

Configurations of Relationships in Different Media:  
FtF, Email, Messenger, Mobile Phone, and SMS

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## Abstract

This study analyzes the configurations of communication relationships in people's everyday communication settings through five different media: face-to-face, email, instant messaging, mobile phone, and small message service. The study focuses on the socio-cultural context of South Korea, and social-networking patterns expressed in the increasingly mobile generation. Through a web survey designed to attract participants throughout Korea and across a variety of employment categories, we asked respondents to identify (1) for each medium (2) up to five of their most frequent communication partners, (3) the partner's social role (work colleagues, family, friends, etc.), and (4) their own employment category. Individual-level analyses and network-level analyses were employed to describe and compare variations in communication relationships, and configurations of relationships among social roles overall, within each of these media, and for different respondent employment categories. While there are some precedents for the methods used here, we used a novel network-analytic approach to identifying configurations of relationships across media. Mobile phones tend to be used in reinforcing strong social ties, computer-mediated text-based media tend to be used in expanding relationships with weak ties, and FtF seems to be a sort of universal medium without significant differences across employment categories.

### Configurations of Relationships in Different Media: FtF, Email, Messenger, Mobile Phone, and SMS

The study explores the configurations of relationships in people's everyday communication through face-to-face and four new media. In particular, it takes into account the social contexts of both respondents (their employment categories) and their communication partners (their social roles), as well as the closeness of the relationships between them. Further, it analyzes and compares configurations of relationships overall and within these media at both the individual (respondent) and configuration (network) level. The study analyzes responses from a cross-section of Koreans, as new media use is especially relevant in the Korean context.

#### *Contextual Aspects of Media Use*

In general, studies of new media use have moved from a more technological to a more social context perspective. The media richness model proposed that the use of a certain medium in a communicative activity is influenced by the fit or match between the medium capacity (richness – presented as an objective characteristics of the medium) and the nature of the task (uncertainty/equivocality). Initial results from this approach were supportive and influential (Daft, Lengel, & Trevino, 1987; Trevino, Lengel, & Daft, 1987). However, as computer-mediated communication (CMC) media became widely available, and more people adopted and used email, voice mail, and the Internet, contradictory findings appeared (for example, greater socio-emotional content and relational development in mediated communication, or broader use by top managers than expected, etc.; see Rice & Love, 1987; Walther, 1992). Researchers began focusing on the social influences, network contexts, and processes of media uses and perceptions (Fulk, Schmitz, & Steinfield, 1990; Rice, 1993; Trevino, Lengel, & Daft, 1987; Walther, 1992). Others proposed that the characteristics of a medium are defined and appropriated in the social activities in which the medium is used (DeSanctis & Poole, 1994; Orlikowski, Yates, Okamura, & Fujimoto, 1995).

Licoppe and Smoreda (2005) point out that specific conditions of communication – aspects of the medium, purposes, and the participants -- influence how one chooses, uses, and perceives different media. For example, because the small screen and keyboards of SMS and wireless email severely limit the length of messages, and even the use of full words, typically senders and receivers must already know a lot about each other as well as the message context, implying that these participants are members of an ongoing communication network. Mobile phone use emphasizes dyadic interaction, while PC email allows copying to multiple others and broadcasting to discussion lists, which generally include many people not personally known to the sender (Miyata, 2006). In Japan, for instance, mobile phone emails tend to go to those more socially or physically present than those contacted through PC email (Miyata, 2006; Miyata et al., 2005). Wuan-Haase and Wellman's (2006) analysis of media use in a high-tech organization concluded that "CMC, FtF contact, and the telephone serve different communication purposes, often working in synergy and not in competition with one another" (p. 299). For example, instant messaging is a transient medium used to check in without requiring an immediate response, to set up a face-to-face meeting, to signal accessibility of others (e.g., whether they are logged on or not) and for chatting and discussing issues, all fostering increased closeness in the workplace. On the other hand, email is used for more detailed information exchange, especially those that do not need an immediate response, to maintain records of the interaction, to forward or broadcast messages to others, or for less close relationships.

#### *Multiple Media Use and Communication Network Relationships*

To what extent, then, can new media maintain, expand, or decrease existing relationships; how might those relationships differ from more traditional FtF relationships; and what participant contexts might influence these differences? Some research argues that people can maintain a sense of interconnectedness, even an intimate community, through media, even if the network members

are geographically dispersed (as Katz & Rice, 2002, and Wellman & Gulia, 1999, argue for the Internet). New media may complement current interpersonal and telephone communication or may lead to additional and specialized uses (Johnson-Smaragdi, 2001; Quan-Haase & Wellman, 2006). Further, mediated communication can foster “connected presence” (Licoppe & Smoreda, 2005) or “communicative readiness” (Nardi, 2005) whereby people can manage multiple encounters at the same time and across time, signal ongoing awareness of and relationships with specific others, indicate one’s availability, and maintain a social context (such as an ongoing “common ground” or “field of connection”), which also influence how other media choices and uses are interpreted (Nardi, 2005; see also Rice, 1987; Sitkin et al., 1992; Wei & Lo, 2006).

For example, maintaining peer relationships is especially important for adolescents and teenagers, as they make the transition from childhood to adulthood, from parent-defined to peer-defined self, dealing with insecurity and changing contexts. A recent Pew report found that teenagers tend to use email for communicating with “adults” and institutions for transmitting lengthy and detailed information to many others, while using instant messaging for day-to-day conversations with a range of friends (Lenhart, Madden & Hitlin, 2005). Similarly, Boneva et al.’s (2006) study of 13-18 year-olds found that conversations using instant messaging were more social than FtF visits or phone conversations. Finnish teenagers also use mobile phones to both maintain and extend their social networks (Oksman & Turtianen, 2004, p. 324).

Moving away to college places great obstacles and costs on maintaining those high school friendships. Cummings et al. (2006) tracked the communication networks of high school students from the spring of their senior year in high school through the end of their junior year in college. Email and IM seem to guard better against declines in closeness to high school friends after moving to college – possibly because communication frequency is least affected by distance and cost – even though phone communication was the strongest predictor of closeness. However, concerning their new college friends, these students communicated much more via FtF and phone interactions than through email and IM. Baym, Zhang and Lin’s (2004) study of US college students’ communication diaries found that most interactions were FtF, followed by phone calls and internet. Nearly two-thirds of the respondents socialized through all three media, with about a quarter doing so through FtF and phone only, and only a small percent doing so through Internet alone. A Pew study (2002) reported that primary uses of the Internet by college students include social communication (42% of respondents), entertainment, easily keeping in touch with their friends, and communicating with friends and family.

Some studies of social uses of new media have more specifically looked at relationships between media use and participants’ social networks. Boase, Horrigan, Wellman and Rainie’s (2006) nationally-representative survey found that people who kept in contact via email with most of their central relationships also had greater telephone contact with those people, and more FtF contact for non-central relationships. Internet users had more non-central relationships. Further, email users received more support from their relationships, and even more so if they used multiple new media (such as instant messaging, mobile phone, PDA, text messaging or wireless Internet connection). Nardi, Whittaker, and Bradner (2000) found that while IM was used by members of an ongoing work group as a channel to seek and exchange content, it was also used as a coordinating tool for managing accessibility and flow of interactions, apart from the content.

