100 days. Median was 19. (Pool-Kochen, 1978)

According to Freeman and Thompson “diary method as used by Pool and Kochen and by Gurevitch provides an estimate of the subset of a subject’s total acquaintances that are active in a sample time period”. (Freeman-Thompson, 1989:154) They pointed out that those acquaintances who are inactive during a given period are still part of ego’s personal network. (Freeman-Thompson, 1989)

Lonkila, in his study, examined 78 teachers’ personal network in St.Petersburg and Helsinki in 1993-1994. Respondent teachers had to record their ‘non-routine’ contacts (mean as brief exchanges of greetings, general talk about the weather, etc.) for 15 days. They kept their diary recorded contacts which referred to the exchange of significant information and which were not part of their daily routine. So they did not have to list close family members, kins or relatives. After the examined period, teachers could add other alters who played a significant role in their life, but whom they did not meet during those 15 days. The study was repeated three years later (1996) with fewer respondents (20 teachers, 6 of them were part of the sample earlier, too). At this time, respondents kept a diary for a shorter period but the diaries were still very informative. During the examined period teachers had to take part in two separate meetings with assistants, they had to fill who-knows-how matrix and a structured interview was also made. Keeping up respondents’ motivation, researchers payed for the teachers’ assistance in the study. Using this method, Lonkila revealed the social networks of teachers and besides he could examine the process of forming networks. (Lonkila, 1999)

1.2.2. Present use of diary methods

Nowadays it is Yang-chih Fu who uses contact diary to study egocentric network. According to Fu, it is difficult to define accurately the social networks around ego. On one hand there are no clear boundaries around an egocentric network; on the other hand, every egocentric network has a certain dynamic, so members of network change over time. (Fu, 2005)

In one of his study Fu pointed out: “Although it has been innovative and illustrative to collect network data by various generators, all of these instruments produce proxy measures of networks rather than actual networks”. (Fu, 2007:195)

Fu compared two methods of measuring daily contacts:

- single-item survey – The question was: “On an average, about how many contact with in a typical day, including all those who you say hello, chat, talk or discuss matters with, whether you do it face-to-face, by telephone, by mail or on the internet and whether you personally know the person or not?” (Fu, 2005:173) The answers were typical ordinal categories (e.g. from ‘0 to 4 persons’ to ‘over 100 persons’). It is a low cost survey with strong limitations about the information on the actual network of ego.
- contact diary – using this measure, researchers appeal only to a few respondents who ‘provide a detailed daily account of the actual contacts they have made during a specific time period’. (Fu, 2005:170) Then respondents are inquired to give detailed information about every single contact and their relation to them. This method demands maximal effort, but provides the opportunity to collect rich information. (Fu, 2005)

According to Fu, the two methods ‘represent highly distinctive research instruments and generate contrasting forms of data that complement each other’. (Fu, 2005:173)

All the pioneer studies mentioned so far had strong limitations as to how many alters ego can record one day: Pool and Kochen asked respondents to enter only those contacts who are acquaintances; Lonkila instructed his informants to record those ties where there was an exchange of significant information with acquaintances. Researchers gave different instructions in connection with keeping a diary. Lonkila proposed teachers in his sample to record their contacts at the end of each day; Fu asked respondents to entry each contact as soon as possible. (Fu, 2007)

Diary method used by Fu differs from the other pioneer studies in other essential points:

- his respondents were asked to record each contact whether it was an acquaintance or not,
- Fu instructed informants to give as detailed information about alters as they could,
- Fu’s diary distinguished the alter’s contact if mentioned in different modes: face-to-face, phone and mail/e-mail. That is, if the respondent had contacted his wife face-to-face, by phone and by e-mail on the same day, the wife would be entered into the diary three times, each contact coded differently according to its specific form. (Fu, 2007)

1.2.3. Contact diary arguments – pros and cons

Pros

- Contacts are recorded in the network diary, show more reliable social actions which form and keep up the structure of network, than the other name generator methods.
- While name generator captures strong ties, position generator and RSW (reverse small world) methods capture weak ties, network diary elicits all kinds of different ties at the same time. Subscribed group of alters mostly aggregate from ties that are close to ego. Diary method compasses distant ties as well.
- Breadth of relations compassed by diary can be a reliable index to estimate the number of people ego can recall. (Bernard et al. 1990; Fu, 2007) Diary method can be a direct and extensive method measuring egocentric network. Because of remembering and recalling daily contacts, it is hard to measure the size and composition of egocentric network. This problem can be reduced by using a well-structured network diary.
- Network diary approach gives all the important information about ego's actual network, opposed to the generator methods where the biggest disadvantage is that they reveal alleged relations. We record those ties that ego can actually count on in a real situation.
- Diary measures ego's actual complete network in a certain time interval. While generator methods give different estimations about complete network or some subsets, network diary makes a more complete profile of personal network. '*While network generators produce various proxies for a global network or its subsets, the contact diary approach offers the potential for compiling a complete profile of such a network*'. (Fu, 2005:172)
- Information that comes from diary is rich and detailed. Data can be used for complex analysis both on the contact and the individual level, too. These advantages might compensate for that the method is quite expensive, time-consuming and needs lots of energy.
- Individual network is dynamic. Contacts as well as the network itself are constantly being formed by the interactions and actions. Daily contacts, interactions, actions should be the basic part of social ties researches, because we understand the structure of individual network from these. The diary could be an attractive, alternative and practical approach to understand the dynamics of people's actual social networks. (Fu, 2008)
- Despite of the obvious risks and limits, network diary encompasses both strong and weak ties. The diary reveals which ties of ego are weak and how intimate close alters change the contact with ego (Killsworth et al., 1990).
- Diary allows researchers to collect the actual, whole contact data regarding the individual network.
- With diary, researchers get a picture also from ego's perception and assessment of relationships with alters. (Fu, 2005)

