

Does Distance Still Matter in the Age of the Internet?

Diana Mok, Juan-Antonio Carrasco and Barry Wellman

Abstract

Our study is part of the broad debate about the role of distance and technology for interpersonal contact. To the best of our knowledge, this is the first study that systematically and explicitly compares the role of distance in social networks pre- and post-Internet. We analyze the effect of distance on the frequency of email, phone, face-to-face and overall contact in personal networks, and we compare the findings with its pre-Internet counterpart whose data were collected in 1978 in the same East York, Toronto locality. We use multilevel models with spline specification to examine the nonlinear effects of distance on the frequency of contact. We compare these effects for both very close and somewhat close ties, and for different role relationships: immediate kin, extended kin, friends and neighbours. The results show that email contact is generally insensitive to distance, but tends to increase for transoceanic relationships greater than 3,000 miles apart. Face-to-face contact remains strongly related to short distances (within five miles), while distance has little impact on how often people phone each other at the regional level (within 100 miles). The study concludes that email has only somewhat altered the way people maintain their relationships. The frequency of face-to-face contact among socially-close friends and relatives has hardly changed between the 1970s and the 2000s, although the frequency of phone contact has slightly increased. Moreover, the sensitivity of these relationships to distance has remained similar, despite the communication affordances of the Internet and low-cost telephony.

Are Cities Losing Their Advantage?

Is the Internet Killing Distance?

Cities have always been interaction maximizers at the crossroads of multiple social networks: compressing people and building channels to increase the efficiency of encounters, planned and happenstance (Meier 1962; Massey 1984). Distance has always mattered: the more physically proximate, the more people interacted (Butts 2009; Hipp and Perrin 2009). While cars, phones and transit stretched interaction and most communication out to the boundaries of metropolitan areas, these media were limited in the speed of travel (cars and transit), what they could communicate (phones), and the cost of communication (cars, transit and phones).

The advent of the Internet has changed the balance between communication and spatial distance, promising to put into effect what Marshall McLuhan presaged as the “global village” (1962) and Manuel Castells has called “the space of flows” (2000), where connectivity functions without regard to place. Email’s social affordances are compelling for communication: high velocity and zero marginal cost above the monthly flat rate; the ability to contact many people at once (and for many to respond to one or to many); the ability of communications to be stored and retrieved later; the lack of visual and audio barriers to making contact; and the ease of contacting, replying and forwarding (Wellman, 1999; 2001). It is almost as easy to communicate with ties (both strong and weak) across the globe as across the street – although time-zone differences still delay some immediate responses.

This fall in the cost of distance for communication has led commentator Frances Cairncross to assert that the Internet has caused “the death of distance: “friends, colleagues, and customers could easily be anywhere – around the corner or around the world – and the new ways of

communicating will effectively wipe out distance as a cost factor, indeed, as a perceptible concept from our lives” (1997: book synopsis on barnesandnoble.com).

Has the Internet actually killed or – less luridly – weakened the effect of distance on interpersonal relations, and in so doing, helped to reduce a key comparative advantage of cities? There is more speculation than evidence (Green, 2002). Visions of bucolic communicators e-chatting abound, with *Wired* magazine putting on a post-(Leo) Marxist (1964), spin on the new WiFi machine in the garden (Wellman and Gulia, 1999; Fisher and Wright, 2001; Axhausen, Urry and Larsen, 2007). At the same time, some worry about increased social isolation (e.g., McPherson, Smith-Lovin and Brashears, 2006), with Pope Benedict XVI warning that “if the desire for virtual connectedness becomes obsessive, it may in fact function to isolate individuals from real social interaction (2009). Yet, there have not been systematic studies to confront these visions with reality.

Glocalization

To be sure, the Internet is not the first technological change to affect the relationship of distance to social interactions. Until the advent of the telegraph, transportation and communication were tightly coupled, with messages transported by hand. Although the telegraph was the first decoupler in the mid-1800s, its expense and difficulty of use made it suitable only for businesses and government – a person-to-person telegraph was only used for life-changing events, such as marriage, birth, illness or death (Pred, 1973).

In the course of the past 200 years, rail, roads and low-cost airplane flights increased the range of viable interpersonal contact throughout the developed world and increasingly in the less-developed world. Where Americans travelled an average of 50 meters per day in 1800, they

travel an average of 50 *kilometres* in the 2000s (Urry, 2007). Getting on an airplane has become more like taking a bus in the 1950s than the swellegant airline travel of the 1930s.

Communities became “glocalized” (Hampton and Wellman, 2002) – with extensive long-distance as well as local relationships – so that they were no longer synonymous with neighbourhoods. Well before the coming of the Internet, ties with friends and relatives stretched beyond the neighbourhood. In 1978, in the same East York area of Toronto that we report about in this paper, 73.0% of an adult’s socially-close (“intimate”) ties with friends and relatives went beyond the neighbourhood, with 61.3% going outside of the relatively compact borough of East York itself, and 42.3% stretching beyond all of metropolitan Toronto (Wellman, 1979). Only 22% of the socially-close friends and relatives of residents of the East York area of Toronto lived within a mile of each other, while one-third (33%) lived more than 100 miles away: the median distance apart was 10 miles. No East Yorkers had most of their active ties living within a mile’s walking distance (Wellman, Carrington and Hall, 1988). Other developed countries had similar situations, for example, Northern California (25% within 5 minutes’ drive; 35% at least an hour away – Fischer, 1982) and Toulouse, France (28% within 5 minutes’ drive; 17% at least an hour away – Grossetti, 2007).

Since the 1940s, the telephone has been the great decoupler of communication from transportation. Like the Internet, it allowed instant communication around the world: people no longer had to travel to remain in contact. Early commentators feared it would lead to the death of distance. It did not, although it did incorporate rural folks more fully into broader societies (Fischer, 1992). In general, the telephone democratized access in the developed world. As it became affordable, if you could talk and turn a dial (or speak to an operator), you could use it.

In 1968, our East York research found that people use both face-to-face and telephone contact to maintain their active ties. Moreover, the rate of telephone and face-to-face contact was positively associated: the more people saw each other, the more they spoke on the phone (Wellman, 1979; Wellman and Tindall, 1993; see also Fischer, 1982). Thus, even before the Internet, phoning, driving and flying meant that some “network travellers [were] ... not form[ing] communities with the neighbours any more [except to] share the same public and semi-public spaces around their front door” (Axhausen, Urry and Larsen, 2007, p. 1).

Despite this long-distance connectivity, our 1978 data showed that proximity continued to be associated with both face-to-face and phone contact. Telephoning did not fully decouple communication from travel. Those who have phoned the most have seen each other the most, and contact by phone as well as by travel declines with distance. The number of friends and relatives in contact has usually decreased with increasing distance. For example, our study of East York in 1978 found two distances where the frequency of contact markedly increased – 5 miles – effectively a local trip in Toronto – and 100 miles – a day-trip by car, train or bus (Mok and Wellman, 2007). Even though telephoning afforded communication to be independent from physical contact, phone contact also diminished over distance, although not as swiftly as face-to-face contact. There were multiple reasons: the then-significant expense of long distance calls, low ability to have caller and receiver available simultaneously, and the intertwining of phone and face-to-face contact – with calls used to sustain contact in-between meetings and to arrange future meetings. In practice, phoning and visiting are part of the same social system, rather than being independent arrangements (Mok and Wellman, 2007).

Glocalization has been, at most, a halfway house on the route to the supposed death of distance. Data from other developed countries show that before and after the advent of Internet,

there have been many nearby ties and even more contact. For example, in 2005, nearly two-thirds of Zurich residents' socially-close ties lived within 25 km, only one-fifth lived more than 100 km away, and the number of face-to-face visits dropped exponentially with distance (Frei and Axhausen, 2007; Axhausen, Urry and Larsen, 2007). A study of ties in Rotterdam and New Haven found that about 30% are with people living in the same neighbourhood (Blokland and Mitzman, 2003). European and Thai studies have found that the type of relationship is associated with residential distance: the more important and stronger ties tend to live closer to one another (Axhausen, Urry and Larsen, 2007; Faust, et al., 2000; Chua, Madej and Wellman, 2010).

Email and Personal Networks

Although the telephone supplemented, rather than replaced, face-to-face contact, what of the Internet – with its greater social affordances for the death of distance? The evidence to date has suggested that distance still matters. Early North American studies have shown that even with the advent of email, there is lower overall contact – face-to-face, phone *and* email – with community ties who live further away. Yet, although only a minority of friends and relatives are walking-distance neighbours, there is still “glocalization”, with frequent email contact with nearby friends and relatives (Stern and Dillman, 2006; Wellman and Hogan, et al., 2006; Quan-Haase and Wellman, 2002; Chen, Boase and Wellman, 2002; Boase, et al., 2006; Carrasco, Miller and Wellman, 2008). Internet communication has joined the telephone to work synergistically with face-to-face contact in an integrated personal communication system (Boase, 2008; Carrasco, Miller and Wellman, 2008; Kenyon and Lyons, 2006; Kim, et al., 2007). Frequent email contact with active friends and relatives is associated with frequent telephone and face-to-face contact. Rather than replacing other forms of contact, email intertwines with them in maintaining ties and arranging face-to-face visits and phone chats (Green, 2002; 2002; Boase, et al., 2006; Wellman

and Hogan, et al. 2006; Curtice and Norris, 2007; Stern and Messer, 2008). If someone moves to another city, there is likely to be a modal shift, with email used more extensively to maintain the tie. Yet, people use face-to-face and phone contact more for the initial development of relationships (Hampton and Wellman, 2002, 2003; Shklovski, Kraut and Cummings, 2008).

The only reliable contrary evidence comes from large-sample Canadian time-use data showing that heavy Internet users spend less face-to-face time with household members as well as friends and relatives (Veenhof, et al., 2008). Moreover, some forms of ICTs – instant messenger (IM), mobile phone, and mobile texting – are primarily restricted to contact with close ties (Curtice and Norris, 2007; Miyata, Boase and Wellman, 2008).

Research Approach

Key Questions

1. What is the role of distance in influencing how members of personal networks stay in touch? Is distance differentially related to email, face-to-face, and phone contact? If so, is there a continuous gradient, or do the effects of distance increase (or decrease) nonlinearly?

2a. Do different types of relationships vary in terms of which media they use to communicate at different distances? 2b. Do the effects of distance vary according to the type of relationship: strong vs. less strong; kin vs. non-related? 2c. If so, is there a continuous gradient, or are there nonlinear places where the effects of distance increase (or decrease) markedly? For example, stronger ties may not require as much face-to-face contact. Moreover, as ties with relatives tend to be densely knit in kinship systems, while friendship ties tend to be more discrete relationships, relations with kin may survive greater distances than relations with friends (Wellman, 1990; Wellman and Wortley, 1990). Earlier surveys have used crude distance and contact categories

that have not allowed researchers to ascertain precisely the relationship of distance to contact. By contrast, we use continuous measures.

3. Have the effects of distance on fact-to-face and phone contact changed pre- and post-Internet? If so, are the changes similar for different types of role relationships? Our study uniquely adds a temporal dimension by examining the changing role of distance in influencing face-to-face and phone contact between the 1970s and the 2000s. This is possible because the samples for the third East York study (in 2005) and the second East York study (in 1978) are drawn from the same locality and asked similar questions.

Building on our Pre-Internet Analysis

The present paper, together with an earlier companion study (Mok and Wellman, 2007), addresses these questions. . To provide a basis for comparison with the pre-Internet results, we ask similar research questions to those poised in our analysis of the 1978 data (Mok and Wellman 2007).

In the companion pre-Internet paper, the results showed a marked drop in the frequency of face-to-face contact at about five miles; the frequency continued to decrease steadily further away, with substantial declines happening at about 50 miles and 100 miles. The results also showed that distance affected telephone contact differently, with one marked drop at about 100 miles.

The present paper uses 2005 interview data from the third East York study (the Connected Lives study) to estimate similar models of the frequency of email, phone and face-to-face contact between the respondents and their community ties and to compare our results with those from the 1978 data (Mok and Wellman, 2007). We build on the companion paper in two

ways. *First*, we examine the role of distance in affecting the frequency of email contact, in addition to face-to-face and phone contact.