IM is thus generally used to maintain a small network of fellow IM users rather than to connect to new others. For example, Nardi, Whittaker, and Schwarz (2002) found workplace IM buddy lists contained six friends/family and 16 coworkers but the users frequently interacted only with four or five of them. Schiano et al. (2002) found teenagers communicated regularly with fewer than five IM buddies, while Grinter and Eldrige (2003) and Ito (2005) noted fewer than three regular

communication partners for UK IM users or Japanese mobile phone users, respectively (cited in Nardi, 2005).

A small set of research focuses on the relationship between multiple media use and network relationship strength. For example, those with stronger ties (formal work ties; close friend or friend) have more relationships, communicate more frequently, and use more media than do those with weaker ties (Haythornthwaite, 2005; Haythornthwaite & Wellman, 1998). In an online distance learning setting, people with strong ties tended to use email and instant messaging more frequently than those with weak ties (Haythornthwaite, 2000). Studied from a series of major Japanese projects have compared network aspects across new media. Ishii (2006) compared the use of landline phone, mobile phone, mobile email (text messaging), and PC email by respondents and their reported partners, based on survey data from a representative sample of nearly a 1000 19-69 year old Japanese, involving an average of 5.6 communication relationships per respondent. Ishii found differences in media use by these dyads based upon gender, partners' social roles, use of other media, and distance between partners. Miyata's (2006) study compared mobile phone email and mobile phone voice communication from over 1000 nationally representative Japanese respondents to a two-year panel survey, which also asked about the diversity of social roles in the respondents' personal networks. While mobile emails did not affect one's network diversity but did foster more supportive network ties, PC emails increased network diversity, especially through more weak ties.

#### Research Questions

So different media may be used in similar, overlapping, and different ways, depending on their technical features, the communication purposes, user and partner characteristics, and social contexts, and may weaken, support or expand current networks or foster new ones. This study examines the configuration of communication relationships with different social roles through different media, across respondent employment categories, at the individual and the network levels of analysis, summarized by the following two general research questions.

*Individual Level RQ1: How do the number, diversity, type and closeness of communication relationships vary across media, and by respondent's employment category?*

*Network Level RQ2: How do configurations of relationships vary across media and by employment category? In particular, how do configurations of relationships in new media compare to those in FtF, overall and across employment categories?*

#### Method

##### *Korean Context*

The Republic of Korea, with a population of 48.2 million, had the 12th largest economy in the world in 2002 (ITU, 2004, p 7), the 7<sup>th</sup> highest level of information use (consumption flows of ICTs/time period) and 98.1% literacy in 2003 (Sciadas, 2005, p. 18). As of 2002, there were 55.2 Internet users per 100 inhabitants, South Korea had the world's highest broadband access (70%), and 68% of the population had mobile phones (compared to 48.9% with landline telephone) (ITU, 2004). By 2003 those figures increased to 61% Internet, 70.1% mobile phone, and 53.8% landline (Sciadas, 2005, p. 22 and 26). By December 2004, South Korea had the 11th highest Internet penetration (63%, 31.6 M of 49.9M) (Internet World Statistics, 2006). According to the National Internet Development Agency of Korea (2005), young people's access to wireless Internet services, compared to other generations, is particularly growing very fast. As of September 2005, more than 80 percent of middle- (83.6%) and high-school students (89.3%) used wireless Internet. Youths (aged 12 to 19) who have their own mobile phones used the Internet 6.7 times per week.

In the case of mobile phone, rapid and extensive adoption was stimulated primarily by the nation-wide development and standardization of CDMA, and regulated low usage rates (Sciadas, 2005), resulting in "state of the art mobile networks and handsets, the world's most extensive broadband network, [and] 25,000 cybercafés located around the country" (ITU, 2004, p. 6). Mobile

phones allow Korean users to purchase goods at coffee shops, convenience stores, department stores (either in person or online), and check on missed SMS calls, purchase lottery tickets, and download and read e-books (p. 29). “To Koreans, their mobile handsets often represent their digital connection to friends, family and the world” (ITU, 2004, p 18). The marketing company IDC (2006) reported that Korea has the greatest penetration of mobile phones with color displays in seven Asia and Pacific countries.

*National Web-based Survey and Network Generator*

A telecommunication company, SK-telecom, sponsored a research study on media users through the Korean Society for Journalism and Communication Studies. The survey was designed by 10 communication researchers in Korea. During the web survey development, the researchers peer-reviewed the questions (adding and subtracting, and revising questions). Then, a survey company took over the survey questionnaires, did a brief pilot survey, revised questions, and implemented the survey. Although this survey was conducted via the web, it was designed to represent the Korean adult population as closely as possible. The commercial company maintains a large master survey pool developed and maintained over time. The company provides small gifts for people who respond to the advertisements for participation, for registration to the master pool, and for participation in each survey. Registrants provide demographic and media ownership and use information. The company then uses the demographic information to create a proportional stratified sampling frame by gender and age categories, appropriate for the specific survey topic (such as email and mobile phone users). The entire master pool is solicited by email, and the survey stays open until each category is filled, closing down each category when it reaches its criterion sample size. Typically, this takes about a week or 10 days. The survey program also evaluates responses to reject surveys with skipped questions and random or invariant responses. A total of 1507 people responded. As the survey collection ended when the stratified categories were filled, there is no “response rate” to report. We collected information on the respondents’ *employment category*, their *media* use, the *social roles* they communicate with through each of those media, and the *closeness* of those relationships, as a very limited but appropriate set of social contexts influencing media use.

The web survey asked respondents to indicate their gender and age (only for descriptive purposes), and check their *employment category* from 11 listed: Administrator/management, IT technician or professional, salaried, sales/service, simple technician and laborer, agricultural/fishery, housework, middle and high school students, college student, no occupation, and other. (The survey considered a person as “salaried” if (a) one is get paid regularly (by month), and (b) if his/her company size is big (over 100 employees) and his/her ranking position is under a managerial position, or (c) if his/her company size is smaller (under 100 employees) and his/her ranking position is under a mid-level managerial position. It does not include government office workers; religion, art, athletic field workers; employees in political and non-governmental political organizations; self-employed; free-lance workers; doctors, nurse; lawyers, accountant; sales-person (at department store or door-to-door); paid-by-day workers; and others such as farmers, fisherman, students, professors, teachers, army, etc.). Because of very small frequencies for some of these, they were grouped into six categories: salaried, homemaker, middle/high student, college student, IT professional, and others. The “other” category, with 468 respondents, was not included in the analyses, to maintain a consistent sample across the analyses that did, and did not, include employment categories. So we use the sample with the five general employment categories throughout.

This sample of 1039 respondents consisted of 44% male and 56% female, distributed across the following age ranges: 29.8% 13-19, 27.9% 20-29, 27.7% 30-39, and 14.5% 40-49, and distributed

across the following employment categories, 27.3% salaried, 23.5% home worker, 14.6% middle/high student, 22.9% college student, and 11.6% technical/professional.