Cons

- Filling the diary is really boring and time consuming. During the pioneer applications it turned out that it is not just time consuming but it is a big favor to ask from the participants. We can ask participant to fill the diary as long as they can, so we will get a whole contact list. Or we can ask them to do it for a fixed, shorter period, which is easier for them, but we will get less information. In previous studies the period for the research was determined between a week and 100 days. Some

people don't define time, but ask the participants to name 100 contacts. (Fu, 2007) Some say that short period (i.e. one week) gives a volatile picture of the person's network, longer period gives a more reliable picture. (Feld-Suitor-Hoegh, 2007)

- Pool and Kochen (1978) also argued that patient and long period data collecting was necessary, because one week can't be taken as an average, things may come to intervene. Nonetheless the primary purpose of these researches is to get a more complete estimate of person's contacts.
- Network diary only contains alters that ego meets in a certain time interval. So it can't be used to study network for longer time and globally. According to Fu those contacts that are not elicited during the examination period, can't be counted as ego's active contacts. (Fu, 2007). In our research there is the possibility to note those alter who are important to ego but were not contacted during the examination period. (see Lonkila above)
- It is more likely that participants recall contacts that are longer in time or emotionally intense. Fu said that the exact planning of the diary, participants' accurate guide and help can reduce this problem to minimal. (Fu, 2007)
- Feasibility. Freeman and Thompson (1989) said that diary method is too tedious and expensive to use for empirical studies. Cannot be used for large and representative samples, not possible to determine the ideal period during which participants have to fill the diary. Fu argues that small number of elements and informative diaries can yield valuable results and illustrate certain aspects of personal networks. (Fu, 2007)
- Ethical problems – In many cases we have more information about alters, than egos.

1.3. Strong tie - weak tie

The previously mentioned study of Marsden and Campbell (1984) was repeated by Mathews and his colleagues in 1998. They measured the strength of ties with a 13-item scale. 'The items were related to four factors, namely: intimacy, time, services, and intensity'. (Petróczi-Nepusz-Bazsó, 2007:40)

Wegener used a multidimensional system of indicators in such a way that on one hand, he made respondents to categorize alters into different type of relationship (mother, father, spouse, sibling, etc.), and on the other hand, asked them to place the alters on a ten-point social distance scale. Name interpreter questions were also expanded, e.g. duration of acquaintanceship; frequency of keeping contact. Besides this Wegener even examined the activities which respondents did with the person contacted. (Wegener, 1991; Böröcz- Southworth, 1995)

'Compared to the 'under-socialization' strong-weak dichotomy, using a multidimensional methods is evidently an improvement. Operationalization of certain factors', e.g. close of relationship, frequency of contacts, categorizing of people to groups, certain components has the same problems than the simple dichotomy: e.g. long period of time together can be in inverse ratio to the intensity of emotions.' (Böröcz-Southworth, 1995:27)

Following the above citation but relying on an even richer data from contact diary, we try to describe the social sphere between strong and weak ties as detailed as we can. Before doing so in Table 1 we first summarise the different dimensions of strong and weak ties.

Table 1. Different characteristics of strong and weak ties

Dimensions	Strong tie	Weak tie
Definitions (Granovetter, 1973; Marsden-Hurlbert, 1988; Wellman-Worthley, 1990:581 quoted Albert-Dávid, 2001; Angelusz-Tardos, 1991:82; Wellman-Worthley, 1990.)	daily, mostly intensive, close, intimate contacts; -close nuclear family ties (parents, children, spouses, siblings) -(close) relatives -confidential, intimate friends with frequent contacts Strong ties that at least 2 statements are true: intimacy, voluntary, multiplexity.	loose contacts, acquaintanceships, which compose a bridge to those valuable contacts which cannot be reached by strong ties; provide information; neighbours, teachers/professors, fellow colleagues, business partners, fellow employers/bosses, fellow soldiers, distant acquaintanceships, friends who are introduced by relatives
Quantity	below 10	many
Density	dense: everybody knows everybody	low density
Multiplexity	Large	small
Bridge role	little probability	high probability
Homophily or heterophily (Angelusz-Tardos, 1991)	contacts which foundation on the same stature (age, qualification)	heterophil contacts, potentially expansive resources
Integration	level of micro-society	level of macro-society
Language code	limited/restricted	detailed/worked out
Activity	expressive (want to save he/she has)	instrumental (want to catch sg)
Social visibility	close	open to the world
Social status	low	high

Edited by the authors. References: Angelusz, R., 2009 – quoted Gyarmati, 2009:55

As it is shown in Table 1. and as it appears in empirical researches the most common approach is that family ties and close friends are defined as strong, acquaintances or distant friends as weak ties. (Erickson et al., 1978; Granovetter, 1974; Murray et al., 1981; Wilson, 1998).

As Petróczi et al. states: „Often, researchers use the notion of weak or strong ties (e.g., Feld, 1997;-Friedkin, 1980; 1982; Haythornthwaite, 2002; Roch et al., 2000) as grouping variables. In many papers, it was rather unclear how the researchers obtain information regarding the strength of interpersonal ties. Few notable exemptions are, for instance, Hansen (1999), Harkola and Greve (1995), Mathews et al. (1998), Plickert et al. (2005), Podolny (2005), and Wellman and Frank (2001). Even in research projects, where the authors quantified their tie-strength related variables in their data set (e.g., Mitchell, 1987; Plickert et al, 2005; Wellman & Frank, 2001), the final outcome, again was nominal data, unsuitable for many statistical analysis, including sophisticated graph theoretical methods available for weighted graphs.” (Petróczi-Nepusz-Bazsó, 2007:41)

According to Granovetter (1973, 1974) there are basically four indicators which define the strength of the tie: 1) intimacy; 2) emotional intensity of the relationship; 3) frequency of interactions; 4) reciprocal services.