Second, we test the nonlinear relationship between distance and contact, using a spline specification in a multilevel model. (In the previous paper, the small sample size made an explicit test of nonlinearity difficult.) By contrast, most studies of social networks have neglected distance while concentrating on network structure, composition, and contents. “Distance” in such studies has usually referred to network distance: how many links does it take to connect two persons. When network analysts use geographical distance, they often use it crudely as a dichotomous measure, such as asking if ties remain within a neighbourhood or reach beyond it. We broaden the existing studies by treating distance as a continuous measure and testing if distance affects short- and long-distance contact similarly. To do this, we use Geographic Information Science (GIS) techniques to geocode the street address of each respondent and the road intersections of the respondents’ ties, measuring straight-line residential distance between the respondent and each community tie.

Methods

Data Collection

Our research is part of the Connected Lives study whose overarching goal is to assess the role of communication media in everyday life and its impact on personal networks. Our analysis is based on four-hour interviews in 2005 with 86 respondents. Using a name generator, interviewers asked respondents (referred to as “egos”) to name other people (referred to as “alters”) with whom ego has a specific connection. After enumerating a set of alters, each ego/respondent described the attributes of these alters and reported on both ego-alter connections and connections between alters (for details, see Hogan, Carrasco and Wellman, 2007 and

Carrasco, Miller and Wellman, 2008). We asked about two types of socially-close “active” ties that comprise about 10% of the average person’s network (Bernard, 2008; Boase, et al., 2006; Wellman and Hogan, et al. 2006).

* *Very Close Ties (“Intimates”)*: People with whom you discuss important matters, regularly keep in touch with or are there for you when you need help (mean = 11.6; median = 10 alters).

* *Somewhat Close Ties (“Non-Intimates”)*: People who are more than casual acquaintances but not very close (mean = 12.2 alters; median = 10 alters).

This “closeness” approach not only measures tie strength, it defines the personal network boundary of “active ties”: excluding less close friends and acquaintances. The complete active personal networks ranged between 3 and 66 (the maximum allowed), with a mean of 23.8 alters, and a standard deviation of 14.5. The subsample geocoded ranged between 3 and 15, with a mean of 12.1 and a standard deviation of 3.2.

We gathered detailed information in a manner that somewhat privileged stronger very close and somewhat close ties (Hogan, Carrasco and Wellman, 2007). Spatial information was geocoded with 95% success. Respondents reported information about communication and interaction patterns with alters: face-to-face, socializing, telephone and email. Telephone use includes both landline and mobile phones. Email use includes instant messaging that was rarely used by these respondents (Wellman and Hogan, et al., 2006).

East York and the East Yorkers

East York, the scene of our case study, is a residential area (population 114,240; 2001 census) of Toronto that has been the locale of NetLab’s two previous community studies in pre-Internet times: a survey in 1968 (Wellman, 1979) and interviews in 1978 (Wellman and Wortley,

1990). Although it is not feasible to do a third longitudinal wave with the same respondents 25 years later, East York retains its value for comparisons between the pre-Internet and the Internet eras.

East York sits squarely within the arterial highway system of Toronto. It is bounded on the west by an expressway, on the south by a subway line, and buses frequently travel main routes. The population is ethnically and socioeconomically mixed, residing in working/middle-class houses and apartment buildings. Mobile phone and broadband Internet service is widely available throughout Toronto, the largest metropolitan area of Canada.

Two demographic changes in East York are relevant. *First*, East York's population is older now. According to the 2001 census, the median age in East York was 37.4 years, while in both 1976 and 1981, the median age was 30 years. *Second*, recent immigration and high-rise apartment development have made the East York cityscape more complex than its village-like past. Previously in 1978, almost all East Yorkers were Canadian born or of British-Canadian ethnicity. In the 2000s, East York is similar to much of the metropolitan Toronto area in its percentage of foreign-born residents. Fifty-three percent of East York residents were Canadian-born in 2001, similar to the 58% of the interview respondents. Visible minorities (i.e., nonwhite-Canadians) are principally East Asians and South Asians. Their ethnic groups are underrepresented in the present study because of language and cultural barriers. In most other respects, our data reflect census demographics, including gender, age, income, education and family composition (Gram, Wellman and Zinko, 2009)

East Yorkers vary in their Internet use. Heavy Internet users have lived in Toronto and their current homes for a shorter period than those who do not use the Internet (Table 1).¹ On the other hand, a greater proportion of heavy users are immigrants, compared to non-users. Among these immigrants, heavy users entered Canada more recently than non-user immigrants did, and they use the Internet to keep in contact with friends and relatives in their homelands.

Distance and Mode of Communication

The number of alters with respect to distance generally declines until a slight rise at far transoceanic distances (Figure 1). The number of alters drops by 45.4% when distance increases to between four and eight miles; it falls by another 50.0% when distance increases to between eight and 12 miles, a geographic scope that is beyond the boundary of East York. The number of alters levels off at less than 20 times beyond 20 miles at the regional level and then rises again when distance becomes transoceanic, beyond 3,000 miles.

> Figure 1: Contacts by Distance <

Figure 2 shows the scatterplots of the frequency of email contact (a) within 500 miles and (b) 500–3,000 miles and (c) beyond 3,000 miles. Figure 3 shows the scatterplots for face-to-face contact (0–5 miles and 5–50 miles, 50–500 miles, and beyond 500 miles), and Figure 4 shows the scatterplots for phone contact (0–100 miles and 100–500 miles, as well as beyond 500 miles).

>Figures 2-4: Scatterplots for Email, Face-to-Face and Phone Contact<

The mean frequency of email is highest within 50 miles, at 104.9 times a year. It drops by 34.1% to 69.1 times for distances between 50 and 500 miles, increases by 32.7% to 91.6 times a year for distances between 500 and 3,000 miles, and increases to 104.8 times a year beyond 3,000 miles. These numbers suggest that distance and email contact are related to one another

¹ “Heavy users” are respondents who use the Internet at least 7 hours a week; “moderate users” use it less than 7 hours a week, while “non-users” do not use the Internet at all. See the expanded online version of the paper for the table of sample characteristics by Internet use: www.chass.utoronto.ca/~wellman/publications/index.html

nonlinearly. Heavy users are more involved in longer distance relationships than non-users: both the mean and the median distance among heavy users are 2.5 times longer than for non-users. Heavy users have more extended kin (aunts, cousins, etc.) in their active networks than non-users, but a smaller proportion of neighbours. (All role relationships are self-identified.)

Phone contact and distance also have a nonlinear relationship. The mean frequency of contact is highest within 100 miles, at 73.9 times a year. It decreases by 39.8% to 44.5 times a year, when distance is 100 to 500 miles. It then increases by 17.8% to reach 52.5 times for distance greater than 500 miles.

Meanwhile, face-to-face contact drops monotonically with distance. The mean frequency falls from 64.4 times a year (more than weekly) within five miles to only 35.7 times (5 to 50 miles). It further declines by one-third to 19.1 times a year when distance is 50 to 200 miles and 6.6 times (once every two months) when distance is 200 to 500 miles. Beyond 500 miles, respondents meet their active ties 1.8 times a year.

Figures 5, 6 and 7 present a complementary view to the relationship between distance and mode of communication. Despite the widespread prevalence of email, about 60% of the alters living within 3,000 miles are *never* in contact with the East Yorkers by email. This percentage changes substantially for distance greater than 3,000 miles, where only 45% of the alters are never in contact by email. As discussed before, heavy use of email (weekly or more frequently) is proportionally higher for distances greater than 3,000 miles. Phone contact frequency tends to be higher for distances within 100 miles. At the same time, the proportion of contact that is never done by phone is almost invariant with respect to distance. Finally, face-to-face frequency of contact shows a marked drop with respect to distance, consistent with the previous results presented in this section.

> Figures 5-7: Bar Graph Frequencies of Contact by Media <

Analytic Models

We divide the sample of socially-close alters in two ways. One way is by role relationship: immediate kin, extended kin, friends and neighbours. The second way is by intimacy: those who are very close (“intimates”) and those who are somewhat close (“non-intimates”). Because intimacy is not independent of kinship, we then interrelate intimacy by role relationship. All relationships are self-identified by the respondents and include only those alters living outside of the respondents’ households.

The analysis involves four models, each focusing on a different mode of contact.

- **Model 1:** Frequency of email contact
- **Model 2:** Frequency of phone contact
- **Model 3:** Frequency of face-to-face contact
- **Model 4:** Frequency of overall contact

In all four models, we estimate a multilevel model to control for the network structure of the data by grouping community ties by their corresponding respondent (see Wellman and Frank, 2001). Following our previous study, we estimate a simplified version of the multilevel model. The simplified version assumes that the slope is deterministic and that only the intercept varies at the respondent level. This simplification allows us to focus on how the slope parameter may vary by the different types of role relationship and tie strength. Our basic estimating equation is:

$$Y_{ij} = \gamma_{00} + \gamma_{01} Z_j + \gamma_{10} X_{ij} + \gamma_{11} Z_j X_{ij} + u_{0j} + \varepsilon_{ij} . \quad (1)$$

The subscript *i* refers to the respondent; the subscript *j* refers to the community tie. The dependent variable Y_{ij} is quantitative (frequency of contact) and X_{ij} is the set of explanatory variables (e.g., residential distance between the respondent and the tie) affecting Y_{ij} , with X_{ij}

being measured at the tie level. Note that Z_j is a vector that describes the characteristics of respondent j ; u_{0j} and ε_j are the errors at the respondent and the tie level, respectively.

The estimating equation (1) is expanded to include a spline specification. A spline specification linearly segments the regression line, allowing the line segments to have different slope estimates. In the simplest case, suppose the data suggest a single knot (cusp point between two line segments) at distance k_d , which divides the data into two subsamples. We further assume that Z_j affect the two line segments similarly. Let $d = 1$ if $X_{ij} \geq k_d$. These assumptions provide the estimating equation for the spline model (see online version for a detailed derivation):

$$Y_{ij} = \gamma_{00}^1 + \gamma_{11}^1 Z_j + \gamma_{10}^1 X_{ij} + \gamma_{10}^2 d (X_{ij} - k_d) + \gamma_{11}^2 Z_j X_{ij} + u_{0j} + \varepsilon_{ij} \quad (2)$$

We estimate equations (1) and (2). Our discussions first focus on the spline models that test if the various linear segments possess different slopes. (We do not use spline models to analyze “neighbours” because only eight live further than five miles away.) The slopes may differ because the dynamics of travel and communication can be nonlinear. For example, an overnight trip of 100 miles has more in common with one of 150 miles than it does with a short drive of 50 miles.

In the spline specification, the knots for each mode of contact are based on prior scatterplots and experimentation with the knot positions that would maximize the log-likelihood function. For email contact, three knots are at 50, 500, and 3,000 miles; for phone contact, two knots are at 100 and 500 miles; for face-to-face contact, three knots are at 5, 50, and 200 miles.

The dependent variables in all four models are the frequency of email, phone, face-to-face, and overall contact. Overall contact refers to the sum of all types of contact. All frequencies are

measured in times per year and are transformed by the natural logarithm, as small increases in frequency are more important for rare contact than for very frequent contact. Because of a large number of null responses for email, Model 1 focuses on positive frequencies only. As a result, the number of observations in Model 1 reduces from 1,019 to 448.

In all four models, the key independent variable is the natural logarithm of the residential distance between the respondent and the network tie, using the same reasoning as for frequency. The slope parameter is interpreted as the percentage change in the frequency of contact for each percentage change in distance. To control for potential bias due to the presence of coworkers who meet face-to-face frequently for long hours daily, we have recoded their distance to zero.

One might believe that immigrant respondents in the sample (n=440) are more likely to be involved in long-distance relationships than non-immigrants. Therefore, contacts between immigrants and their community ties could be less sensitive to or even increase with distance. To investigate this potential difference between immigrants and non-immigrants, we introduce two covariates into our model. The first covariate is a dichotomous variable that identifies immigrants in the sample—that is, the variable receives a one if the respondent is an immigrant and a zero otherwise. The parameter estimate of this dichotomous variable would allow us to test explicitly if immigrants have more contact than non-immigrants. The second variable cross multiplies this dichotomous variable with the residential distance between the respondent and his/her community tie. The parameter of this variable allow us to test if immigrants are more or less sensitive to distance than non-immigrants when contacting their community ties.²

In general, our results show that contacts between immigrants and their community ties are not statistically different from non-immigrants (see online version for a role relation analysis)

² Immigrants refer to respondents who were born outside of Canada regardless of the year of arrival. We reran the models by identifying “recent immigrants” who have stayed in Canada for less than 10 years (n=190) or five years (n=153). The result is comparable to what is reported in the present study.