On a separate set of web pages for each of *five different media* (face-to-face -- FtF; email – EM; messenger – MSG; mobile phone – MP; and short messaging service -- SMS), the respondent identified a maximum of five communication partners with whom they communicate most frequently. The respondent listed each communication partner by number (i.e., “person 3”), but identified that partner distinctively across the media. That is, if a partner was identified in one medium but also appeared as a partner in the list for another medium, the respondent would mark the partner as the same person (“person 3”). This approach is midway between an ego-network (respondents list the others with whom they have contacts, with no attempt or ability to assess links among those contacts) and a system-network (respondents indicate contacts on a roster of a bounded system of actors). Here, we used what Marsden (1990) refers to as a “role relation name generator”. For each person indicated, respondents checked the *social role* (spouse, children, parent, sibling, other relative, elementary/middle/high school friend, college friend, girl/boy friend/lover, other types of friend, work colleague, work boss/managers, work subordinate, other work related, teacher/professor, or online only). These social roles are fairly similar across GSS-type surveys (see Hashimoto et al., 2000; Van der Gaag, 2005). We avoided some possible problems of name-generator approaches (a brief review is available from the authors) by using the very general referent of “who you most frequently communicate with” (through each medium), and separately asking for an indication of the *closeness* of each communication relationship (from 1=not close to 5=extremely close), which Marsden and Campbell (1984) concluded was the best single item indicator of relationship strength.

#### *Identifying Configurations of Relations by Medium, Employment Category and Social Role*

Typically, in the GSS network surveys, respondents are then asked to estimate the presence and strength of ties among those few named alters or social roles (Burt, 1984; Marsden, 1987; Ruan, 1998). One can then compute some network measures among those few estimated others, and analyze and report the distributions of those measures, and associations of those measures with individual-level variables, across the entire sample. However, we take a different approach, in order to reflect a broader social level analysis, to compare configurations across media, and to increase the number and possible diversity of relationships within and across media.

#### *Analyses*

Analyses involved both the traditional respondent-by-variable dataset (individual-level), and the social role matrices for each medium (network-level).

For *individual-level analyses*, we used repeated-measure ANOVA to test for differences in amount, closeness and overlap in social roles across employment categories (salaried, homemaker, middle and high school student, college students, and information related technicians) and media. We performed 5X5 repeated-measure ANOVA tests with mean value of closeness for each medium as within-factor and employment category as between-factor.

For *network-level analyses*, we used all respondents’ answers about their communication relationships to create a matrix for each medium. (For these and other network analyses we used Ucinet 6.0; Borgatti, Everett & Freeman, 2002). We’ll call this matrix  $G(k)$ , where  $k$  represents the specific medium. Each of the 1039 rows ( $i$ ) is a different respondent. Each of the 15 columns indicates a different social role ( $j$ ). The value in cell  $(i,j)$  indicates the number of mentions of communication with that social role ( $j$ ) the respondent ( $i$ ) reported for that specific medium. For example, survey participant 232’s communication partners through FtF include 1 spouse (we would hope no more than 1!), 2 work colleagues, and 2 work bosses/managers (for the maximum of five relationships).

Each of those five media matrices was then converted into a matrix  $A_k$ . Matrix  $A_k = G_k * G_k'$ .  $G_k$  is the original 1039 respondent x 15 social roles matrix for medium  $k$ .  $G_k'$  is  $G_k$  transposed.  $G_k$  is then matrix-multiplied by  $G_k'$ . The resulting matrix  $A_k$  is a 15x15 social role by social role matrix, aggregated across the 1039 respondents, for medium  $k$ . Note that these values are *not* the frequency of communication between those social roles; rather, they indicate the extent to which both of these social roles exist in the overall configuration of social roles for each medium, across the entire sample.

As an example, consider the  $A_k$  matrix where  $k$  is FtF. A value on the *diagonal* ( $j_j$ ) indicates the number of times the respondents overall identified that social role  $j$  as a communication partner (ranging from a low of 10 teacher/professor communication partners, to 263 spouse communication partners, to a high of 420 middle/high school friend communication partners) for the FtF medium. An *off-diagonal* ( $i_j$ ) value indicates the number of times any two social roles ( $i$  and  $j$ ) were *both* mentioned by any respondent. For example, 263 respondents reported communicating FtF with a spouse (*diagonal value* for the spouse social role); whereas 65 reported communicating with a spouse and with children, 28 with a spouse and with a college friend, and only 2 with a spouse and with someone only online (*off-diagonal values*).

We then used Ucinet 6.0 to transform those  $A_k$  frequency matrices into correlation matrices. The correlation between any two social roles in a particular medium matrix indicates the extent to which those two social roles have similar patterns of frequencies with all other social roles in the  $A_k$  matrix. Just as two variables are correlated in traditional analysis, here two columns are correlated. The correlations between each two columns are placed in the respective cell of a new matrix, and that new correlation matrix is used as input for subsequent analysis. Netdraw (a module of Ucinet 6.0) was used to visually display the results of multi-dimensional scaling of the correlation matrices, showing how the social roles are more or less “close” to each other in each medium. The configuration of these relationships within media can thus be described and compared both visually and statistically.

To compute the correlation (extent of similarity) between pairs of the matrices, and the statistical significance of those correlations, we used the Quadratic Assignment Procedure (QAP) in Ucinet 6.0. This permutes (by default, 2500 times) the rows and columns of one of the pair of matrices, and computes the correlation between the two matrices for each permutation. This is done simply by converting all the non-diagonal values from one matrix into a single column of values, and the same for the other matrix, and then the two columns are correlated as two variables are typically correlated. The program then creates a distribution of all those 2500 correlations, and then determines where along that distribution of possible correlations the empirical correlation between the actual two matrices lies. This nonparametric approach to assessing statistical significance is required because the rows and columns of network matrices are not independent, unlike the traditional assumption underlying survey data and parametric statistics. In order to assess how the social configurations in the four new media were uniquely associated with the FtF social configuration, the multiple regression quadratic assignment procedure (MRQAP) with semi-partialing (Krackhardt, 1988) was applied to compute the overall  $R^2$  and each new media matrix's partial beta coefficients. This uses the same approach as QAP but controls for interdependence among the explanatory matrices.

## Results

### *Individual Level: Mean Relationships by Medium and Employment Category*

The mean number of communication partners for FtF was 3.6 (s.d. 1.4); for Email, 2.9 (1.6); for Instant Messenger, 2.6 (1.9); for Mobile Phone, 3.5 (1.5); and for SMS 3.1 (1.7). There were significant differences (means table not included) in the number of communication partners across employment categories for all media except FtF ( $F(4,1034)=2.7$ , n.s.). For email ( $F(4,1034) = 16.2$ ,

$p < .001$ ), a post hoc test revealed a significantly higher number of relationships for worker (salaried and tech professionals,  $M = 3.3$  for each) than for the other employment categories, especially middle/high students ( $M = 2.3$ ). For instant messenger ( $F(4, 1034) = 36.9, p < .001$ ), the home worker category has significantly fewer relationships ( $M = 1.4$ ) than the other groups (especially college students,  $M = 3.2$ ). For mobile phone ( $F(4, 1034) = 10.1, p < .001$ ) and SMS ( $F(4, 1034) = 3.6, p < .01$ ), middle/high school students have fewer relationships than all other groups ( $M = 2.8$  for each).