Petróczi, Nepusz and Bazsó (2007) offer an excellent review of the many attempts that have been made to find valid indicators and predictors of tie strength: “intimacy/closeness; multiplexity; frequency of

contact; reciprocity; reciprocal emotional support; social homogeneity; shared affiliation and social circles”. (Petróczi-Nepusz-Bazsó, 2007:40)

From the Hungarian studies, we mostly rely on the research and operationalization of Angelusz and Tardos (1991) to define types of tie strength. The two authors treated strong and weak ties logically separated and made them independent to each other. To measure weak ties, using principal component analysis, they compiled a complex index. To this, they used the following indexes: 1) number of contacts as occupations; 2) contacts as occupational prestige value; 3) estimated numbers of acquaintanceship; 4) number of postcards (at Christmas). The order of indexes counts as weight of factors in principal analysis. Angelusz and Tardos constructed another complex index to measure strong ties, too, using the following indexes: 1) multiplexity as one of the most accepted criterion of tight of contacts; 2) intimacy of contacts (speaking about private themes); 3) member of close family (parents, spouses, children) as basically strong ties; 4) important contacts (multifunctionality, intimacy, physical available; frequency of meeting are above the average. After defining the strong and weak ties, authors distinguished four types according to two dimensions: 1) poor in contacts (rates of strong and weak ties are below the average); 2) dominant strong tie (strong ties are above the average; weak ties are below the average); 3) dominant weak tie (strong tie are average the mean; weak tie are above the average); 4) rich in contacts (rates of strong and weak ties are above the average).

2. Method

In this paper our aim is to offer a more precise description of the structure of the social sphere based on data using the contact diary method. With more distinct categories we want to reveal what is between the strong and weak ties. The idea to develop and use contact diary in Hungary came from Róbert Angelusz, one of the leading network researchers in the country. Since 2006 he and Eva Huszti, co-author of this paper, have been working together on the adaptation and the piloting of the instrument applied in our research.

Based on Fu's and others' work, the most important features of the contact diary compiled by Angelusz and Huszti are:

- It is basically self-administered i.e. respondents fill the diaries themselves but if needed trained interviewers' assistance is available anytime throughout data collection. Prior to the filling a face-to-face introduction is provided to the respondents
- A 7 days (one week) data collection period – for the respondents 7 days seem to be still acceptable to participate and it is enough time to gather reliable information and data on egos' active network ties and relations
- A one-page manual is provided to help eliciting contacts and names – this is a practical guide where different tips are listed. The most optimal time to fill the diary, the contacts that should be registered and the way the name generator questions are to be interpreted.
- Definition of a contact: all kinds of one-on-one contacts lasted for at least 5-10 minutes, or contacts though shorter but considered important for the respondent. Contacts include from saying hello,

chatting, talking, meeting, or to sending/receiving a message; it can occur face-to-face, over the phone, on the Internet, or by other means of communication.

- An easily followed and structured outlook of the diary log: each day is divided into 3 periods (morning, afternoon and evening). This is a very sufficient help to elicit all the contacts occurred during the day.
- A two-page cover for each day. There are 15 name-generator questions for each alter. No matter if the alter is mentioned in more than one contact (i.e. more than once a day or week) the name generators should be filled only once.
- Important but not active persons: an extra two-page log for persons who are very important for the respondents but for one reason or another they were not mentioned during that 7 days period in question. * In our research 8 % of the alters belonged to this group: important but not mentioned during the week. On one hand this means that the contact diary elicits most of ego's active ties but it is still important to add such an extra name generator situation not to leave out a very important but less active segment of one's egocentric network.
- Contact diary log: each diary is an 18 pages long booklet, (see Appendix A for the questions)

2.1. Data collection

Our results are based on two different datasets: one is a so called general population sample in Nyiregyhaza; the other is a special sample of roma college students studying in Budapest. The Nyiregyhaza data collection is based on a sample which was used in a panel survey to study quality of life in Nyiregyhaza[§]. This sample contained inhabitants of Nyiregyhaza older than 18.

They were chosen by random sampling. Sample contained 2000 people supplemented with an extra-sample with further 400 inhabitants. The sample was representative for gender. Our sample was partly compiled from this previous survey. We carried out data collection in two phases: springtime of 2010 and autumn of 2011 in Nyiregyhaza. In each period 200 people were chosen independently to fill the contact diary. As a result 67 diaries (response rate 17, 6%) were filled. To reach a minimum of 100 contact diaries further people were selected with similar criteria to be representative for gender. In this 'third wave' 75 more diaries were filled. For our research purposes altogether 142 diaries were analysed; in these cases the data from the name-generator questionnaires were also available.

In both cases the data collection procedure was the same: first, we prepared and informed social worker students to be interviewers. They had known the structure of the diary and learnt how the diary should be filled. Then they went to all the given addresses where at first they filled the questionnaires with the name generator questions. Then the interviewer informed the respondent what the diary is about and how it works. They could assist the respondents and fill the first side of the diary together. The interviewer if needed could go back and visit the respondents at least once during the week of the data collection period to give further information and help. At the end of the week, when they collected the completed diaries, they had to check it and made any necessary correction.

[§] It is a town North-East of Hungary with about 120 000 inhabitants.

Budapest – roma college students

The sample in Budapest was not only smaller but much more homogeneous than in Nyiregyhaza. In 2011 the Hungarian Jesuit province together with representatives of other Christian churches and the Hungarian government established a broad network of four Roma colleges^{**}. Since the program bears great societal relevance and impact the Institute of Mental Health (Semmelweis University), the strategic research partner of the colleges has initiated a panel research design in which from 2012 the students from all the colleges will be followed up for four years. In the Jesuit Roma College we piloted the research design. This consists of three subresearches: a value study with self-administered questionnaires, in-depth interviews and the contact diaries.