The parameter for the dichotomous variable that identifies immigrants in the sample receives insignificant estimates in most of the models; the parameter for the crossed variable (between the dichotomous variable and residential distance) also receives insignificant estimates. The exception is email contact among extended kin: immigrants are less sensitive to distance than non-immigrants when emailing their extended kin.

How Communication Mode and Distance Affect Contact

Email Contact (Model 1)

The evidence shows that although email weakens the negative effects of distance on contact, distance has not died. Overall, the respondents email their active ties 50.6 times a year. Most importantly, the frequency of email contact drops slowly over distance: for each percent increase in distance, the frequency declines by 0.1%. However, for long-distance relationships of more than 3,000 miles, the frequency of email increases. For each percent increase in distance beyond 3,000 miles, the frequency rises by 4.5%: these are usually immigrants in active transoceanic contact with their kin.³

The mean frequency of email contact is highest among extended kin (193.1 times per year), followed by immediate kin (104.8 times: parents and adult children, including in-laws), and much less often by neighbours (51.4) and friends (41.7). Email contact is mostly insensitive to distance: most estimates for the slope parameter are statistically insignificant. The exception is immediate kin, whose email contact is nonlinearly related to distance. The slope receives an estimate of -0.3, meaning that for each percent increase in distance, email contact decreases by 0.3% [$\exp(-0.3)-1$]. This holds only within 3,000 miles; for immediate kin who live further than 3,000 miles, the frequency of email increases by 8.3% [$\exp(-0.27-0.03-0.05+2.57)-1$]. Of the

³As only six neighbours live further than five miles away from their egos, all discussions of neighbours are based on the multilevel model without spline specification.

three knots at 50, 500 and 3,000 miles, only the knot at 3,000 miles receives an estimate that is significant. Those alters residing more than 3,000 miles away are almost always either friends and relatives back in immigrants' homelands or friends and relatives who have moved away from Canada.

Intimates email each other 1.8 times more often (a mean of 68.8 times per year) than non-intimates (38.6) times a year (slightly more than once every two weeks). Email contacts among intimates and non-intimate email contact are similarly sensitive to distance. For each percent increase in distance, the frequency of email and message contact declines by 0.1%. However, none of the knots receive a significant estimate.

Intimates: Intimate extended kin email each other most often (almost 5 times a day), 13.6 times more often than intimate immediate kin do (112.6 times); however, we are mindful that the group of intimate extended kin constitutes a small sample size of 24. Intimate neighbours (84.8 times) email each other 2.4 times more often than intimate friends do (34.9 times).

Most parameter estimates for distance and the knots are insignificant except for intimate immediate kin and friends whose frequency of emails decreases as distance increases. Among intimate immediate kin, the frequency drops by 0.3% (at the 0.05-significance level) for each percent increase in distance, but it rises by 8.6% for those immediate kin who live further than 300 miles away from each other. Email contact among intimate friends is insensitive to distance within 50 miles, but drops over distance beyond the knot of 50 miles. For each percent increase in distance beyond 50 miles, the frequency drops by 0.5%.

Non-Intimates: Only 10 of the small number of non-intimate immediate kin email each other, a sample size too small for valid statistical estimates. Non-intimate extended kin email each other the most frequently: 193.7 times a year. This number is about one-tenth as frequent as

the extraordinarily high frequency of their intimate counterparts. Their email contact is not sensitive to distance. None of the knots receive a significant estimate.

Non-intimate friends email each other a mean of 40.8 times a year, a intimate friends do (34.9). Neighbouring is especially sensitive to levels of intimacy: those who are non-intimates email each other infrequently (19.5 times a year), only 23.0% of the rate of their intimate counterparts.

Overall, email contact among non-intimates is insensitive to distance for kin. By contrast, while the frequency of contact with friends and neighbours is insensitive to distance within 50 miles, their email contact increases at a rate of 0.7% beyond 50 miles.

> Table 1 about here: Model 1 results: Email/Instant message contact <

Phone Contact (Model 2)

While the frequency of email contact is only slightly related to distance, the frequency of phone contact declines with distance. Contact generally drops smoothly over distance, although there is a marked drop at the 100-mile cusp point. However, contact increases beyond 500 miles. Overall, respondents are in phone contact with their active ties 18.6 times a year. Within 100 miles, the frequency of phone contact hardly drops (the slope parameter receives an insignificant estimate); beyond 100 miles, it declines at 0.2%. The other knot at 500 miles receives a significant estimate of 1.0. Although these data are for the entire sample, analysis of the minority of East Yorkers who do not use email provide similar results.

Immediate kin phone the most often, a mean of 53.3 times a year. Extended kin phone 27.9 times a year. Friends call more often (20.8) than neighbours (17.8). Intimates phone more often (40.5) than non-intimates (8.3). The frequency of phone contact drops at a similar rate among different role relationships (0.01%), but the slope estimates are not significant except for

extended kin, whose frequency drops at a rate of 0.2%. Phone contacts among intimates and non-intimates are sensitive to distance only beyond 100 miles, at which point contacts drop at a rate of 0.5%.

Intimates: Frequency of phone contact is highest among intimate immediate kin, who call 70.4 times a year (slightly more than weekly). Intimate extended kin have the second highest frequency of 44.2 times a year (slightly less than once a week), followed by intimate friends (43.0) and neighbours (39.3).

Phone contact is generally insensitive to distance among intimate role relationships, except for immediate kin and friends. Among immediate kin, phone contact is insensitive to distance within the cusp point of 100 miles, beyond which frequency drops at a rate of 0.7%. Among intimate friends, frequency drops smoothly over distance at a rate of 0.1%, similar to the 1978 East York data: people call somewhat distant kin, rather than visiting them.

Non-Intimates: Non-intimate extended kin phone most often (18.0 times a year), while non-intimate immediate kin (10.7 times) phone about half as often; non-intimate friends call each other 8.6 times a year while non-intimate neighbours call the least often (7.9 times a year).

Phone contact is generally insensitive to distance among kin. By contrast, it is sensitive to distance for friends: their phone contact shows two cusp points, at 100 and 500 miles. Within 100 miles, their phone contact is not sensitive to distance; between 100 and 500 miles, contact drops at a rate of 0.6%; beyond 500 miles, it increases at a rate of 0.6%.

> Table 2 about here: Model 2 results: Phone contact <

Face-to-Face Contact (Model 3)

The respondents meet their active ties face-to-face an average of 40.0 times a year. The mean frequency shows a marked drop at the cusp point of five miles, a fairly local drive or

transit ride for East Yorkers. Within five miles, the frequency drops by 0.1% for each percent increase in distance; beyond five miles, the decline in frequency accelerates to 0.3%. All other knots receive insignificant estimates.

The mean frequency of face-to-face contact differs by role relationship. Neighbours meet an average of 92.8 times a year, with a big decline in contact among immediate kin to 49.0 times a year, extended kin (33.0) and friends (26.7). Intimates meet more often (43.5 times per year) than non-intimates (36.4).

Not surprisingly, face-to-face contact is the contact medium that is most sensitive to distance. While face-to-face contact among kin (both immediate and extended) is not sensitive to distance, contact with non-kin (friends, etc.) drops smoothly over distance at a rate of 0.1%, and all knots receive insignificant estimates. For each percent increase in distance, face-to-face contact decreases by 0.1%. The frequency of contact for neighbours drops more markedly (0.3%). Among intimates, face-to-face contact is sensitive to distance; it drops at a rate of 0.1% within five miles and an additional 0.3% beyond five miles. The frequency of face-to-face contact among non-intimates drops smoothly over distance, at 0.2%.

Intimates: Intimate neighbours understandably meet face-to-face the most often: 85.6 times a year (slightly less than twice a week). Intimate immediate kin meet 54.3 times a year, followed by intimate friends (34.9), with intimate extended kin meeting the least often (23.7).

Among intimate immediate kin and friends, the frequency of face-to-face contact is not sensitive to distance. Extended kin show a different pattern. The frequency shows a marked drop at the five-mile cusp point: within five miles, the frequency is not sensitive to distance; beyond five miles, the rate of decline reaches 0.5%. The frequency of face-to-face contact among neighbours declines smoothly at a rate of 0.3% for each percent increase in distance.

Non-Intimates: Similar to their intimate counterparts, non-intimate neighbours also meet face-to-face the most often (98.5 times a year). Non-intimate extended kin meet twice as often (58.0) as their intimate counterparts; non-intimate friends meet 18.6 times a year. The small number of non-intimate immediate kin meet only 21.6 times a year, about half as often as their intimate counterparts do. When immediate kin do not fit the norm of intimacy, contact is low and usually takes place only in larger kinship group gatherings (Wellman, 1990).

Face-to-face contact among all non-intimate role relationships is sensitive to distance except for non-intimate immediate kin and friends, who receive insignificant estimates for all distance variables and knots. The frequencies for non-intimate extended kin and neighbours drop smoothly over distance, at a rate of -0.3%. All knots receive insignificant estimates.

> Table 3 about here: Model 3 results: Face-to-face contact <

Overall Contact (Model 4)

As people use many media to stay in contact with their active ties, it is important to look at the overall personal communication systems. By one medium or another, respondents are in contact with their alters an average of 110.1 times a year, nearly twice per week. Overall, email is used most often (50.4 times a year), followed by face-to-face (39.6 times) and phone (18.5 times), although specific profiles vary by alter, role relationship and tie strength.

There is no cusp point: the mean frequency of contact drops smoothly over residential distance, with all coefficient estimates for the knots being insignificant. The frequency drops by 0.1% for each percent increase in distance. This result implies that with increasing distance, phone and then email compensate for less face-to-face contact.

Among the various role relationships, neighbours (160.8 times a year) contact each other the most frequently, followed by immediate kin (164.9 times), extended kin (124.1 times), and

friends (96.6 times). The strength of ties also matters: intimates communicate twice as often (147.8 times) as non-intimates (78.8 times).

Overall contact among immediate kin and extended kin are not sensitive to distance: all the coefficient estimates for distance and the knots are statistically insignificant. Among friends, the frequency of overall contact drops smoothly over distance: for each percent increase in distance, contact drops by 0.1% (at 0.10-significance level). Extended kin show a nonlinear pattern. Their overall contact is insensitive to distance within 150 miles; beyond 150 miles, frequency of contact increases by 0.2%.

Overall contact with intimates is only moderately sensitive to distance: the ties are strong enough that they find a way to be in touch. Frequency drops modestly at a rate of 0.1%, but increases at a rate of 0.01% beyond 150 miles. For non-intimates the frequency of overall contact decreases with two cusp points: five and 50 miles. Within five miles, the decrease occurs at a rate of 0.1%; between five and 50 miles, the rate is 0.4%, and beyond 50 miles, the frequency increases at a rate of 0.7%.

Intimates: Neighbours are in contact the most frequently: 217.0 times a year, followed by intimate immediate kin (205.4 times), friends (139.8 times) and extended kin (129.3 times) – their frequency is one-half as often as immediate kin.

Overall, contacts among intimate immediate kin and extended kin are not sensitive to distance. Intimate friends show a different pattern: their frequency of contact is insensitive to distance within 50 miles, beyond which their frequency drops by 0.7%. Beyond 150 miles, their frequency decreases minutely by 0.001% for each percent increase in distance.

Non-Intimates: Unlike their intimate counterparts, non-intimate extended kin are in overall contact the most often among various kinship groups at an average of once every three days

(171.9 times a year). Neighbours are in contact at an average of 141.2 times a year. Non-intimate friends are in contact only 53.7 times a year, while the small number of non-intimate immediate kin contact the least often at an average of once every three weeks (22.7 times).