*Individual Level: Number, Unique and Duplicate Relationships by Medium and Employment Category*

--- Table 1 about here ---

Next we focus on comparisons of communication with social roles across employment categories (see Table 1, which also provides definitions of total, unique and duplicated relationships as well as unique social roles). Overall, the number of *unique relationships* varied by employment category ( $F(4, 1034) = 40.5, p < .001$ ). Post-hoc analysis showed that significant mean differences (from lowest to highest) were found for: middle/high student (2.7), college student (3.52), homemaker and tech professionals (4.16 and 4.25), and tech professionals and salaried (4.25 and 4.67). However, more work-related partners were found in both FtF and in email ( $F(4, 1034) = 82.9, p < .001$ ;  $F(4, 1034) = 109.9, p < .001$ , respectively), with more in FtF than email ( $t(1038) = 3.6, p < .001$ ).

There was an overall difference in the number of *duplicated relationships* in FtF and email among the employment categories ( $F(4, 1034) = 6.3, p < .001$ ). However, a post-hoc test revealed that the differences were mainly between mid/high student and working categories (we would not expect young students to have many communication relationships with organizational workers). The other two employment categories (college student and home worker) were not significantly different from the working categories. More specifically, there was a significant difference in the number of *duplicated work-related communication relationships* in FtF and email ( $F(4, 1034) = 29.8, p < .001$ ). Based on a post-hoc comparison, the two work categories differed from the three non-work categories.

*Individual Level: Comparison of Social Roles and Employment Category Overall and by Medium*

--- Table 2 about here ---

Table 2 provides descriptive statistics for the number of relationships by social role, employment category, and overall and for each medium. Aggregating across media, the largest number of relationships are with friends, then family, then work, and then online. More specifically, the largest number is for students communicating with their friends, through FtF, IM, SMS and mobile phone. Homeworkers have the largest number of family relationships, primarily through mobile phone and FtF. Naturally, salaried and tech professionals have the greatest number of work relationships, primarily through FtF and email.

*Individual Level: Relational Closeness by Medium and Employment Category*

--- Table 3 about here ---

Table 3 provides the means for closeness of relations for each of the employment categories within, and the total for, each of the five media. Since the assumption of sphericity was violated, multivariate test results were used in the interpretation. Table 4 provides the overall ANOVA statistics. There was a significant *medium* (within-subject) effect ( $F(4, 873)=123.5, p<.001; Eta^2 =.36$ ): instant messaging is used for communicating with weak relations, mobile phone for strong ones. There was a significant *employment category* (between-subject) effect ( $F(4, 876) = 10.3, p<.001, Eta^2 = .05$ ) on closeness. Homeworkers had lower overall closeness with their partners compared to all other employment categories, due primarily to the low closeness through instant messaging. There was also a significant *interaction* effect -- that is, medium by employment category ( $F(16, 2667.7) = 13.7, p<.001$ ).

--- Table 4 about here ---

Email differs significantly from all other media in its interaction with respondent employment category. Students use email to communicating with less close others in comparison to others, especially homemaker, salaried and tech professionals, with the latter two categories reporting the highest closeness..

*Network Level: Descriptive Analysis of Configurations of Relationships by Medium*

Overall, we would like to know how similar the five media are in terms of how they are used to support communication with each of the social roles. First, quadratic assignment was used to compute the Pearson correlation between each pair of media. These were all highly intercorrelated, from .57 between mobile phone and IM to .90 between mobile phone and FtF. These correlations were then entered into a 5x5 (medium by medium) matrix (ignoring the diagonals), which was provided to Ucinet's multidimensional (MDS) and hierarchical procedures.

--- Figure 1 about here ---

Figure 1 shows that the configurations of relationships among the social roles in FtF and mobile phone are quite similar and are therefore those two media are tightly clustered in the MDS representation. Email and SMS are also tightly but separately clustered, and IM is less tightly clustered with email and SMS while being least similar to FtF and especially mobile phone. Thus, these five media are not interchangeable, although some are quite similar to others. These comparisons are, however, visual and not statistical.

*Network Level: Statistical Analysis of Configurations of Relationships by Medium*

--- Table 5 about here ---

The first column in Table 5 provides the overall test explaining the FtF configuration by the other four media configurations, using MRQAP. The mobile phone configuration provides the strongest association with the FtF configuration ( $\beta=.69, p<.001; \text{adjusted } R^2 = .65 (p<.001)$ ). Indeed, this swamps the effects of all other media such as email, instant messaging, and SMS (betas for email, messenger, and SMS were .51, .12, and -.30, respectively, all n.s.), largely due to the strong intercorrelation among the media pairs, noted above, so that there is little variance remaining after the strongest association is removed.

*Network Level: Descriptive Analysis of Configurations of Relations by Medium and Employment Category*

Figures 2, 3 and 4 portray the two-dimensional multidimensional scaling of relationships among the social roles for FtF, email, and IM. Due to space limitations, we selected the three most different from each other, based on the overall multidimensional scaling and clustering in Figure 1 (the figures for mobile phone and SMS are available from the authors). Line thickness is proportional to the *similarity* (correlation) between each pair of relations.

--- Figure 2 about here ---

For FtF, relations involving spouse and children are most central, and mediate between other relatives and work relations. Within work relations, co-worker and boss relations are most

similar. Relations among school and friends and one's professor are quite distinct from the relation/family/work relations. Note that the configuration of relationships in FtF is quite differentiated, with school relations on one side, family relations in the middle (with spouse and children central), and work relations on the other side.

--- Figure 3 about here ---

Email apparently allows for denser interrelations among workers, but also among relatives, presumably because of its ability to overcome distance and time constraints (because of its asynchronicity, unlike the mobile phone) on communicating with them. Here, online and teacher/professor relations become a completely distinct social arena, presumably representing the educational communication domain.

--- Figure 4 about here ---

Instant messaging seems to predominantly involve children, spouse, sibling and parents, and more centrally but less frequently, relatives and other friends – i.e., a family medium. There are also shared relations involving workers, but somewhat less separated from the family network than in FtF and especially email. Note that while the configuration of one's communication with spouse and one's work boss is somewhat similar in FtF and in IM, there is no such similarity in the email medium.

The configuration of relations among the social roles through the mobile phone (not shown) are much denser than in the other media, except the clearly distinct dyad involving college friends and girl/boy friends and lovers. Though still closely related through the spouse, the work subnetwork and the family subnetwork are distinct, unlike in IM. Mobile phone relations also have stronger relations (greater similarities/correlations) within each of those subnetworks than in the FtF network. Siblings, children and parents are at the center of the SMS network (not shown), indicating that this medium is used to coordinate the activities and whereabouts of family members. There are also strong relations between spouse and work subordinates, indicating that people are trying to manage aspects of both their work and family life.

*Network Level: Statistical Analysis of Configurations of Relations by Medium and Employment Category*

To test for differences in configurations across media by the respondents' employment categories, we separated the original 5 data matrices into 25 matrices, one for each medium (5) by employment category (5) combination. Then we tested, for each employment category, the influences of the new media configurations on the FtF configuration, as we did above. Not surprisingly the remaining columns in Table 5 show that the similarity between mobile phone and FtF relations was strong and significant for all employment categories. Students report the most similar relations with the various social roles in FtF and mobile phone communication.