Students' involvement became problematic because of ethical issues: students were afraid and mistrustful that the names elicited in the diary can be easily identified and misused. The layout of the two contact diaries were almost identical thus to make more comparable results. Contrary to Nyiregyhaza data collection interviewers were not involved in Budapest. Roma students filled the diary themselves; they were only informed once when the diaries were distributed. Questions were pretty personal so it was useful that they filled it individually and handed back at the end. All 18 diaries were filled and returned, unfortunately some were incomplete.

As part of the follow up study, we want to repeat data collection every year nearly at the same time. Feld et al. (2007) suggested repeating it for two reasons: less burden for the participants and the change in the personal networks can be studied. With the panel design we want to follow the dynamic change in Roma students' network. Study (1) which ties remain or diminish; (2) how do the parameters of the ties change; (3) what will be the extension of ties; (4) how would the whole network structure change.

2.2. Data processing methods: netwise and tiewise databases

Based on Müller C., Wellman, B., Marin A. (1999) 'How to use SPSS to study ego-centred networks', we set up two datasets:

- 'focal individuals and their ego-centred networks' (Müller, Wellman, Marin, 1999:1) – we have two different ego-netwise datasets: 1) an ego-netwise for Nyiregyhaza general population and 2) another ego-netwise for Budapest, roma college students;
- 'network members and their ties with focal individuals' (Müller, Wellman, Marin, 1999:1) – we have two different tiewise datasets: 1) tiewise-diary for Nyiregyhaza general population and 2) another tiewise-diary for roma college students

We had to link the ego-netwise and the tiewise-diary datasets in both of samples to make analysis on the network level. First, we ordered a NETID variable and values to every Ego in the ego-netwise (Nyiregyhaza general population: NETID 1-142; Budapest, roma college students: NETID 1-18) and then we gave the same NETID values to every Alters. The NETID identifies each ego. 'In the tiewise dataset, the NETID variable identifies the ego-centred network to which each networks member belongs. If several network members belong to the same network, each of the network members will have the same

^{**} <http://www.jesc.net/2011/10/the-church-and-the-eu-roma-strategy/>

NETID number.’ (Müller, Wellman, Marin, 1999:3) NETID variable makes possible to count aggregated indexes from alters data.

Contents of ego-netwise: socio-demographic characteristics of egos (‘personal characteristics’) and characteristics of their networks (network size, etc.)

Contents of tiewise-diary: socio-demographic characteristics of alters (‘personal characteristics’) and their tie characteristics – general characteristics of the tie (type of the relation; frequency of interactions; emotional intensity of the relationship, etc.) special information of particular cases (place, face-to face, etc.)

3. Results

Socio-demographic characteristics of the respondents (egos)

In the Nyiregyhaza sample, the average age was 45 years, and the rate of female was 58%. Most respondents completed secondary school. It can be said that considering age group and level of education all categories were represented (Appendix B)

In the student sample of the Jesuit Roma College the rate of female was 56%, average age was 21 years. All respondents finished secondary school. In this sense it is a much more homogeneous sample. Considering their marital status none of them were married, divorced or widowed.

Sociodemographic Characteristics of the Alters

Nyiregyhaza sample: in the 142 diary, the rate of female alters is 53%, average age is 41 years; the largest proportion has completed secondary school. (Appendix C)

Budapest sample: in the Roma students’ diaries the rate female alters is 55 %; average age was 27 years.

Network size

On average, Roma students named 26 alters in a week, while participants in Nyiregyhaza wrote only 18. The minimum entry was 6 and 2 respectively, the maximum number of alters was 93 and 43. (Table 2.) During the survey week people in Nyiregyhaza named 38 meetings on average. For the roma sample the average no. of contacts was 54.

Table 2. Network size

	Nyiregyhaza general population N=142	Budapest roma college students N=18
Total number of alters	2580	468
Total number of contacts	5451	965
Mean number of alters	18,17	26,06
Std.dev.	12,73	9,68
Min	2	6
Max	93	43
Mean number of contacts	38	53,61
Std.dev.	21,53	21,42
Min	3	15
Max	126	93

The Roma college students mentioned people in their networks more frequently. The reason might be their younger age, their higher educational background and their way of living: college students live a more aggregated life at school living in dorms, going to classes, clubs and other activities. The average number of alters are more balanced^{††} than in the Nyiregyhaza sample. In Nyiregyhaza the extremities are higher: there are people almost isolated while on the contrary some respondents are rich in contacts.

In Nyiregyhaza sample it is also possible to compare the number of alters elicited with name generator and with contact diary plus the overlaps and the differences. It is only every third alter (31%) mentioned in the diary that also was mentioned in ego's name generator network. This means that the bigger proportion of the diary contacts (69%) were revealed as a new contact compared to the name generator. Besides the primarily strong ties that were also elicited with name generator, many, significant new alters were introduced through the diary method.

4. Analysis

Our goal to draw a more detailed picture of the social sphere between strong and weak ties, we applied principal component analysis in our research. Since the analysis was to be on the alter level the two tie-wise-diary datasets were used separately but with identical commands and calculations.

First, we excluded those alters whom the respondents did not meet during the examined week, but had important role in ego's life as their names were recorded in the diaries. Some of the name interpreter questions were not applicable for these alters, therefore we had no information in connection to those variables we included in the PC analysis. For this reason we excluded these alters from the further analysis.

^{††} The StD. in the roma sample is smaller.