Contacts among non-intimate friends are not sensitive to distance. Contacts are most sensitive to distance among non-intimate kin (at a rate of -0.4%), while those among neighbours drop at 0.3%. Immediate kin show a non-linear pattern: their contacts are not sensitive to distance within five miles, but drop at 1.0% between five and 50 miles. Beyond 50 miles, overall contacts increase at a rate of 2.5%. Their frequency drops at 0.3% beyond 150 miles.

> Table 4 about here: Model 4 results: Overall contact <

Comparing How Distance Has Mattered Before and After the Internet

Has the influence of distance on the frequency of contact changed after the Internet? To address this question, we compare the 2005 data from the third East York study (reported on here) to the pre-email data from the second (1978) East York study (reported in more detail in Mok and Wellman, 2007; Wellman, Carrington and Hall, 1988). Our comparison uses multilevel models without spline.

The 1978 and 2005 samples differ somewhat in terms of the characteristics of the role relationships (see expanded online version of this paper). *First*, the present post-Internet study involves relationships with longer mean distances than the pre-Internet second study. The mean distance in the 2005 study is two times greater than the mean reported in the 1978 study. Yet, the median distance is somewhat lower in the present study (6.4 miles) than in the 1978 study (8.5 miles), using the Wilcoxon-Mann-Whitney test. This suggests that while the Internet has helped maintain contact with extremely distant ties, it has not expanded the spatial range of all active ties.

Second, the present study contains an older sample than the second study. *Third*, the present study contains more transoceanic immigrants and hence a greater likelihood of very distant ties. *Fourth*, respondents from the present study have identified a significantly greater percentage of intimates among their active ties: 54.2% as compared to only 39.1% in the second study. *Fifth*, the present study includes more friends, but fewer neighbours and immediate kin.

Our comparison is made, based on the results reported in tables 2(b), 3(b) and 4(b). In these tables, the column “SEY-t” shows the t-statistics associated with testing the difference in parameter estimates between the 1978 and the 2005 East York studies. Overall, the frequency of *phone contact* has increased from 1978 to 2005 (0.10 sig.): from 12.3 to 20.9 times a year. The higher mean in 2005 is driven primarily by the higher frequency among those who are not related by kinship: they phone 50.9 times a year, compared to 9.8 times in 1978. In particular, friends—especially intimate friends—have become less sensitive to distance. The slope parameter reduces by half from 0.3% in 1978 to 0.1% in 2005. This increased frequency probably reflects the much lower costs of long-distance telephony in 2005.

The frequency of *face-to-face contact* and its sensitivity to distance have scarcely changed between the 1970s and the 2000s. Overall, the mean frequency of face-to-face contact is 44.8 times a year in 1978 and 46.5 times in 2005: an insignificant difference. Moreover, the frequency of face-to-face contact has a similar relationship with respect to distance, pre- and post-Internet. The principal difference is that extended kin—especially non-intimate kin—meet more often in 2005, compared to 1978. The mean (30.9 in 1978 versus 59.1 in 2005) is about twice of the mean reported in the second East York study (10-percent significance level). Face-to-face contact among neighbours has also become more sensitive to distance (-0.01% in 1978 versus -0.3% in 2005), while friends have become less sensitive (-0.3% in 1978 versus -0.2% in 2005).

The implication of these results is that despite the advancement in telecommunication technologies, face-to-face contact remains substantially local. Both its frequency and its sensitivity to distance have hardly changed, pre- and post-Internet. In particular, kin and intimates meet as often in 2005 as they did in 1978.

Has Distance Died?

Summary

Despite persistent fears about the death of community in both the developed and less developed worlds, the East Yorkers we studied have abundant contact with their active ties, an average of 110.1 times per year (about twice per week). As people have a median of 23 active ties, this means they use a variety of media to have 2,863 contacts per year – about eight per day – and this is just with the active ties that typically comprise only 10% of their networks.

Email has joined face-to-face and phone as a major medium of communication. Once distance has been accounted for, people email more frequently than they phone or meet each other. Indeed, people email each other most often (50.6 times), followed by face-to-face contact (39.8 times) and phone contact (18.6 times). Although not all ties use email, those who do use it, use it a lot.

Distance is dead only if email is looked at in isolation. Email contact is insensitive to distance. It is as frequent at 500 miles as at 5 and 50 miles. When relationships are very distant – transoceanic – email is almost the only medium the East Yorkers use for contact, as Internet phone services such as Skype had not become widely known.

Although email gets the lions-share of hype and analysis these days, it is the relationship that is the most important – and not the medium of communication. Most active ties

communicate by multiple means. The exceptions are the obvious extremes: neighbours and alters living 3,000 miles apart.

Despite the distance-insensitivity of the Internet, distance still matters for the overall relationship. Yet, different modes of communication have different sensitivities to distance:

(a) The frequency of email shows a cusp point at 3,000 miles: within 3,000 miles, distance decreases by 0.1% for each percent increase in distance; beyond 3,000 miles, the frequency of contact increases at 4.4%.

(b) Phone contact is half as sensitive to distance as face-to-face contact. Its sensitivity to distance drops modestly beyond 100 miles, but increases beyond 500 miles.

(c). Face-to-face contact displays a marked drop at five miles. Beyond five miles, the frequency of face-to-face contact drops nearly twice as fast as those relationships that live within five miles. Not surprisingly, neighbours meet each other face-to-face the most often.

Distance has little impact on how often people phone each other within 100 miles. As this is an appreciably further distance than that covered by Toronto's flat-rate telephone plans, the 100-mile cusp point is not heavily driven by costs. However, 100 miles is at the outer limit of a day's drive from East York, suggesting that face-to-face and phone contact are intertwined. Despite the prevalence of low-cost telephone plans for longer distances, the frequency of phone contact drops twice as fast for relationships that are more than 100 miles apart.

Tie strength and traditional *kinship* ties remain important predictors of who contacts whom. Intimates contact each other more often than non-intimate active ties, regardless of the mode of contact: face-to-face, by phone or by email. Yet, non-intimates have much contact, calling into question assumptions of "social isolation" based only on the dearth of intimate ties (e.g., McPherson, Smith-Lovin and Brashears, 2006).

People related by kin—immediate kin or extended kin—are usually in contact with one another more often than friends or neighbours. Immediate kin are especially apt to be in frequency contact. The only exception is that friends and neighbours tend to have more face-to-face contact than extended kin.

Technology has only partially altered the way people maintain their relationships in this Canadian city. The frequency of face-to-face and phone contact among various role relationships have hardly changed between the 1970s and the 2000s. Such contact is also similarly sensitive to distance, pre- and post-Internet, with the exceptions of intimate neighbours and non-intimate friends. Face-to-face and phone contacts among non-intimate friends have become less sensitive to distance.

The frequency of overall contact is similar between 1978 and 2005, despite the addition of email to the ensemble of communication media. Although the mean frequency of overall contact of once every three days in 2005 is up a bit from once every four days in 1978, mean contact is not statistically different. However, the frequency of overall contact has become less sensitive to distance in 2005, reflecting the zero-distance cost of email, lower costs for short and long distance telephony, and lower airplane travel costs.

As the frequency of face-to-face and phone contact have hardly changed between the two studies, email accounts for the lion's share of lower sensitivity to distance. Almost all of the intercept parameters in 2005 receive an estimate that is not significantly different from those in 1978. The exceptions are face-to-face contact among intimate neighbours and non-intimate friends. Among intimate neighbours, the frequency of face-to-face contact in 2005 is half as often as in 1978; among non-intimate friends, the frequency in 2005 is less than one-third of that in 1978. These results reflect email's advantage in maintaining contact with weaker ties (Boase

et al., 2006). Moreover, face-to-face contacts among non-intimate friends have also become less sensitive to distance, perhaps reflecting email's ease of use and zero cost for arranging such meetings.

Telephoning is coupled with face-to-face contact in 2005, just as it was in 1978. The frequency of face-to-face and phone contact is positively related: those who are seen the most phone the most, and contact by both phone and face-to-face declines by distance.

However, there does appear to be some shift from phone to email. Phone contact among intimates, intimate and non-intimate friends are less than half as sensitive to distance in 2005 as compared to 1978.

Implications

Our study has multiple implications for understanding communication technology and social networks. As with any case study, our specific findings pertain only to the East York locality. Yet, we believe that their implications are pertinent to North America, the developed world, and perhaps, the less developed world (for a similar rural Canadian analysis, see Collins, Mok, Carrasco and Wellman, forthcoming).

First, the results above suggest some "specialization" of various modes of contact with respect to distance. Face-to-face contact is predominantly local, which involves mainly short-distance relationships. Despite the widespread availability of cars, transit and planes, its frequency drops rapidly beyond five miles. By contrast, phone contact is regional. It allows people to reach alters who live further away: its frequency drops slowly within 100 miles but drops faster beyond 100 miles. Email is by far the fastest and easiest way to reach people across provinces and nations.

Second, this is fuzzy specialization, with almost everyone using multiple media, but in different proportions, depending on their distance apart and the nature of their relationship. All but neighbours phone or email; all but transoceanic ties have appreciable face-to-face and phone contact. In between, people use whatever means is necessary and deemed appropriate to communicate. Although people have become more comfortable with email since its mostly instrumental use a decade ago, it is hard to hug online. Yet, our interviews tell us that some people prefer emailing friends and relatives because of its ease and quickness of use: not everyone wants a nuanced, hugging relationship in every interaction (Wellman and Hogan, et al., 2006).

Third, distance still matters for personal networks in the Internet era. The frequencies of both face-to-face and phone contact drop significantly over distance. What is more striking is that the degree of sensitivity is similar pre- and post-Internet, despite the putative ability of the Internet to facilitate face-to-face and phone contact. This result contributes to the on-going debate regarding the death of geography in the advent of telecommunication technologies—our results support the anti-thesis that geography still matters.

Fourth, compared to 1978, the Internet has enabled the East Yorkers to have more contact with more ties (Wellman and Hogan, et al., 2006). Face-to-face and phone contact remain high, with Internet contact (email, etc.) added on to it. This is consistent with American and world survey data Quan-Haase and Wellman, 2002; Chen, Boase and Wellman, 2002; Boase, et al., 2006).

Fifth, distance has become effectively shorter in the transitions from carriages to railroads to expressways to airplanes. With email and phone contact, time may be simultaneous, although communicators still must deal with time-zone work/sleep cycles. With glocalization, people exist

in multiple times, local and distant (Zeruvabel, 1985; Hongladarom, 2002; Galison, 2003). For example, one of us will email the editors of this journal trusting they will get our file tomorrow across the Atlantic; then, one will phone the other 100 km apart – “it’s done”; finally, we will hug our spouses and turn out the lights in “real time”.

Sixth, the proliferation of email (and IM) and mobile phone use is part of the great transitions away from door-to-door contact (walking) and place-to-place contact (by phone, transit or driving). While neighbours still walk door-to-door, and many households drive/fly to have place-to-place contact, our interviews make it clear that much communication is *person-to-person* (Wellman, 2001). At each end of the communication link, people login to their Internet accounts as individuals, and not as households. Not only is the relationship relatively insensitive to distance, it can be independent of any other household member. Although still somewhat sensitive to distance, mobile phone ties also share the characteristic of person-to-person contact in comparison to traditional landline phones. While our data are from Toronto, we suspect this transition is happening globally, albeit unevenly (Fortunati, 2003).

Seventh, the result is a personalized and somewhat mobile society, even though we have to email from somewhere. Our “place” is wherever our computer and phone are (Casey, 1997; Urry 2007). Yet, the continued prevalence of kinship and neighbourhood ties suggests that traditional solidarities remain strong. Email especially enables kinship ties to be active over great distances, as the social cohesion of relatives partially surmounts distance. There is a solidary core of some (but not all) kin, combined with a multitude of sparsely-knit friends. Yet, at the same time, friendship remains abundant and strong, using whatever communication means needed, time and availability deemed most necessary for the contact.

Eighth, the continuing importance of kin shows that even in the age of personal networks, interpersonal social systems are more than the sum of their ties. Kinship is synergistic, with the social system keeping members in contact. This calls into question overly strong assertions that the Internet has fostered a world consisting only of voluntary friendship relationships.