However, homemakers' relations through email and instant messenger are essentially completely independent of their FtF relations. Homemakers may use these CMC media to keep in touch with social roles who they cannot frequently meet in person -- i.e., old friends, relatives, etc. For both salaried and technical/professional users, the greatest similarity in configurations occurs between email and FtF, though their mobile phone configuration is also similar to their FtF configuration of relationships. Unlike the younger generations (middle, high school, and college students), for organizational workers email is a medium frequently used in the maintenance of the same kinds of relationships managed through FtF. This may be so for several reasons. First, they are old enough to have experienced email when it was earlier introduced so that they feel comfortable using email (rather than using other media). Second, in work places, email is a crucial medium supporting work tasks with fellow employees (Rice & Webster, 2002).

Summary and Discussion

*Limitations*

The present results are clearly provisional and non-generalizable. First, social network analysis is typically applied to the members of a closed group or organization. Since the data were obtained from a public online survey, complete networks could not be obtained. However, we used a common approach of collecting ego network data and specific social roles (e.g., homemaker, salaried worker), and transforming these 2-mode matrices (respondents by social roles) into relation matrices for each medium (and then also each employment category). Second, although the survey was carefully designed, it was a public web-based survey, so there is no known sampling frame, response rate, or sample generalizability. However, it applied a quite rigorous sampling design for web surveys, and did generate a reasonable distribution of the employment categories representative of new media users in Korea.

*Number, Unique and Duplicate Relations by Medium and Employment Category*

Overall, the media with the largest number of reported partners were FtF and mobile phone, with IM having the least. Employment categories differed significantly in the number of reported relations across all the new media, but not for FtF. This by itself reveals a difference in social configurations of FtF compared to new media – that is, people in different employment categories use the new media to support slightly different amounts of relations, unlike in FtF which seems to be a sort of universal channel. In particular, workers had more relations in email, college students had more relations in IM, and middle/high students had fewer relations in both mobile phone and SMS.

Concerning unique and overlapping relations (i.e., a specific partner – not general social role -- identified in two or more media), middle/high students had the fewest unique relations while workers had the most. That is, young students managed a more general configuration of relationships through multiple media, while workers seem to manage somewhat different sets of relationships through each medium. However, people working outside the home seem to complement their FtF relations with specific partners through email, and especially so with other work-related people. This might motivate further research on the social influence of communication technologies, in the sense that the nature or characteristics of communication technologies are significantly defined through, and in the use of them with, significant others (Licoppe & Smoreda, 2005).

*Relational Closeness by Medium and Employment Category*

The mobile phone supports communication with the closest (not FtF, even though it supports the most relationships), and IM the least close, relationships. It is probably not easy to avoid having conversations with weak relations in FtF communication settings, but the mobile phone can be used to communicate with, and maintain, only close relations. One implication is that recent Korean mobile services such as "bus-ting (bus meeting)" heavily invested in by the three big telecommunication companies in Korea (KTF, KT, and SKT) might not be successful for a while. In this service, telecommunication companies send the phone numbers of registered users to each other when both get on the same bus, as indicated by a phone number sensor on the bus and transmitted to the phone service. The criterion for the match is common hobbies and interests, previously entered through the mobile phone by the user and stored in the company's database. The three companies (who otherwise compete with each other) collaboratively offered the service, perhaps fearing that the service would not be popular or profitable enough as competing services. From the perspective of this study, this means that the separately supported networks would not represent each user's full mobile phone network.

On the other hand, students and young adults tend to use IM as a group-talking tool, in which they often invite and are invited to talk with persons who may be involved with the group but not strongly with the individual.

Homeworkers overall had the least close relations across the media. But there was a medium by occupation interaction: homemaker relations through email, as well as IT technical workers' and professionals' relations through email, involved the closest partners. Since homeworkers' social movement may be somewhat limited (if they are responsible for raising children and taking care of elderly family members, common in Korea), their email communication partners might be people with whom they would not be easily able to communicate via FtF. It makes sense that IT workers are very comfortable using email to keep in touch and manage their projects with close partners.

#### *Configurations of Relationships by Medium*

The configurations of relations in FtF and mobile phone are very similar, constituting a cluster separate from the other three media (IM, email and SMS), and the mobile phone relations are the sole unique predictor of the FtF relations (although all the media configurations are significantly interrelated at the bivariate level). So, at least in Korean society today, these two channels represent similar social uses; mobile phone and FtF communication seem to support and reinforce the same network of relationships.

Similarly, for each of the five employment categories – and especially for students – the mobile phone configurations of relationships were significant predictors of the FtF configuration. However, workers' email relationships are also significant predictors of worker FtF relationships. Alternatively, IM, email (except for workers) and SMS relationships, *after controlling for mobile phone relations* (they are otherwise significantly similar), are independent from FtF relations (as indicated by the cross-medium cluster analysis).

#### *Configuration of Relationships by Medium and Employment Category*

Multidimensional scaling of communicating with the 15 different social roles (grouped as family/relatives, friends, work-related, teacher/professor and online) for each medium showed some variation in the social configurations. In FtF, spouse and children were most central, with friends and fellow students quite distant. Email seems to foster greater similarity among workers and among relatives, but isolates online and teacher relations. IM seems a family medium, with some simultaneous management of work relations. The mobile phone seems to integrate all the social roles (while distinguishing between work and family subnetworks), save for college friends and boy/girl friends. And SMS seems to foster relations among the nuclear family, again with some management of work relations (especially subordinates).

Overall, FtF seems to be the common medium for the three major employment categories, while each category has its own distinctive set of complementary media: IM, SMS and mobile for students, mobile for homeworkers, and email for organizational workers. The mobile phone is used as sort of a multiplexing device for maintaining everyday relationships. Also, as friends appear in almost every medium, friendship seems to be an important element of Koreans' social lives (at least for those in 10s to 40s). There seems to be a rather clear divide between the use of email by older people and the use of mobile phone (and IM and SMS) by younger people. Further, the social environment of working in an organization is obviously a supportive context for using email to communicate with others. Homemakers intentionally used CMC media (email and messenger) to communicate with people who may not readily appear in their FtF communication.

We believe that exploring the configurations of relationships involving the social contexts of users of FtF and new media and their communication partners has provided some insight into the complementary as well as unique uses and implications of new media.

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Table 1.

*Total and Unique Relations Overall, and Work and Duplicated Relations across FtF and Email, by Employment Category*

Respondent Employ- ment Category	Total Relation- ships across All Media (max 25)			Unique Relation- ships across All Media (max 25)			Duplicated Relation- ships across All media		Unique Social Roles across All Media (max 15)		Worker Relation- ships in FtF		Worker Relation- ships in Email		Worker Relation- ships in Both FtF and Email		Number of Social Roles in Both FtF and Email		
	N	M	s.d.	M	s.d.	M	s.d.	M	s.d.	M	s.d.	M	s.d.	M	s.d.	M	s.d.	M	s.d.
Salaried	284	16.8	6.2	8.9	3.8	7.94	4.44	4.67	1.86	1.59	1.63	1.30	1.51	.44	.91	1.28	1.37		
Home- worker	244	14.5	5.3	7.6	3.2	7.00	3.69	4.16	1.53	.25	.73	.20	.54	.04	.24	1.13	1.19		
Mid/high student	152	14.6	6.2	8.3	3.8	6.28	4.37	2.70	1.45	.02	.18	.02	.14	0	0	.86	1.35		
College student	238	16.2	6.2	8.0	3.7	8.21	4.41	3.52	1.63	.24	.74	.12	.46	.03	.22	1.03	1.26		
Technical/ professional	121	15.9	6.5	8.2	4.2	7.67	4.53	4.25	1.79	1.31	1.59	1.23	1.55	.37	.80	1.37	1.34		
Total	1039	15.7	6.1	8.2	3.7	7.51	4.31	3.95	1.79	.70	1.30	.58	1.16	.18	.60	1.14	1.31		

Note:

Total relationships across all media (max 25) = the number of communication partners identified across all five media.