Table 3. Characteristics of Contacts (Frequencies of variables included in principal component analysis)

	Nyiregyhaza general population		Budapest roma college students	
	N	%	N	%
'In general how do you feel being with this person?' (1. independent variable)				
1=dislike very much	24	1	3	1
2	94	4	18	4
3	513	22	66	16
4	805	35	107	26
5=like very much	889	38	217	53
'Frequency of talking' (2. independent variable)				
less than monthly (1)	234	10	29	7
monthly (2)	161	7	13	3
more than once a month (3)	386	17	31	8
weekly (4)	374	16	78	19
more than once a week (5)	479	21	117	28
every day (6)	681	29	146	35
Number of meeting during examined week* (3. independent variable)				
1	1474	60	258	61
2	334	14	75	18
3	170	7	27	6
4	132	5	18	4
5	108	4	12	3
6	50	2	15	4
7	200	8	15	4
Intimate contact (4. independent variable)**				
0=not at all	128	6	24	6
1	680	29	170	41
2	758	33	160	39
3=very much	737	32	57	14

*Number of records in the diary regarding the given alter

** more detailed see above

As the principal component analysis needs to use high measurement level variables, we created the INTIM variable using three, originally nominal, low measurement level variables. Merged variables are the following:

- Ego has been at alter's flat (yes-no)
- whether ego talks with alter about private issues (yes-no)
- actually speaking face-to-face (yes-no)

We consider an ego-alter contact intimate, if ego has already been at alter's flat, ego speaks with alter about private issues and spoke face-to-face during the studied period. Thus, we don't treat an ego-alter dyadic contact intimate, if ego has not been at alter's flat, ego does not speak important issues with alter and their contact was not face-to-face during the given period. We added this newly composed INTIM variable as the fourth explanatory variable to principal component analysis.

In spite of the differences the distribution of variables in the two samples are rather similar. (Table 3.) It is particularly true for the frequency of speaking and numbers of meeting during the examined week. We measured a larger deviation in the case of the other two variables. In the Nyiregyhaza general sample where respondents were elder, thus they had more contacts which exist longer period, their contacts with alters is rather intimate (very intimate 32% versus 14%). At the same time, for young college students is more important to enjoy the mentioned alters' company and they qualify according to this feeling their relationship (very enjoy alter company 53% versus 38%)

From variables which was used in the principal analysis, all scored the required communality rates (above 0,25) . In the models, Nyiregyhaza sample saved more than 50%; Budapest sample saved almost 50% from original variables' contents of information. (Appendix D)

In both samples the most influential variable, with the highest communality score was the Intimacy variable. (Appendix E) It is also noteworthy that in both cases the order of the variables in the component matrix was also identical: how intimate the contact is, frequency of speaking, number of meetings during examined week and the least important is the general feeling towards the person.

5. Discussion

Strong tie, weak tie and in-betweeners

The SoT index (Strength-of-Ties index) generated by principal analysis assigns a value to every single alter which is regarded as the tie strength of any given ego-alter contact. The higher the value of this SoT index is the stronger the contact is between ego and alter. In the Nyiregyhaza general population sample, the value of this index for the 2238 alters ranges between - 1.99 and 2.68, while in Budapest roma college students' sample, the value of this index ranges between -3.2 and 2.4. In this latter sample, the SoT index had a higher value on both sides, the positive as well as the negative side.

Tie strength of dyad contacts were compared on the type of relation describing the tie between ego and alter so to give a finer and more precise description of the structure of egocentric network. Instead of the usual two-pole world, where the division is simply between strong and weak ties we show a more detailed social environment of ties. In this way less significant differences became tangible and an apparent sequence of the tie types could be identified: the range of ties from the strong-strong ties, across the weak-strong ties and loose-weak ties to the absolutely weak-weak ties.

In Table 4, we indicated the frequency of type of ego-alter relation in both of our samples. From this, we can see that certain types of relations don't or hardly appear in roma college students' sample: there are a few neighbour, colleague and contacts in the service sector. At the same time, it is only roma students who have college mates contacts. Compared to Nyiregyhaza general sample, the rate of the closest friends is double among alters named by students (30 versus 15%). In the general population the rate of close-kin ties (mainly because of spouses/ partners), present neighbour, present colleague and contacts that link to workplaces are higher. In the Nyiregyhaza ego-networks' every tenth contact is related to some kind of services.

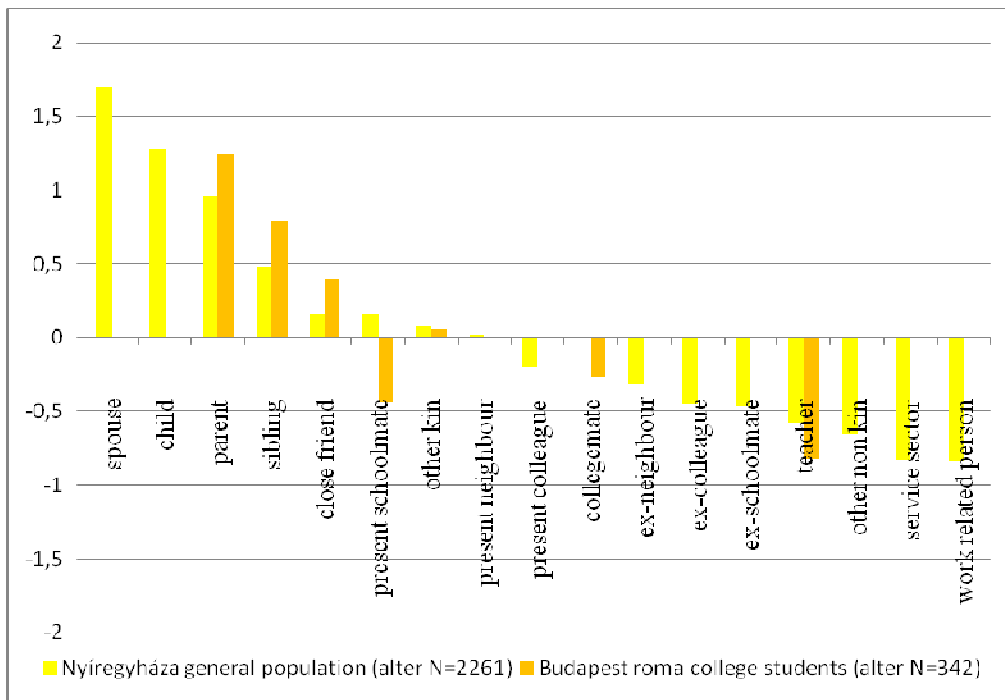
Table 4. Type of relation between ego and alter (predictor variable)