Ninth, the combination of face-to-face, phone and email communication means that the role of cities as interaction maximizers remains, in modified form. Cities continue to foster face-to-face contact, and much contact is local. There is no global village. Rather, there is glocalization, with extensive local contact joined by amplified long-distance connectivity. The city is no longer the boundary – if it ever was – it is the hub.

References

- Axhausen, Kay, John Urry and Jonas Larsen. 2007. "The Network Society and the Networked Traveller." Research Paper 435, IVT, Swiss Federal Institute of Technology Zurich, May.
- Benedict XVI, Pope. 2009. "New Technologies, New Relationships." January 24. http://www.vatican.va/holy_father/benedict_xvi/messages/communications/documents/hf_b-en-xvi_mes_20090124_43rd-world-communications-day_en.html
- Bernard, H. Russell. 2008. "Honoring Peter Killworth." Paper presented to the International Sunbelt Social Network conference," St. Petersburg, FL, January.
- Blokland, Talja and L.K Mitzman. 2003. *Urban Bonds*. Cambridge: Polity.
- Boase, Jeffrey. 2008. "Personal Networks and the Personal Communication System." *Information Communication and Society* 11: 490-508.
- Boase, Jeffrey, John Horrigan, Barry Wellman and Lee Rainie. 2006 *The Strength of Internet Ties*. Washington: Pew Internet and American Life Project, January.
- Butts, Carter. 2009. "The Importance of Simple Things." Plenary presentation to the

International Sunbelt Social Network Conference, San Diego, March.

- Cairncross, Frances. 1997. *The Death of Distance*. Boston: Harvard Business School Press.
- Carrasco, Juan-Antonio, Eric J. Miller and Barry Wellman. 2008. "How Far and With Whom do People Socialize? Empirical Evidence about Distance Between Social Network Members." *Transportation Research Record: Journal of the Transportation Research Board* 2076: 114-122.
- Casey, Edward. 1997. *The Fate of Place*. Berkeley: University of California Press.
- Castells, Manuel. 2000. *The Rise of the Network Society*, 2nd ed. Oxford Blackwell.
- Castells, Manuel, Mireia Fernandez-Ardevol, Jack Linchuan Qiu and Araba Sey. 2006. *Mobile Connectedness*. Cambridge, MA: MIT Press.
- Chayko, Mary. 2008. *Portable Communities*. Albany: State University of New York Press.
- Chen, Wenhong, Jeffrey Boase and Barry Wellman. 2002. "The Global Villagers" Pp. 74-113 in *The Internet in Everyday Life*, edited by Barry Wellman and Caroline Haythornthwaite. Oxford: Blackwell.
- Chua, Vincent, Julie Madej and Barry Wellman. 2010. "Personal Communities." *Sage Handbook of Social Network Analysis*. London: Sage: forthcoming.
- Collins, Jessica, Diana Mok, Barry Wellman and Juan-Antonio Carrasco. 2009. "'Chapleau Has Joined the World.'" *American Behavioral Scientist*: forthcoming
- Curtice, John and Pippa Norris. 2007. "Isolates or socialites?" Pp. 239-59 in *British Social Attitudes: the 23rd Report*, ed. by A. Park, J. Curtice, K. Thomson, M. Phillips and M. Johnson. London: Sage.

- Faust, K., B. Entwisle, R.R. Rindfuss, S.J. Walsh, and Y. Sawangdee. 2000. "Spatial Arrangement of Social and Economic Networks Among Villages in Nang Rong District, Thailand " *Social Networks* 21: 311-37.
- Fischer, Claude. 1982. *To Dwell Among Friends*. Berkeley: University of California Press.
- Fischer, Claude. 1992. *America Calling*. Berkeley: University of California Press.
- Fisher, Dana, and Larry Michael Wright. 2001. "On Utopias and Dystopias." *Journal of Computer Mediated Communication* 6: <http://jcmc.indiana.edu/vol6/issue2/fisher.html>
- Fortunati, Leopoldina, James Katz, and Raimonda Riccini. 2003. *Mediating the Human Body*. Mahwah, NJ: Lawrence Erlbaum.
- Frei, Andreas and Axhausen, Kay. 2007. "Size and Structure of Social Network Geographies." Research Paper 444, IVT, Swiss Federal Institute of Technology, Zurich, September.
- Gram, Sarah, Barry Wellman and Natalie Zinko. 2009. "East York: A Profile." 2nd ed. Toronto: NetLab Report.
- Green, Nicola. 2002. "On the Move: Technology, Mobility and the Mediation of Social Time and Space." *The Information Society* 18:281-92.
- Grossetti, Michel. 2007. "Are French Networks Different?" *Social Networks* 29: 391-404.
- Hampton, Keith, and Barry Wellman. 2002. "The Not So Global Village of Netville." Pp. 345-371 in *The Internet in Everyday Life*, edited by Barry Wellman and Caroline Haythornthwaite. Oxford: Blackwell.
- Hipp, John and Andrew Perrin. 2009. "The Simultaneous Effect of Physical Distance and Social Distance on the Formation of Neighborhood Ties." *City & Community* 8: 5-25.
- Hampton, Keith, and Barry Wellman. 2003. "Neighboring On and Offline in Netville, the Wired Suburb." *City and Community* 1: 277-311.

- Hogan, Bernie, Juan-Antonio Carrasco and Barry Wellman. 2007. "Visualizing Personal Networks." *Field Methods* 19: 116-44
- Hongladarom Soraj. 2002. "The Web of Time and the Dilemma of Globalization." *The Information Society* 18: 241-49.
- Kenyon, Susan and Glenn Lyons. 2006. "Changing Access to Key Activities over Time." ICT, Everyday Life and Change conference, Bergen, NL, November.
- Kim, Hyo, Wang Jae Kim, Han Woo Park and Ronald Rice. 2007. "Configurations of Relationships in Different Media." *Journal of Computer Mediated Communication* 12: <http://jcmc.indiana.edu/vol12/issue4/kim.html>
- Marx, Leo. 1964. *The Machine in the Garden*. New York: Oxford University Press.
- Massey, Doreen. 1984. *Spatial Divisions of Labour*. London: Macmillan.
- McLuhan, Marshall. 1962. *The Gutenberg Galaxy*. Toronto: University of Toronto Press.
- McPherson, Miller, Lynn Smith-Lovin and Matthew Brashears. 2006. "Social Isolation in America." *American Sociological Review* 71: 353-75.
- Meier, Richard. 1962. *A Communications Theory of Urban Growth*. Cambridge, MA: MIT Press.
- Miyata, Kakuko, Jeffrey Boase and Barry Wellman. 2008. "The Social Effects of *Keitai* and Personal Computer Email in Japan." Pp. 209-222 in the *Handbook of Mobile Communication Studies*, edited by James Katz. Cambridge, MIT Press.
- Mok, Diana and Barry Wellman. 2007. "Did Distance Matter Before the Internet." *Social Networks* 29: 430-61.
- Pred, Allen. 1973. *Urban Growth and the Circulation of Information*. Cambridge, MA: Harvard University Press.

- Quan-Haase, Anabel and Barry Wellman 2002. "Capitalizing on the Internet: Network." Pp. 291-324 in *The Internet in Everyday Life*, edited by Barry Wellman and Caroline Haythornthwaite. Oxford: Blackwell.
- Shklovski, Irina, Robert Kraut and Jonathon Cummings. 2008. "Keeping in Touch by Technology." *Proceedings of the Human Factors in Computer Science Conference*. New York. ACM Press.
- Stern, Michael and Don A. Dillman. 2006. "Community Participation, Social Ties, and Use of the Internet." *City and Community* 5: 409-24.
- Stern, Michael and Chris Messer. 2008. "How Family Members Stay In Touch." *Marriage and Family Review*: forthcoming.
- Urry, John. 2007. *Mobilities*. Cambridge, Polity.
- Veenhof, Ben, Barry Wellman, Carsten Quell and Bernie Hogan. 2008. "Isolation, Cohesion or Transformation?" *Connectedness*: report series: F0004M-16, December 4.
<http://www.statcan.gc.ca/pub/56f0004m/56f0004m2008016-eng.pdf> .
- Wellman, Barry. 1979. "The Community Question." *American Journal of Sociology* 84: 1201-31.
- Wellman, Barry. 1990. "The Place of Kinfolk in Personal Community Networks." *Marriage and Family Review* 15: 195-228.
- Wellman, Barry. 1999. "The Social Affordances of E-Mail." *SIGGROUP Bulletin* 20: 63.
- Wellman, Barry. 2001. "Physical Place and Cyber-Place." *International Journal for Urban and Regional Research* 25: 227-52.

- Wellman, Barry, Peter Carrington, and Alan Hall. 1988. "Networks as Personal Communities." Pp. 130-84 in *Social Structures: A Network Approach*, edited by Barry Wellman and S.D. Berkowitz. Cambridge: Cambridge University Press.
- Wellman, Barry and Kenneth Frank. 2001. "Network Capital in a Multi-Level World: Getting Support in Personal Communities." Pp. 233-73 in *Social Capital*, edited by Nan Lin, Karen Cook and Ronald Burt. Chicago: Aldine DeGruyter, 2001.
- Wellman, Barry, and Milena Gulia. 1999. "Net Surfers Don't Ride Alone: Virtual Communities as Communities." Pp. 331-366 in *Networks in the Global Village*, edited by Barry Wellman. Boulder, CO: Westview.
- Wellman, Barry and Bernie Hogan, with Kristen Berg, Jeffrey Boase, Juan-Antonio Carrasco, Rochelle Côté, Jennifer Kayahara, Tracy Kennedy and Phuoc Tran. "Connected Lives." Pp. 157-211 in *Networked Neighbourhoods*, edited by Patrick Purcell. Guildford, UK: Springer, 2006.
- Wellman, Barry and David Tindall. 1993. "Reach out and Touch Some Bodies." *Progress in Communication Science* 12: 63-94.
- Wellman Barry and Scot Wortley. 1990. "Different Strokes from Different Folks:". *American Journal of Sociology* 96: 558-88.

Table 1. Model 1 results: Email/Instant message contact

(a) With spline

i. Single classification

	Overall		Kinship				Not related				Intimacy				
	knots (miles)	Estimate	S.E.	Immediate kin		Extended kin		All		Friend		Intimates		Non-intimates	
				Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Intercept		3.92	0.53	4.65	0.59	5.26	1.44	3.78	0.18	3.73	0.27	4.23	0.25	3.65	0.23
LnDist		-0.12	0.12	-0.27	0.12	-0.45	0.32	-0.05	0.06	-0.03	0.07	-0.13	0.06	-0.12	0.07
d1*(LnDist-kd1)	50	0.00	0.22	-0.03	0.40	0.24	1.01	0.08	0.29	-0.10	0.30	-0.26	0.29	0.51	0.34
d2*(LnDist-kd2)	500	-0.15	0.44	-0.05	0.73	-0.05	1.70	-0.18	0.59	-0.09	0.61	0.32	0.57	-0.71	0.76
d3*(LnDist-kd3)	3000	1.96	1.07	2.57	1.53	0.73	4.01	1.66	1.70	1.60	1.73	1.86	1.20	0.24	2.57
RIMM		-0.52	0.25	-0.86	0.72	-2.54	1.37	-0.35	0.27	-0.57	0.38	-0.45	0.38	-0.46	0.33
RIMM*LnDist		0.09	0.05	0.17	0.11	0.35	0.19	0.01	0.06	0.03	0.07	0.09	0.07	0.03	0.07
N		448		112		41		295		202		259		189	
IR var		0.25	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
IT var		2.73	0.21	2.41	0.34	3.42	0.83	2.72	0.23	2.41	0.24	2.75		1.71	0.13
-2LL		1723.80		409.80		159.50		1138.30		754.70		999.50		714.00	

ii. Intimates

	Kinship				Not related				
	knots (miles)	Immediate kin		Extended kin		All		Friend	
		Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Intercept		4.72	0.61	7.35	2.34	3.95	0.29	3.55	0.43
LnDist		-0.28	0.12	-0.72	0.49	0.01	0.09	0.11	0.11
d1*(LnDist-kd1)	50	0.02	0.46	0.37	1.18	-0.52	0.43	-0.78	0.43
d2*(LnDist-kd2)	500	-0.11	0.86	1.29	2.04	0.65	0.83	0.91	0.82
d3*(LnDist-kd3)	3000	2.64	1.58	-5.39	6.11	1.81	2.05	2.38	1.91
RIMM		-0.63	0.74	-4.98	1.83	-0.03	0.47	0.29	0.55
RIMM*LnDist		0.15	0.12	0.70	0.28	-0.02	0.10	-0.12	0.11
N		102		24		133		98	
IR var		0.00		0.00	0.00	0.00	0.00	0.00	0.0
IT var		2.46	0.36	3.09	1.06	2.90	0.37	2.32	0.344
-2LL		377.60		81.40		519.30		360.50	

iii. Non-intimates

	knots (miles)	Kinship				Not related			
		Immediate kin		Extended kin		All		Friend	
		Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Intercept		--	--	5.27	1.92	3.63	0.23	3.71	0.34
LnDist		--	--	-0.65	0.48	-0.09	0.07	-0.09	0.09
d1*(LnDist-kd1)	50	--	--	0.89	2.28	0.64	0.39	0.33	0.42
d2*(LnDist-kd2)	500	--	--	-0.62	3.85	-0.78	0.89	-0.20	1.00
d3*(LnDist-kd3)	3000	--	--	2.03	5.39	0.29	3.16	-3.29	3.71
RIMM				-1.60	2.64	-0.40	0.34	-1.21	0.53
RIMM*LnDist				0.11	0.30	0.01	0.08	0.12	0.12
N		10	--	17		162		104	
IR var		--	--	0.00	0.00	0.00	0.00	0.00	0.00
IT var		--	--	3.28	1.46	2.50	0.28	2.20	0.32
-2LL		--	--	51.60		608.80		375.40	