Unique relationships across all media (max 25) = the number of unique communication partners identified across all five media.

Duplicated relationships across all media = the number of communication partners who are the same people across at least two media.

Unique social roles across all media (max 15) = the number of unique social roles (out of 15 kinds: spouse, children, parents, etc.) across all five media.

For example, if a person reports 2 children, 1 sibling, 2 college friends, 1 work boss, and 2 work colleagues across all the media, and the same college friend is mentioned for both FtF and email, then there are 8 total relationships, 7 unique relationships, 1 duplicated relationship, and 5 unique social roles.

Table 2.  
*Mean Relationships by Social Role, Employment Category and Medium*

Social Role (grouped)	Respondent Employment Category	All		FtF		Email		Instant Messenger		Mobile Phone		SMS	
		M	s.d.	M	s.d.	M	s.d.	M	s.d.	M	s.d.	M	s.d.
Family	Salaried	1.67	1.59	.77	.99	.48	.78	.29	.58	1.14	1.22	.65	.82
	Home worker	2.89	1.69	1.45	1.31	1.17	1.18	.41	.88	1.97	1.29	1.18	1.07
	Middle/high	1.18	1.44	.59	.98	.34	.71	.16	.58	.66	.98	.23	.48
	College	1.19	1.31	.65	1.02	.29	.72	.15	.51	.71	.98	.27	.60
	Tech/ prof	1.69	1.64	.93	1.08	.75	1.01	.33	.68	1.22	1.23	.78	.91
	Mean	1.78	1.67	.89	1.13	.61	.96	.27	.66	1.18	1.25	.64	.89
Friends	Salaried	3.59	2.63	1.25	1.41	1.39	1.42	1.50	1.49	1.57	1.43	1.78	1.55
	Home worker	3.37	2.57	1.51	1.39	1.37	1.26	.79	1.31	1.33	1.22	1.39	1.26
	Middle/high	6.59	3.55	2.96	1.62	1.67	1.68	2.74	1.78	2.08	1.77	2.39	1.88
	College	5.98	3.09	2.59	1.60	1.94	1.58	2.81	1.64	2.64	1.46	2.95	1.54
	Tech/ prof	3.31	2.94	1.24	1.47	1.19	1.37	1.29	1.55	1.40	1.51	1.40	1.56
	Mean	4.49	3.21	1.87	1.64	1.53	1.48	1.79	1.74	1.81	1.54	2.00	1.66
Work	Salaried	3.29	2.94	1.59	1.63	1.30	1.51	.93	1.30	.88	1.25	.58	.95
	Home worker	.68	1.33	.25	.73	.20	.54	.13	.54	.18	.52	.22	.63
	Middle/high	.05	.27	.02	.18	.02	.14	.01	.08	.01	.11	.02	.18
	College	.44	1.13	.24	.74	.12	.46	.11	.44	.11	.45	.10	.39
	Tech/ prof	2.94	2.94	1.31	1.59	1.23	1.55	.75	1.14	.91	1.30	.64	1.12
	Mean	1.51	2.43	.70	1.30	.58	1.16	.40	.94	.42	.94	.31	.77
Online	Salaried	.27	.97	.09	.57	.11	.56	.14	.61	.09	.54	.11	.56
	Home worker	.19	.96	.03	.21	.11	.47	.08	.46	.04	.25	.05	.26
	Middle/high	.27	.67	.01	.08	.11	.42	.13	.45	.05	.24	.09	.33
	College	.19	.63	.03	.17	.07	.30	.09	.37	.02	.14	.04	.19
	Tech/ prof	.16	.62	.01	.09	.07	.31	.09	.52	.06	.32	.07	.28
	Mean	.22	.82	.04	.33	.10	.44	.11	.49	.05	.35	.07	.37

Table 3.

*Mean Closeness of Communication Relationships by Medium and Employment Category*

Respondent Employment Category	N	FtF		Email		Instant Messenger		Mobile Phone		SMS	
		M	s.d.	M	s.d.	M	s.d.	M	s.d.	M	s.d.
Salaried	262	4.41	.64	4.23	.86	3.69	1.65	4.61	.56	4.56	.54
Homeworker	210	4.60	.49	4.44	.76	2.13	2.27	4.70	.44	4.56	.54
Middle/high student	97	4.57	.62	4.16	1.21	3.64	1.76	4.64	.52	4.55	.58
College student	206	4.65	.47	4.13	1.07	4.13	1.27	4.69	.44	4.57	.49
Technical/ professional	106	4.54	.50	4.45	.65	3.44	1.89	4.63	.52	4.60	.50
Total	881	4.54	.55	4.27	.92	3.38	1.93	4.66	.50	4.57	.53

Note: Closeness was measured as 1=not close to 5=extremely close.

Table 4.

*Summary ANOVA tables for differences in mean closeness*

*A. Repeated measure ANOVA table, within-subjects effect (medium and interaction)*

Effect	Wilks' Lambda	df	F
Medium	.639	4.0	123.5 ***
Medium * employment	.786	16.0	13.7 ***

\*\*\*  $p < .001$

*B. Repeated measure ANOVA table, between-subjects effect (employment)*

Source	SS	df	MS	F
Intercept	69442.6	1	69442.6	43191.7
Employment	66.5	4	16.6	10.3 ***
Error	1408.4	876	1.6	

\*\*\*  $p < .001$

Note: As we used multivariate tests (instead of a within Subject test) because of the sphericity problem, the two table formats are not the same.