	Nyiregyhaza general population		Budapest roma college students	
	N	%	N	%
Close kin-ties (parents, children, spouse, siblings); partner	484	19	54	11,5
Other kin relations	361	14	49	10,5
Neighbour (total)	239	9	6	1,5
present	159	6	2	1
Former	80	3	4	0,5
Colleague (total)	403	15	19	4
present	316	12	8	2
Former	87	3	11	2
Schoolmate (total)	107	4	68	14
present	47	2	52	11
Former	60	2	16	3
Teacher	12	0,4		6,5
present	6	0,2	26	6
Former	6	0,2	3	0,5
Close friend	393	15	135	30
Acquaintance	17	0,7	13	3
Contact connected to workplace/school	171	7	13	3
College mate	-	-	62	13
Service sector (postman, hairdresser, shop assistant, doctor, nurse, pharmacist, etc)	259	10	12	3
total number of alters	2580		464	

We examined the connection between predictor variable (type of relation) and SoT index by using anova. Not only the connection between the two variables has similarly significant and strong explanatory power in both of the samples, (see Appendix F), but from Fig.1. we can see that the order of the types of the relation regarding tie strength is also similar^{††}. This result confirms our initial concept that it is possible and meaningful to distinguish the different types of relations on a more sophisticated scale where there are more choices than just strong and weak.

Figure 1 SoT index of the type of relation in the two samples

^{††} Except for one type: present classmate.



Strong strong-ties

In Fig.1. on the left side of the scale there are the so called classical strong tie relationships: spouse, child, partner and sibling. These people enjoy each others’ company, they are in an intimate relation, often meet and talk frequently. For the roma students since they are single and childless, parents and siblings are the closest and strongest ties.

Weak strong-ties

In both samples (especially in the roma sample) close friends are strong ties. In a younger age the strength of these ties are stronger, with older age they seem to lose their importance but still remain essential and relevant connections. Other kin relations are also to be regarded as strong ties but the strength of these ties are incomparably weaker than any other kin ties. Interestingly the only difference in the two samples is how present schoolmates are „treated”: for the roma college students they are probably important but nonetheless weak ties whereas for respondents in the general population these relations are less important but still regarded as strong ties. For them these ties are more homogeneous while for the roma students most of these schoolmates are rather strangers. Although it is also possible that during their higher educational period a few of these schoolmates will become closer and turn to be friends while the rest remain less important weak ties. Present neighbours with almost „undetected” tie strength (the average value is almost 0) are the typical *either/or* ties: for some (probably old people) they are strong ties while for others it is just an „irrelevant category”. In this respect gender homogeneity is a significant explanatory factor: neighbour ties are strong if the respondent and the alter are both of the same sex.

Strong weak-ties

In the roma students' network similar positions describe school- and college mates; at present these are strong weak-ties who in the course of time might change and become one's intimate and supportive relations or on the contrary they even

In the general population where more different relational types can be analysed present colleagues, plus all the „ex”-es, ex-colleagues, ex-schoolmates and ex-neighbours seem to be the important (classical) weak ties. The role of present colleagues partly supports/confirms those observations that suggest a decrease in the level of commitment and loyalty to one's workplace and colleagues. With special former ties TIME as a very relevant aspect of tie strength should be considered: with time passing certain tie-weakening and erosion seems unavoidable but still these ties remain visible and are at hand when needed.

Weak weak-ties

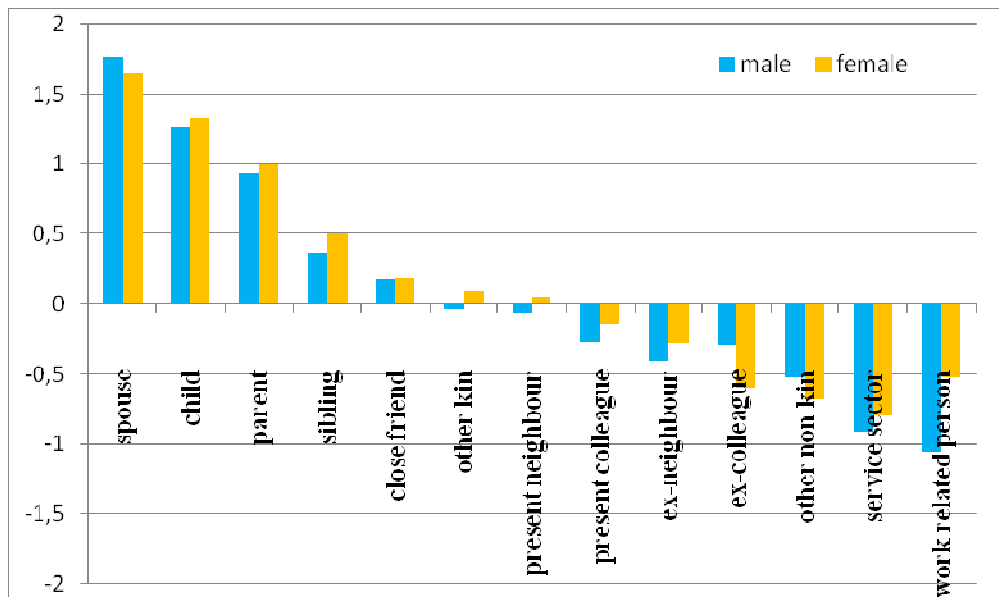
At the right end of the line (Fig.1) weak and less important weak ties can be identified. These are teachers, other non-kin relations, people who are connected to workplace and relations which can be categorised as people working in the service sector. In this last group there are for example the postman, hairdresser, shop assistant, doctor, nurse, pharmacist and so forth.