(b) Without spline

i. Single classification

	Overall		Kinship				Not related						Intimacy			
	Estimate	S.E.	Immediate Kin		Extended kin		All		Friends		Neighbours		Intimates		Non intimates	
			Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.		
Intercept	3.88	0.17	4.50	0.55	4.58	0.87	3.75	0.18	3.77	0.25	3.94	0.62	4.23	0.24	3.57	0.22
LnDist	-0.10	0.03	-0.23	0.09	-0.28	0.13	-0.02	0.04	-0.05	0.05	-0.06	0.33	-0.14	0.05	-0.07	0.05
RIMM	-0.61	0.25	-1.13	0.72	-2.59	1.32	-0.40	0.27	-0.64	0.37	-0.85	1.16	-0.64	0.37	-0.46	0.33
RIMM*LnDist	0.14	0.04	0.28	0.10	0.37	0.18	0.05	0.06	0.05	0.07	0.15	0.37	0.17	0.06	0.05	0.07
N	448		112		41		295		202		23		259		189	
IR var	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IT var	2.76	0.19	2.51	0.35	3.19	0.74	2.72	0.23	2.38	0.24	4.73	1.53	2.81	0.25	2.56	0.27
-2LL	1729.70		419.00		164.50		1141.60		756.90		97.00		1007.60		718.50	

ii. Intimates

	Kinship				Not related					
	Immediate kin		Extended kin		All		Friends		Neighbours	
	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Intercept	4.54	0.57	5.95	1.35	4.03	0.28	3.84	0.40	4.44	0.67
LnDist	-0.23	0.09	-0.40	0.20	-0.05	0.07	-0.02	0.08	0.20	0.48
RIMM	-0.91	0.75	-4.69	1.72	-0.17	0.46	-0.02	0.54	-0.11	1.35
RIMM*LnDist	0.26	0.11	0.67	0.25	0.04	0.09	-0.02	0.10	-0.17	0.51
N	102		24		133		98		14	
IR var	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IT var	2.57	0.37	2.83	0.90	2.91	0.36	2.41	0.35	3.74	1.67
-2LL	386.90		91.70		525.70		369.80		53.00	

iii. Non-intimates

	Kinship				Not related					
	Immediate kin		Extended kin		All		Friends		Neighbours	
	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Intercept	--	--	3.74	1.03	3.53	0.22	3.72	0.30	2.97	1.20
LnDist	--	--	-0.23	0.16	-0.01	0.05	-0.08	0.07	-0.01	0.51
RIMM			-1.04	2.38	-0.41	0.33	-1.18	0.52	-1.10	2.05
RIMM*LnDist			0.11	0.28	0.02	0.08	0.11	0.11	-0.10	0.70
N	10	--	17		162		104		9	
IR var	--	--	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IT var	--	--	2.83	1.11	2.50	0.28	2.19	0.31	5.84	3.70
-2LL	--	--	63.20		615.60		382.10		32.20	

Notes:

1. The model with spline is based on the equation $Y_{ij} = \gamma_{00} + \gamma_{11} Z_j + \gamma_{10} X_{ij} + \gamma_{10}^2 d (X_{ij} - k_d) + \gamma_{11}^2 Z_j X_{ij} + u_{0j} + \varepsilon_{ij}$, where Y_{ij} measures the frequency of contact; X_{ij} is the residential distance (LnDist) between the respondent and the community tie, and Z_j is a dichotomous variable that identifies immigrant respondents (RIMM) in the sample. The variable d is a dummy variable that identifies observations whose distance is greater than the knot k_d . The terms u_{0j} and ε_{ij} are the errors of the model.
2. The model without spline is based on the equation $Y_{ij} = \gamma_{00} + \gamma_{01} Z_j + \gamma_{10} X_{ij} + u_{0j} + \varepsilon_{ij}$. Definitions of the terms are same as before.
3. "IR var" shows the amount of variation at the respondent level, whereas "IT var" is the amount of variation at the community tie level. The total variation is the sum of IR var and IT var.
4. Estimates in bold faces are significant at the 5 percent level; those that are also italicized are significant at the 10 percent level.

Table 2. Model 2 results: Phone contact

(a) With spline

i. Single classification

	knots (miles)	Overall		Kinship				Not related				Intimacy			
				Immediate kin		Extended kin		All		Friend		Intimates		Non-intimates	
		Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Intercept		2.92	0.11	3.98	0.31	3.33	0.51	2.79	0.13	3.03	0.18	3.70	0.14	2.11	0.15
LnDist		0.01	0.03	-0.07	0.07	-0.22	0.11	0.01	0.04	-0.05	0.05	-0.04	0.04	0.03	0.04
d1*(LnDist-kd1)	100	-0.80	0.27	-0.42	0.38	-0.16	0.67	-0.92	0.42	-0.69	0.42	-0.65	0.31	-0.80	0.40
d2*(LnDist-kd2)	500	0.96	0.46	0.37	0.62	0.44	1.13	1.20	0.74	0.97	0.74	0.64	0.53	1.03	0.69
RIMM		-0.23	0.17	-0.43	0.45	0.23	0.61	-0.19	0.19	0.04	0.27	-0.06	0.23	0.01	0.22
RIMM*LnDist		0.09	0.03	0.10	0.07	0.09	0.10	0.06	0.05	0.02	0.06	0.11	0.04	0.00	0.05
N		1019		257		112		650		420		550		469	
IR var		0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IT var		3.11	0.14	2.33	0.21	2.54	0.35	3.32	0.18	2.83		2.51	0.15	2.69	0.1771
-2LL		4044.70		936.70		425.10		2634.60		1637.80		2064.70		1802.30	

ii. Intimates

	knots (miles)	Kinship				Not related			
		Immediate kin		Extended kin		All		Friend	
		Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Intercept		4.25	0.29	3.79	0.62	3.59	0.17	3.76	0.23
LnDist		-0.05	0.06	-0.21	0.13	-0.07	0.05	-0.10	0.06
d1*(LnDist-kd1)	100	-0.67	0.36	-0.35	1.02	-0.53	0.61	-0.60	0.62
d2*(LnDist-kd2)	500	0.59	0.58	0.62	1.78	0.40	1.07	0.55	1.10
RIMM		-0.53	0.43	-0.37	0.75	0.14	0.30	-0.03	0.36
RIMM*LnDist		0.14	0.07	0.25	0.13	0.08	0.07	0.08	0.08
N		210		52		288		211	
IR var		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IT var		1.78	0.18	2.10	0.44	3.00	0.25	2.62	0.26
-2LL		712.50		185.50		1139.90		807.80	

iii. Non-intimates

	knots (miles)	Kinship				Not related			
		Immediate kin		Extended kin		All		Friend	
		Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Intercept		2.37	0.92	2.89	0.76	2.06	0.16	2.15	0.24
LnDist		-0.03	0.19	-0.25	0.15	<i>0.08</i>	0.05	0.05	0.06
d1*(LnDist-kd1)	100	1.28	1.27	0.23	0.83	-1.12	0.53	-0.86	0.53
d2*(LnDist-kd2)	500	-1.79	1.81	-0.03	1.37	<i>1.54</i>	0.94	1.16	0.93
RIMM		0.39	1.36	0.53	0.89	-0.01	0.23	0.09	0.37
RIMM*LnDist		-0.18	0.29	0.01	0.13	-0.02	0.06	-0.03	0.08
N		47		60		362		209	
IR var		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IT var		2.23	0.50	2.41	0.46	2.79	0.21	2.35	0.23
-2LL		163.50		222.80		1407.20		777.90	

(b) Without spline

i. Single classification

	Overall			Kinship						Not related								
				Immediate Kin			Extended kin			All			Friends			Neighbors		
	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t
Intercept	3.04	0.11	3.96	4.20	0.28	2.19	3.27	0.42	-0.45	2.86	0.12	3.93	3.13	0.17	-2.08	2.88	0.30	0.40
LnDist	-0.06	0.02	-1.25	-0.14	0.05	-0.08	-0.21	0.07	0.98	-0.05	0.03	-0.06	-0.10	0.04	4.25	-0.05	0.13	-0.52
RIMM	-0.19	0.17		-0.33	0.44		0.21	0.59		-0.16	0.19		0.07	0.27		0.25	0.49	
RIMM*LnDist	0.06	0.03		0.07	0.06		0.11	0.09		0.04	0.05		0.02	0.05		0.11	0.19	
N	1019			257			112			650			420			96		
IR var	0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00	
IT var	3.16	0.14		2.34	0.21		2.50	0.34		3.34	0.19		2.84	0.20		4.34	0.64	
-2LL	4057.0			938.0			426.2			2640.9			1640.0			414.9		

	Intimacy					
	Intimates			Non intimates		
	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t
Intercept	3.83	0.14	0.95	2.21	0.15	1.45
LnDist	-0.11	0.03	0.80	-0.03	0.03	-0.38
RIMM	0.05	0.23		0.01	0.22	
RIMM*LnDist	<i>0.06</i>	0.04		-0.01	0.05	
N	550			469		
IR var	0.00	0.00		0.00	0.00	
IT var	2.55	0.15		2.71	0.18	
-2LL	2073.1			1806.9		

ii. Intimates

	Kinship						Not related								
	Immediate kin			Extended kin			All			Friends			Neighbours		
	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t
Intercept	4.61	0.26	1.61	3.83	0.52	--	3.65	0.17	1.21	3.88	0.22	-0.70	3.67	0.45	-0.19
LnDist	-0.16	0.04	-0.53	-0.22	0.09	--	-0.12	0.04	1.48	-0.17	0.05	2.40	0.24	0.28	1.46
RIMM	-0.37	0.42		-0.41	0.72		0.24	0.30		0.07	0.35		0.54	0.71	
RIMM*LnDist	0.09	0.06		0.27	0.12		0.03	0.06		0.05	0.07		-0.28	0.32	
N	210			52			288			211			41		
IR var	0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00	
IT var	1.83	0.18		2.02	0.41		3.01	0.25		2.64	0.26		4.40	1.02	
-2LL	718.20			187.80			1143.60			811.50			175.10		

iii. Non-intimates

	Kinship						Not related								
	Immediate kin			Extended kin			All			Friends			Neighbours		
	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t
Intercept	2.20	0.89	0.00	2.59	0.60	-0.49	2.14	0.16	1.61	2.30	0.23	-2.44	2.30	0.36	-0.55
LnDist	0.01	0.19	0.16	-0.17	0.10	0.49	0.02	0.04	1.48	-0.01	0.05	4.06	-0.01	0.14	-0.53
RIMM	0.16	1.16		0.62	0.62		-0.01	0.23		0.13	0.37		-0.21	0.59	
RIMM*LnDist	-0.08	0.21		0.02	0.12		-0.04	0.06		-0.04	0.08		0.07	0.28	
N	47			60			362			209			55		
IR var	0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00	
IT var	2.17	0.47		2.35	0.44		2.83	0.21		2.37	0.23		3.32	0.66	
-2LL	167.90			225.10			1413.10			781.50			221.50		

Notes:

1. The model with spline is based on the equation $Y_{ij} = \gamma_{00}^1 + \gamma_{11}^1 Z_j + \gamma_{10}^1 X_{ij} + \gamma_{10}^2 d (X_{ij} - k_d) + \gamma_{11}^2 Z_j X_{ij} + u_{0j} + \varepsilon_{ij}$, where Y_{ij} measures the frequency of contact; X_{ij} is the residential distance (LnDist) between the respondent and the community tie, and Z_j is a dichotomous variable that identifies immigrant respondents (RIMM) in the sample. The variable d is a dummy variable that identifies observations whose distance is greater than the knot k_d . The terms u_{0j} and ε_{ij} are the errors of the model.
2. The model without spline is based on the equation $Y_{ij} = \gamma_{00} + \gamma_{01} Z_j + \gamma_{10} X_{ij} + u_{0j} + \varepsilon_{ij}$. Definitions of the terms are same as before.
3. "IR var" shows the amount of variation at the respondent level, whereas "IT var" is the amount of variation at the community tie level. The total variation is the sum of IR var and IT var.
4. Estimates in bold faces are significant at the 5 percent level; those that are also italicized are significant at the 10 percent level.
5. The column "SEY-t" shows the t-statistics for comparing the parameter estimates reported in the Second East York study. The sample of Intimate extended kin is excluded for comparison because the sample size is too small (n=7) in the Second East York study.