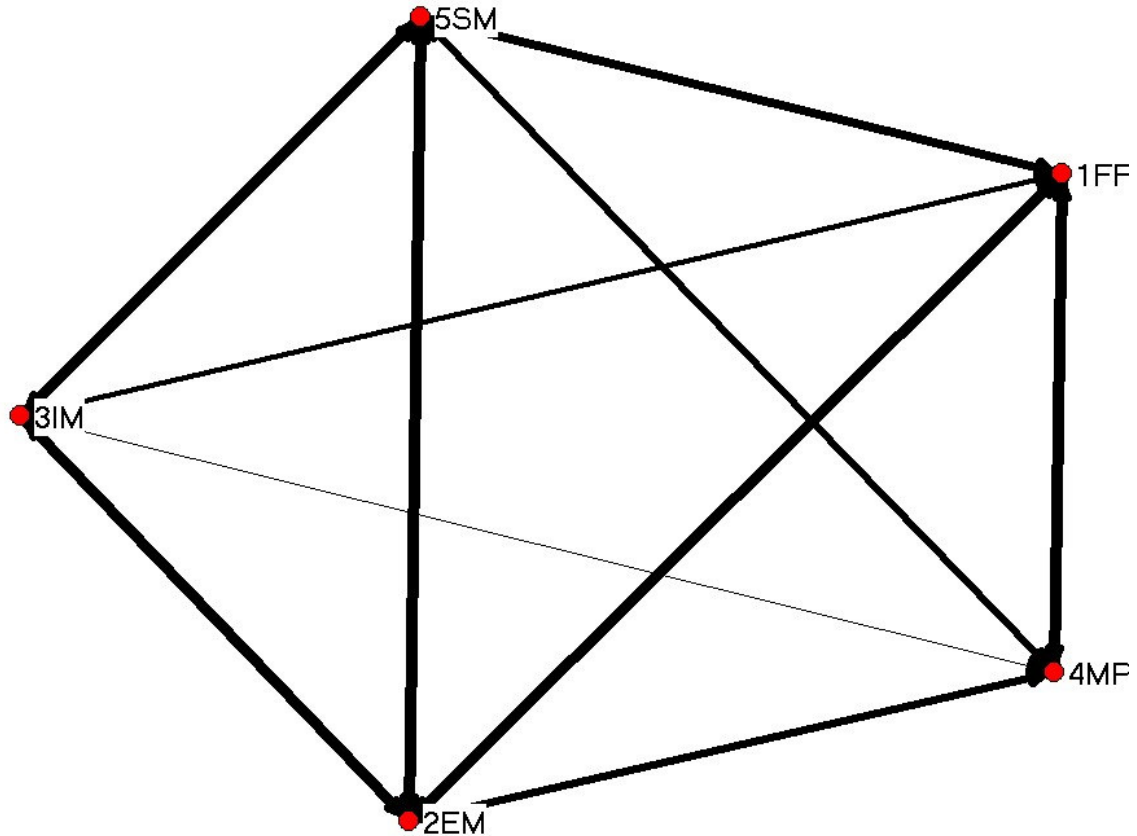
Table 5.

*Multiple QAP Regressions Explaining the FtF Configuration of Relationships from Configurations of Other Media Relationships, Overall and by Employment Category*

Medium	Employment Category					
	Overall	Salaried	Home worker	Middle/high student	College student	Technical/professional
Email	.51	.63 *	-.01	.25	.13	.56 **
Instant Messenger	.12	.07	-.09	.24	.25	-.11
Mobile Phone	.69 **	.49 *	.68 *	.76 ***	.89 **	.41 *
SMS	-.30	-.32	.37	-.20	-.24	.06
Adj R <sup>2</sup>	.65 ***	.70 ***	.90 ***	.88 ***	.96 ***	.78 ***

Note: Values for each explanatory medium matrix are standardized beta coefficients

\* p<.05; \*\* p<.01; \*\*\* p<.005



Pearson	F M	I E S
Correlation	F P	M M M
.90	X X	. . .
.89	X X	. X X
.87	X X	X X X
.74	X X X	X X X

Figure 1.  
*Multidimensional Scaling of the Five Media Configurations of Relationships, with Hierarchical Clustering*

Note: FF = face to face; EM = email; IM = instant messenger; MP = mobile phone; SM = SMS  
 The Pearson correlation is the correlation between each pair of matrices; higher values mean the patterns of communicating with the 15 social roles in each of the compared medium matrices are more similar, and thus more strongly clustered. The thickness of the line between each medium matrix is proportional to strength of the correlation. Media are considered grouped together, at each given correlation level, if their correlation is as strong as the listed correlation. The strongest cluster includes FF and MP; the next closest cluster includes, first, EM and SM, and then IM.

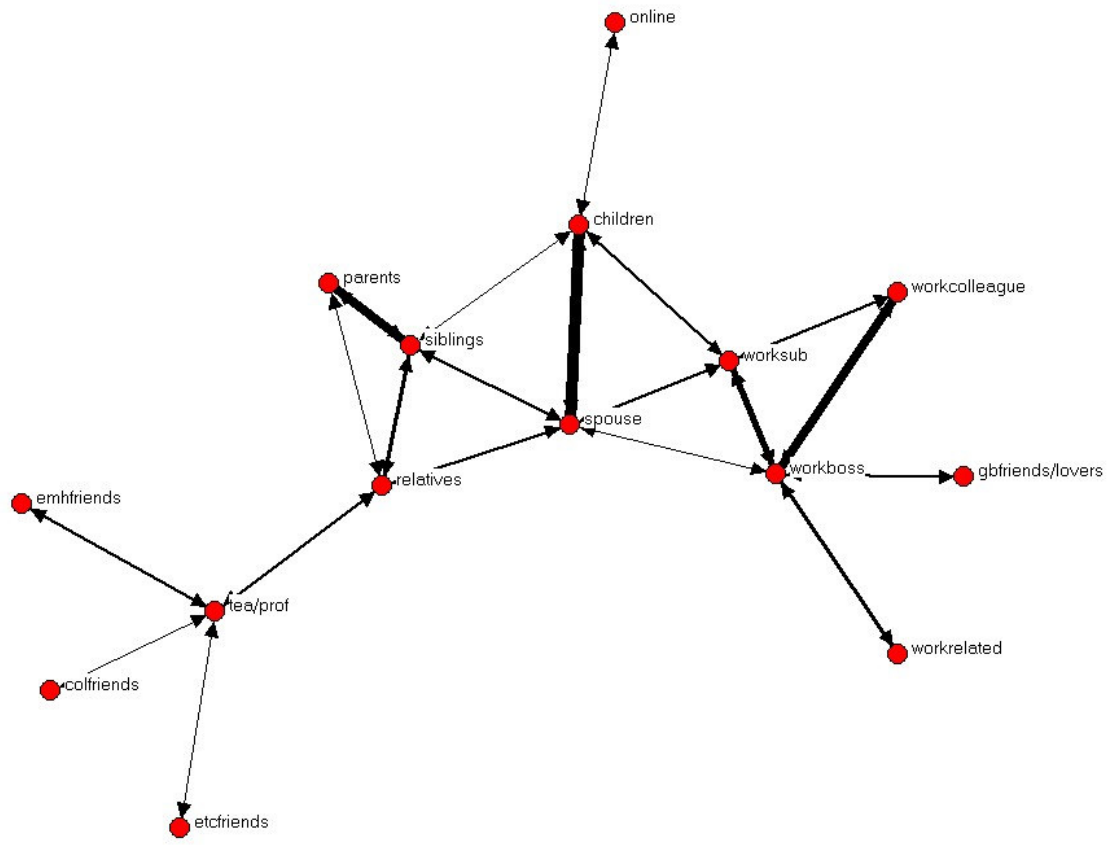


Figure 2.  
*Configuration of FtF Relationships*

Note: Figures 2, 3 and 4 show multidimensional scaling of configurations of the social roles based on the correlations among them as derived from the  $A_k$  matrix (the frequency of co-mention of the 15 social roles for the  $k$  medium – here, FtF, email, and IM); line thickness is proportional to strength of correlation between (similarity of) each pair of social roles.