Besides the simple comparison of the two samples on the basis of tie strength it is also challenging to study the difference of egocentric networks based on gender and age group of the respondents. Are there any diversions in the nature of different type of relation and if yes, what are these differences. Since the roma student sample was too small, this kind of analysis was only done in Nyiregyhaza general sample.

Differences on the basis of gender and age of the respondents

In respect to SoT index we found significant differences by egos' gender. (Fig.2)

Figure 2 SoT index of the type of relation by respondents' gender



Women have a little bit stronger contacts with members of the close family than men, which primarily can be explained by the fundamental roles based on the gender. However, in the case of spouses men’s contacts are stronger. (This is in accordance with name generator surveys where men tend to name their spouses more intimate than women.)

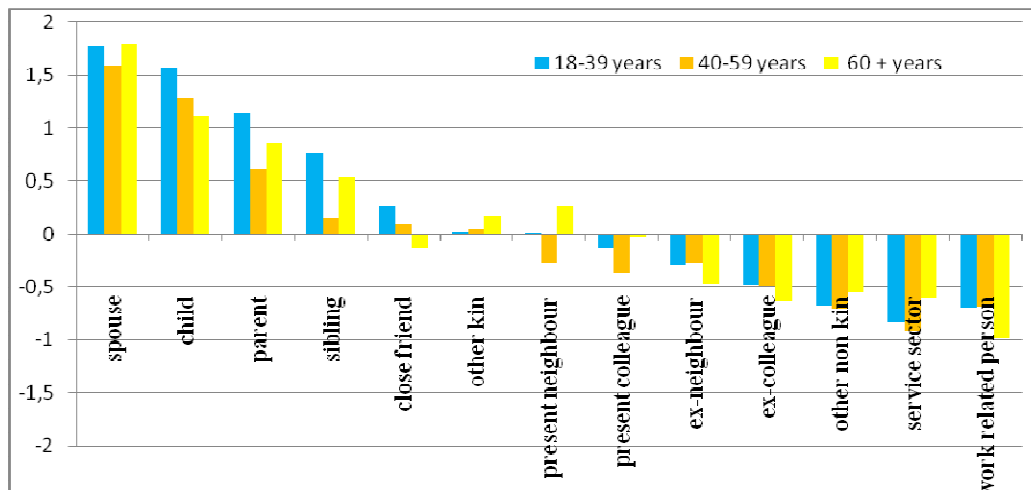
Relations to other kin are also stronger among women who can also be explained with the traditional women roles: one of their most important tasks is keeping family together and maintain a good relationship with family members.

The strength of contacts with close friends don’t differ thus on one hand we can confirm t that intimacy also plays an important role in the friendship for men, and on the other hand contacts with close friends have similar content for men and women. It would be worth extending to study these contents of meeting and talking with friends.

Strong relation with present neighbours is more typical to women. In cases of women, relation with present neighbours is positive, while among men this relation appears in the negative side. Relation with ex-neighbours is negative for both men and women, thus they are essentially weaker ties than present neighbours. Connection with them shows more positive relation in cases of women.

Contact with both present and ex-colleagues is considered a weak tie, but women have less weak relations with present colleagues, while among men connection with ex-colleagues is stronger.

Figure 3 SoT index of the type of relation by respondents’ age group



On the basis of respondents' age we can see that connection with spouses is the strongest in cases of young (18-39 year old) and elder (60+) respondents. In the cases of young people the feeling of new and undiscovered emotions influence the strength of these ties, while in cases of elder people it is the feeling of affection and the shared past that make these ties stronger.

In the cases of young people the strength of connection with children is the strongest and this value is reduced with age progressing. In the parent-child relation one of the most important factors is how often they meet. The child-parent relation is the strongest at the two poles: 1) young respondents' contacts with their parents are the strongest, because of meeting daily and discussing important things; 2) the strength of elder respondents' relation to their parents can become stronger when supporting and spending more time together, with more frequent talking and meeting. Connections with sibling are stronger among young and elder respondents. Role of the family of orientation (parent, sibling) is stronger in ego's younger and elder ages when everybody needs this kind of support. The importance of other kin ties increases with people's age thus the relation with them becomes stronger.

Unsurprisingly, relation with close friends is the strongest in the young age group.

Present neighbours play the most important role in life of elderly people. Their connection with neighbours is stronger, which can be increased by the physical closeness because of repeated meetings, talking and 'engaging in conversation' that are more typical among old people. Connection to neighbours is the weakest among middle-aged, which can be explained by lack of time. In their cases connection with present neighbours is also in the negative domain.

Relation with present colleagues is in the negative pole in every age group, but middle-age's connections with their colleagues can be qualified even weaker than among the young.

6. Conclusion

With this paper our aim was to offer a more precise description of the structure of the social sphere by using network data from contact diaries. With more distinct and explicit categories we wanted to reveal what is between strong and weak ties. Our concept and hypothesis was examined on two completely different datasets yielding very similar results. Therefore we are quite convinced about the

reliability of contact diary as a method for studying egocentric networks. On the other hand there is the issue of validity. Calculations from the general population dataset verify our conviction that contact diary data reveal a larger network structure where more numerous, especially weak (non-kin) ties are elicited. In the general population sample the rate of kin ties based on name generators was 51 % while 31 % based on the contact diary dataset.