Table 3. Model 3 results: Face-to-face contact

(a) With spline

i. Single classification

	knots (miles)	Overall		Kinship				Not related				Intimacy			
				Immediate kin		Extended kin		All		Friend		Intimates		Non-intimates	
		Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Intercept		3.68	0.09	3.89	0.25	3.50	0.36	3.66	0.11	3.28	0.17	3.77	0.12	3.60	0.14
LnDist		-0.14	0.07	-0.12	0.08	-0.10	0.10	-0.16	0.04	-0.09	0.06	-0.08	0.04	-0.22	0.05
d1*(LnDist-kd1)	5	-0.20	0.11	-0.21	0.17	-0.38	0.25	-0.22	0.16	-0.23	0.17	-0.26	0.14	-0.24	0.18
d2*(LnDist-kd2)	50	-0.10	0.28	-0.10	0.36	-0.01	0.57	0.00	0.44	0.04	0.45	-0.30	0.34	0.36	0.47
d3*(LnDist-kd3)	200	0.09	0.29	-0.04	0.38	0.25	0.60	0.03	0.46	-0.14	0.47	0.27	0.36	-0.26	0.48
RIMM		-0.15	0.14	-0.36	0.31	-0.36	0.39	-0.08	0.17	-0.16	0.24	0.02	0.19	-0.24	0.19
RIMM*LnDist		-0.01	0.03	0.01	0.05	0.03	0.06	-0.01	0.04	0.00	0.05	-0.02	0.04	0.00	0.04
N		1019		257		112		650		420		550		469	
IR var		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
IT var		1.97	0.09	1.11	0.10	1.03	0.14	2.46	0.14	2.28	0.16	1.17	0.10	2.11	0.1398
-2LL		3584.50		754.80		330.70		2443.90		1550.60		1860.40		1691.10	

ii. Intimates

	knots (miles)	Kinship				Not related			
		Immediate kin		Extended kin		All		Friend	
		Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Intercept		4.00	0.25	3.17	0.52	3.76	0.15	3.55	0.22
LnDist		-0.12	0.08	0.13	0.16	-0.09	0.07	-0.06	0.08
d1*(LnDist-kd1)	5	-0.15	0.17	-0.76	0.34	-0.26	0.24	-0.25	0.25
d2*(LnDist-kd2)	50	-0.40	0.39	0.17	0.90	-0.30	0.61	-0.26	0.64
d3*(LnDist-kd3)	200	0.29	0.41	0.14	1.01	0.27	0.63	0.13	0.67
RIMM		-0.10	0.33	-0.21	0.58	0.14	0.27	-0.06	0.33
RIMM*LnDist		-0.02	0.05	0.03	0.10	-0.04	0.06	-0.01	0.07
N		210		52		288		211	
IR var		0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00
IT var		1.04	0.10	1.29	0.27	2.31	0.19	1.78	2.30
-2LL		606.60		163.30		1067.50		765.80	

iii. Non-intimates

	knots (miles)	Kinship				Not related			
		Immediate kin		Extended kin		All		Friend	
		Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Intercept		3.07	0.90	4.06	0.45	3.57	0.16	2.93	0.24
LnDist		0.00	0.27	-0.36	0.12	-0.21	0.06	-0.08	0.08
d1*(LnDist-kd1)	5	-0.53	0.47	-0.07	0.29	-0.26	0.23	-0.33	0.23
d2*(LnDist-kd2)	50	1.02	0.84	0.11	0.67	0.32	0.64	0.38	0.61
d3*(LnDist-kd3)	200	-1.26	0.79	0.09	0.66	-0.18	0.68	-0.36	0.66
RIMM		-1.38	0.98	-0.86	0.48	-0.16	0.22	-0.32	0.34
RIMM*LnDist		0.12	0.21	0.08	0.07	-0.01	0.06	0.02	0.07
N		47	--	60		362		209	
IR var		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
IT var		0.98	0.22	0.66	0.13	2.50	0.19	2.07	0.21
-2LL		130.70		152.70		1368.50		753.30	

(b) Without spline

i. Single classification

	Overall			Kinship						Not related								
	Estimate	S.E.	SEY-t	Immediate Kin			Extended kin			All			Friends			Neighbours		
				Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t
Intercept	3.84	0.09	1.17	4.38	0.19	-0.39	4.08	0.28	2.32	3.75	0.11	0.32	3.49	0.15	-0.79	4.53	0.17	-0.19
LnDist	-0.26	0.02	-1.24	-0.30	0.03	0.98	-0.33	0.04	-0.70	-0.25	0.03	-1.63	-0.22	0.03	1.39	-0.31	0.08	-4.61
RIMM	-0.10	0.14		-0.17	0.31		-0.57	0.39		-0.05	0.17		-0.06	0.24		0.47	0.28	
RIMM*LnDist	-0.04	0.03		-0.04	0.04		0.06	0.06		-0.04	0.04		-0.03	0.05		-0.06	0.11	
N	1019			257			112			650			420			96		
IR var	0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00	
IT var	2.01	0.09		1.15	0.10		1.07	0.15		2.48	0.14		2.32	0.16		1.40	0.21	
-2LL	3602.40			762.70			334.40			2448.40			1556.90			310.60		

	Intimacy					
	Intimates			Non intimates		
	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t
Intercept	4.02	0.11	-1.12	3.67	0.13	0.93
LnDist	-0.25	0.02	0.06	-0.28	0.03	-1.16
RIMM	0.21	0.19		-0.25	0.19	
RIMM*LnDist	-0.08	0.03		-0.01	0.04	
N	550			469		
IR var	0.00	0.00		0.00	0.00	
IT var	1.82	0.11		2.11	0.14	
-2LL	1888.80			1689.20		

ii. Intimates

	Kinship						Not related								
	Immediate kin			Extended kin			All			Friends			Neighbours		
	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t
Intercept	4.50	0.20	-0.08	4.17	0.45	--	3.89	0.15	-1.22	3.81	0.21	-0.20	4.45	0.24	-2.66
LnDist	-0.31	0.03	-0.73	-0.31	0.08	--	-0.23	0.04	0.90	-0.23	0.05	0.46	-0.34	0.15	-1.86
RIMM	0.09	0.33		-0.44	0.62		0.30	0.26		0.12	0.33		1.25	0.39	
RIMM*LnDist	-0.06	0.05		0.06	0.10		<i>-0.10</i>	0.05		-0.07	0.07		-0.13	0.17	
N	210			52			288			211			41		
IR var	0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00	
IT var	1.10	0.11		1.50	0.31		2.38	0.20		2.40	0.24		1.31	0.31	
-2LL	615.80			173.40			1076.40			791.90			130.30		

iii. Non-intimates

	Kinship						Not related								
	Immediate kin			Extended kin			All			Friends			Neighbours		
	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t
Intercept	3.65	0.61	-0.66	3.96	0.31	1.99	3.63	0.15	0.12	3.16	0.22	-3.73	4.59	0.22	0.56
LnDist	-0.22	0.13	0.84	-0.35	0.05	-0.89	-0.28	0.04	-1.69	-0.20	0.05	4.39	-0.31	0.09	-4.34
RIMM	-1.08	0.80		<i>-0.85</i>	0.44		-0.17	0.22		-0.29	0.34		-0.27	0.37	
RIMM*LnDist	0.01	0.14		0.09	0.06		-0.01	0.06		0.02	0.07		0.06	0.18	
N	47			60			362			209			55		
IR var	0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00	
IT var	1.02	0.22		0.63	0.12		2.49	0.19		2.09	0.21		1.29	0.25	
-2LL	136.10	--		151.40			1367.90			755.50			171.50		

Notes:

- The model with spline is based on the equation $Y_{ij} = \gamma_{00}^1 + \gamma_{11}^1 Z_j + \gamma_{10}^1 X_{ij} + \gamma_{10}^2 d(X_{ij} - k_d) + \gamma_{11}^2 Z_j X_{ij} + u_{0j} + \varepsilon_{ij}$, where Y_{ij} measures the frequency of contact; X_{ij} is the residential distance (LnDist) between the respondent and the community tie, and Z_j is a dichotomous variable that identifies immigrant respondents (RIMM) in the sample. The variable d is a dummy variable that identifies observations whose distance is greater than the knot k_d . The terms u_{0j} and ε_{ij} are the errors of the model.
- The model without spline is based on the equation $Y_{ij} = \gamma_{00} + \gamma_{01} Z_j + \gamma_{10} X_{ij} + u_{0j} + \varepsilon_{ij}$. Definitions of the terms are same as before.
- “IR var” shows the amount of variation at the respondent level, whereas “IT var” is the amount of variation at the community tie level. The total variation is the sum of IR var and IT var.
- Estimates in bold faces are significant at the 5 percent level; those that are also italicized are significant at the 10 percent level.
- The column “SEY-t” shows the t-statistics for comparing the parameter estimates reported in the Second East York study. The sample of Intimate extended kin is excluded for comparison because the sample size is too small (n=7) in the Second East York study.