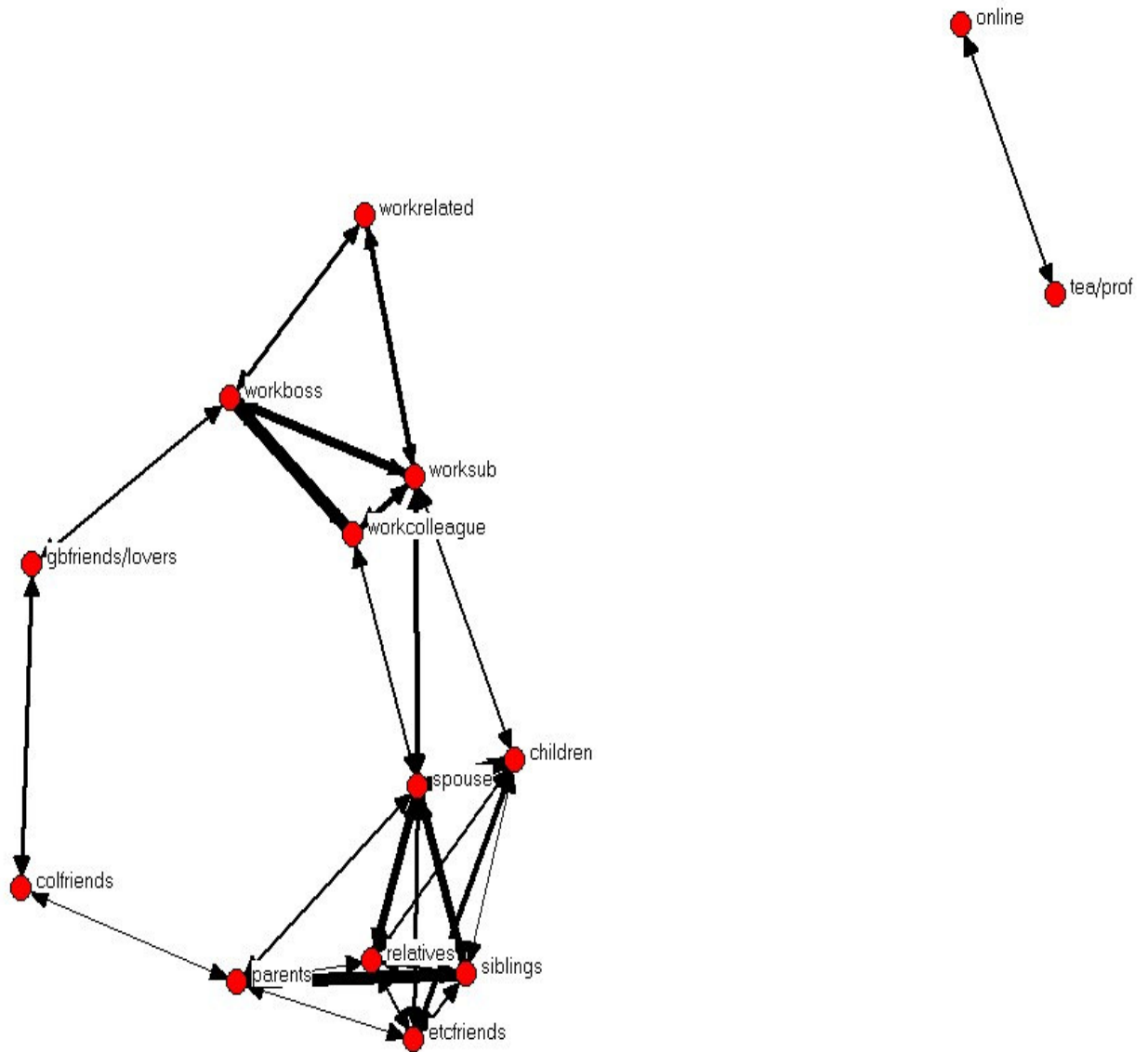


Figure 3.  
*Configuration of Email Relationships*

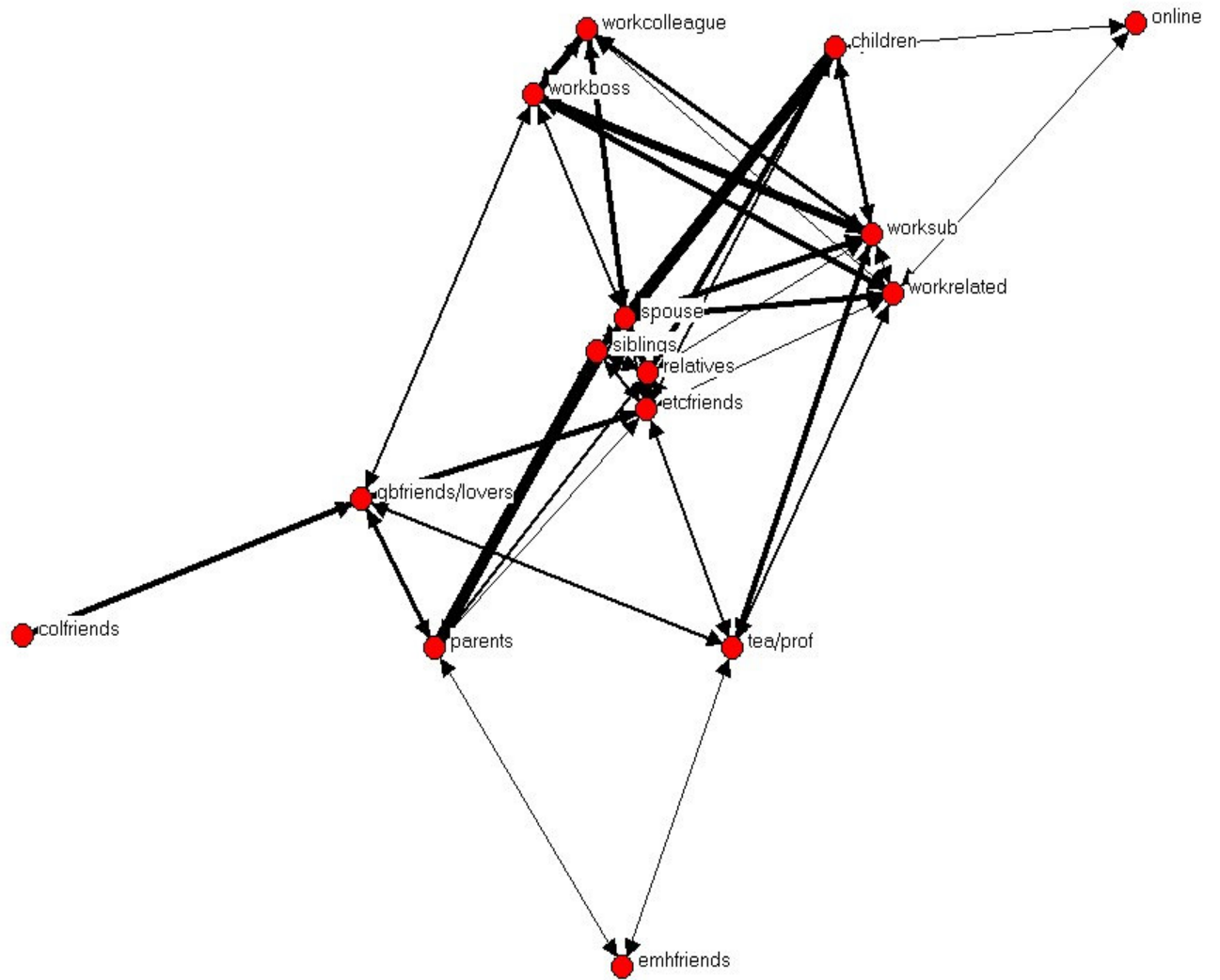


Figure 4.  
*Configuration of Instant Messenger Relationships*

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