The other focus of our research was to model and calculate tie strength. Our index measuring tie strength (SoT index) was calculated on the type of relation between ego and alter. The contact diary features (with daily division), the complementary name generators and the valid network structure all promoted our operationalisation techniques. Apart from the variables generally included (like each other in general and frequency of talking) we introduced other explanatory variables such as number of contacts in the given week and the level of intimacy. The latter was operationalised on the basis of three dummy variables. On the other hand we have to note that neither multiplexity nor reciprocity measures were included in our model. As a result instead of the usual two-pole world, where the division is simply between strong and weak ties we described a more detailed social environment of ties. In this way less significant differences became tangible and an apparent sequence of the tie types could be identified: the range of ties from the strong-strong ties, across the weak-strong ties and loose-weak ties to the absolutely weak-weak ties.

The future potentials of the method lie in the panel research we initiated among the roma colleges across the country. With the four year follow up design we will study the dynamic changes of the roma students' network: (1) which ties are strengthen or fray; (2) how the parameters of the ties change; (3) what will be the extension of ties; (4) as well as how does the whole network change. For the Nyiregyhaza general population sample where more and different data are available the wide range of network measures and indices can be used to explain other, important independent variables such as subjective health, quality of life or level of satisfaction.

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APPENDICES

Appendix A

Name interpreter questions used in the diary:

1. demographical data
 - gender
 - age
 - is he or she Roma? (used only in the Roma students' diary)
 - educational qualification
 - occupation
 - place of residence
2. questions concerning about relationship
 - how long ego knows alter (1=just met for the first time, 2= for a couple days, 3= for weeks, 4= for month, 5= for years)
 - the nature of the relationship (1=spouse, 2=parent, 3=child, 4=brother/sister, 5=other relatives, 6=former neighbor, 7=current neighbor, 8=former classmate, 9=current classmate, 10=former teacher, 11=current teacher, 12=former colleague, 13=current colleague, 14=close friend, 15= other...)
 - has ego ever been in alter's place (yes-no)
 - frequency of conversation (1=daily, 2=weekly, 3=more times a week, 4= more times in a month, 5=monthly, 6=less than a month)
 - In general how much does ego enjoy to be in alter's company? (in scale from 1-5)
 - does ego discuss important things with alter? (yes-no)
3. Questions describing to the specific meeting
 - place of meeting (1=ego's place, 2=workplace/school, 3=place of business (bank, post office), 4= public place (street, restaurant, cafes, pub etc.), 5=alter's place, 6=alter's workplace, 7=other:.....)
 - form of the conversation (1=personal, 2=telephone, 3=chat/Skype/e-mail)
 - who initiated the conversation (E=ego, A=alter, SE= somebody else, -=no one, meet by chance)
 - number of people present during the conversation (outside of ego)
 - content of the conversation: such as confidential, personal, politics, actualities, sport, TV shows etc. (only used in Roma students' diaries)

Appendix B

Socio-demographic characteristics of Respondents (egos)

		Nyiregyhaza general population		Roma college students	
		N	%	N	%
Sex	Male	58	42	8	44
	Female	78	58	10	56
Age	20-29 years	26	19		
	30-39	32	23		
	40-49	23	16		
	50-59	23	16		
	60-69	19	14		
	70<	17	12		
Education	Max.elementary	12	9		
	Middle school	78	60	18	100
	High school	41	31		
Marital status	Single	24	18	18	100
	Married	83	61		
	Common-law marriage	8	6		
	Divorced	10	7		
	Widowed	11	8		
Economic activity	Active	76	53		
	Unemployed	18	13		
	Retired	21	15		
	Other (student, dependant)	27	19	18	100

Appendix C

Socio-demographic characteristics of Alters

	Nyiregyhaza		Roma college students	
	N	%	N	%
Sex				
Male	1212	47	212	45
Female	1364	53	256	55
Age				
<20	137	5	83	18
20-29 years	524	21	246	53
30-39	593	23	49	11
40-49	474	19	47	10
50-59	425	17	21	4,5
60-69	262	10	13	3
70 <	116	5	2	0,5
Education				
max. elementary	272	11	46	10
middle school	1412	57	267	58
high school	795	32	144	32
Roma origin				
yes	-	-	224	48
no			242	52

Appendix D

Principal Component Analysis

D.1. Communalities

Variables	Extractions	
	General population sample	Roma college students
frequency of speaking	0,565	0,333
'In general how do you feel being with this person?'	0,435	0,563
Number of meetings during examined week	0,533	0,475
Intimate contact (according to 3 variables)	0,611	0,504

D.2. Total Variance Explained

Component	General population sample					
	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,145	53,636	53,636	2,145	53,636	53,636

Component	Roma college students					
	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1,875	46,879	46,879	1,875	46,879	46,879

Appendix E

Component Matrix

Variables	Component 1	
	General population sample	Roma college students
Intimate contact (according to 3 variables)	0,782	0,750
Frequency of speaking	0,752	0,710
Number of meetings during examined week	0,730	0,689
'In general how do you feel being with this person?'	0,660	0,577

Appendix E

E.1. ANOVA Tables

General population sample					
	Sum of squares	df	Mean square	F	Sig.
factorscore*type of relationship Between (Combined)	955,539	16	59,721	103,340	0,000
Within Groups	1296,827	2244	0,578		
Total	2252,366	2260			

Roma college students					
	Sum of squares	df	Mean square	F	Sig.
factorscore*type of relationship Between (Combined)	134,139	9	14,904	21,969	0,000
Within Groups	265,268	391	0,678		
Total	399,407	400			

E.2. Measures of Association

	General population sample		Roma college students	
	Eta	Eta Squared	Eta	Eta Squared
factorscore*type of relationship	0,651	0,424	0,580	0,336