Table 4. Model 4 results: Overall contact

(a) With spline

i. Single classification

knots (miles)	Overall		Kinship				Not related						Intimacy			
			Immediate kin		Extended kin		All		Friend		Neighbours		Intimates		Non-intimates	
	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Intercept	4.70	0.10	5.11	0.34	4.82	0.51	4.64	0.11	4.57	0.17	5.08	0.17	5.00	0.12	4.37	0.15
LnDist	-0.11	0.04	-0.12	0.11	-0.17	0.15	-0.11	0.04	-0.11	0.06	-0.10	0.09	-0.08	0.05	-0.12	0.05
d1*(LnDist-kd1) 5	-0.16	0.12	-0.19	0.24	-0.15	0.36	-0.14	0.16	-0.03	0.18	-1.38	0.67	-0.12	0.14	-0.38	0.19
d2*(LnDist-kd2) 50	-0.18	0.37	0.04	0.62	-1.45	1.03	0.03	0.51	-0.35	0.53	1.98	6.83	-0.68	0.42	1.04	0.59
d3*(LnDist-kd3) 150	0.42	0.37	0.24	0.63	1.96	1.05	0.18	0.51	0.35	0.54	-0.07	8.30	0.89	0.42	-0.80	0.59
RIMM	-0.26	0.15	-0.30	0.43	-0.82	0.55	-0.17	0.17	-0.20	0.25	0.33	0.29	-0.04	0.20	-0.23	0.20
RIMM*LnDist	0.08	0.03	0.06	0.07	0.15	0.09	0.06	0.04	0.04	0.05	0.15	0.20	0.10	0.04	0.00	0.04
N	1019		257		112		650		420		96		550		469	
IR var	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60		0.00	0
IT var	2.32	0.10	2.17	0.20	2.05	0.29	2.36	0.13	2.32	0.16	1.42	0.21	1.30		2.25	0.1491
-2LL	3714.00		919.90		395.10		2386.80		1539.60		296.30		1818.10		1694.40	

ii. Intimates

knots (miles)	Kinship				Not related			
	Immediate kin		Extended kin		All		Friend	
	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Intercept	5.33	0.28	4.86	0.52	4.94	0.15	4.94	0.21
LnDist	-0.14	0.09	-0.05	0.16	-0.08	0.06	-0.09	0.07
d1*(LnDist-kd1) 5	-0.03	0.21	-0.29	0.39	-0.12	0.23	0.05	0.23
d2*(LnDist-kd2) 50	-0.60	0.56	-0.77	1.17	-0.72	0.68	-1.28	0.69
d3*(LnDist-kd3) 150	0.78	0.57	1.01	1.28	0.90	0.68	1.31	0.70
RIMM	-0.10	0.39	-1.20	0.59	0.17	0.26	0.02	0.31
RIMM*LnDist	0.08	0.06	0.36	0.10	0.06	0.06	0.04	0.06
N	210		52		288		211	
IR var	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IT var	1.45	0.15	1.30	0.28	2.12	0.18	1.97	0.20
-2LL	671.70		159.70		1036.70		747.30	

iii. Non-intimates

	knots (miles)	Kinship				Not related			
		Immediate kin		Extended kin		All		Friend	
		Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Intercept		3.12	1.28	5.15	0.72	4.36	0.15	3.98	0.26
LnDist		0.30	0.39	-0.38	0.20	-0.11	0.06	-0.02	0.08
d1*(LnDist-kd1)	5	-1.31	0.68	-0.04	0.48	-0.25	0.22	-0.30	0.24
d2*(LnDist-kd2)	50	3.50	1.48	-1.05	1.37	0.99	0.72	0.86	0.74
d3*(LnDist-kd3)	150	-2.86	1.42	1.75	1.34	-0.81	0.73	-0.97	0.77
RIMM		-0.56	1.39	-1.10	0.76	-0.19	0.21	-0.36	0.36
RIMM*LnDist		-0.13	0.29	0.09	0.12	0.00	0.05	0.01	0.08
N		47		60		362		209	
IR var		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IT var		1.99	0.45	1.63	0.32	2.27	0.17	2.19	0.22
-2LL		157.60		197.00		1311.50		749.70	

(b) Without spline

i. Single classification

	Overall			Kinship						Not related								
	Estimate	S.E.	SEY-t	Immediate Kin			Extended kin			All			Friends			Neighbours		
				Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t
Intercept	4.77	0.09	2.50	5.20	0.27	0.17	5.23	0.39	1.50	4.67	0.10	2.27	4.66	0.16	0.50	5.12	0.18	1.02
LnDist	-0.17	0.02	1.63	-0.18	0.05	1.70	-0.34	0.06	-0.26	-0.15	0.03	1.76	-0.16	0.03	2.99	-0.27	0.08	-3.73
RIMM	-0.28	0.15		-0.39	0.42		-1.05	0.55		-0.18	0.16		-0.17	0.24		0.29	0.30	
RIMM*LnDist	0.09	0.03		0.09	0.06		0.23	0.08		0.06	0.04		0.04	0.05		0.21	0.11	
N	1019			257			112			650			420			96		
IR var	0.00	0.00		0.00			0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00	
IT var	2.33	0.10		2.16			2.10	0.29		2.35	0.13		2.32	0.16		1.57	0.23	
-2LL	3713.50			918.80			400.30			2383.80			1537.70			314.40		

	Intimacy					
	Intimates			Non intimates		
	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t
Intercept	5.12	0.11	-0.28	4.42	0.14	1.41
LnDist	-0.17	0.02	2.97	-0.19	0.03	3.06
RIMM	-0.01	0.19		-0.26	0.20	
RIMM*LnDist	0.10	0.03		0.00	0.04	
N	550			469		
IR var	0.00	0.00		0.00	0.00	
IT var	1.83	0.11		2.25	0.15	

ii. Intimates

	Kinship						Not related								
	Immediate kin			Extended kin			All			Friends			Neighbours		
	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t
Intercept	5.44	0.23	0.47	5.43	0.43	--	5.02	0.14	-0.32	5.09	0.20	0.68	5.38	0.23	-0.65
LnDist	-0.19	0.04	0.92	-0.29	0.07	--	-0.18	0.04	3.45	-0.19	0.04	1.94	-0.07	0.14	0.26
RIMM	-0.17	0.38		-1.35	0.59		0.23	0.25		0.08	0.30		0.93	0.37	
RIMM*LnDist	<i>0.10</i>	0.05		0.39	0.10		0.05	0.05		0.04	0.06		-0.05	0.16	
N	210			52			288			211			41		
IR var	0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00	
IT var	1.45	0.14		1.32	0.27		2.14	0.18		2.02	0.20		1.16	0.27	
-2LL	670.90			164.20			1039.40			752.30			122.60		

iii. Non-intimates

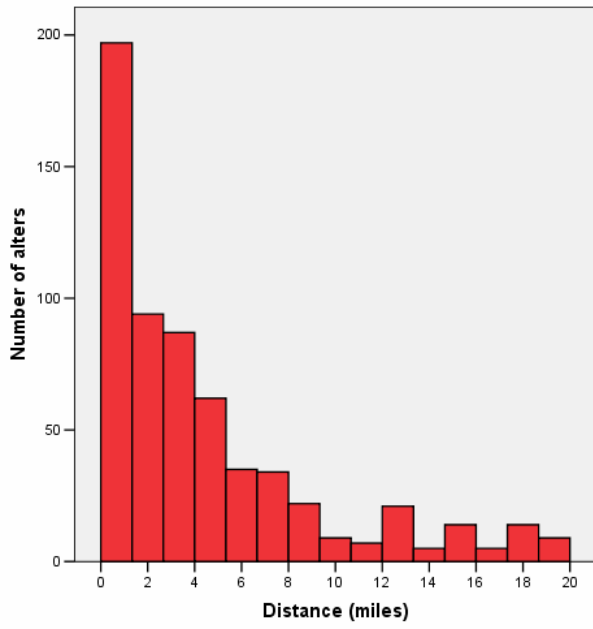
	Kinship						Not related								
	Immediate kin			Extended kin			All			Friends			Neighbours		
	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t	Estimate	S.E.	SEY-t
Intercept	4.32	0.88	-0.48	5.02	0.52	1.80	4.35	0.14	0.76	4.17	0.23	-1.30	4.95	0.23	0.77
LnDist	-0.18	0.18	0.34	-0.37	0.08	-1.14	-0.12	0.04	1.68	-0.12	0.05	3.82	-0.29	0.09	-3.87
RIMM	-1.38	1.15		-1.21	0.73		-0.20	0.21		-0.36	0.36		-0.34	0.38	
RIMM*LnDist	0.06	0.20		<i>0.19</i>	0.11		0.01	0.05		0.01	0.07		0.09	0.18	
N	47			60			362			209			55		
IR var	0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00	
IT var	2.12	0.46		1.68	0.32		2.26	0.17		2.20	0.22		1.37	0.24	
-2LL	166.80	--		202.80			1311.20			751.50			173.00		

Notes:

- The model with spline is based on the equation $Y_{ij} = \gamma_{00}^1 + \gamma_{11}^1 Z_j + \gamma_{10}^1 X_{ij} + \gamma_{10}^2 d (X_{ij} - k_d) + \gamma_{11}^2 Z_j X_{ij} + u_{0j} + \varepsilon_{ij}$, where Y_{ij} measures the frequency of contact; X_{ij} is the residential distance (LnDist) between the respondent and the community tie, and Z_j is a dichotomous variable that identifies immigrant respondents (RIMM) in the sample. The variable d is a dummy variable that identifies observations whose distance is greater than the knot k_d . The terms u_{0j} and ε_{ij} are the errors of the model.
- The model without spline is based on the equation $Y_{ij} = \gamma_{00} + \gamma_{01} Z_j + \gamma_{10} X_{ij} + u_{0j} + \varepsilon_{ij}$. Definitions of the terms are same as before.
- “IR var” shows the amount of variation at the respondent level, whereas “IT var” is the amount of variation at the community tie level. The total variation is the sum of IR var and IT var.
- Estimates in bold faces are significant at the 5 percent level; those that are also italicized are significant at the 10 percent level.
- The column “SEY-t” shows the t-statistics for comparing the parameter estimates reported in the Second East York study. The sample of Intimate extended kin is excluded for comparison because the sample size is too small ($n=7$) in the Second East York study.

Figure 1. Number of alters by distance

(a) Alters located within 20 miles



(b) Alters located beyond 20 miles

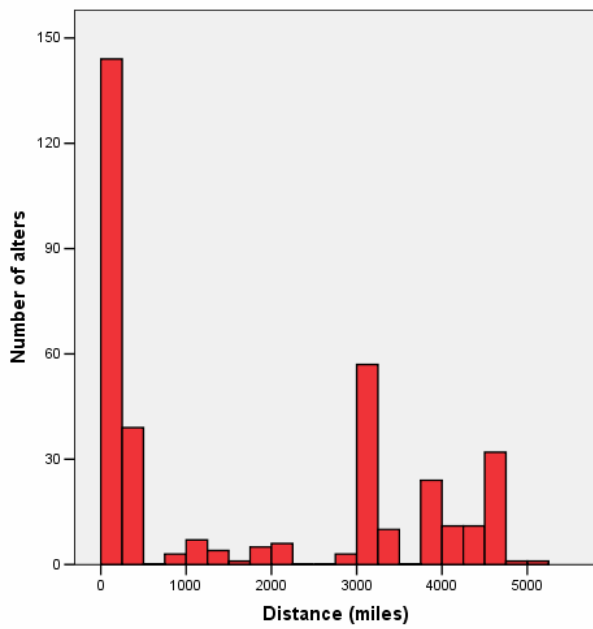
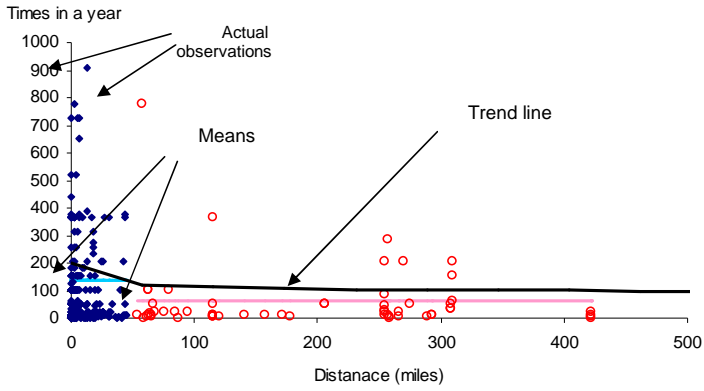


Figure 2. Scatterplot of frequency of email/instant message contact by distance

(a) Within 500 miles



(b) 500–3000 miles and beyond 3000 miles

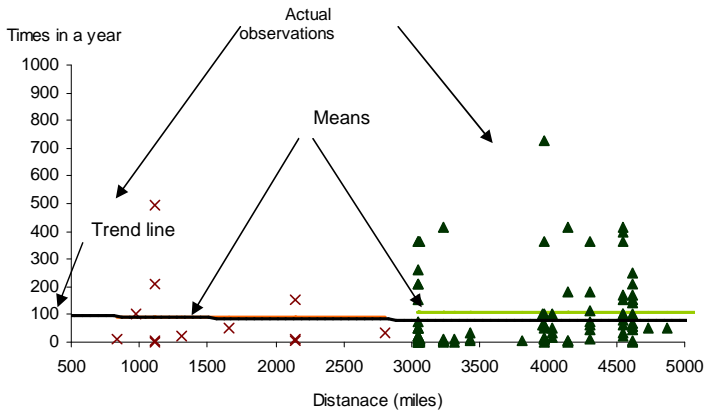
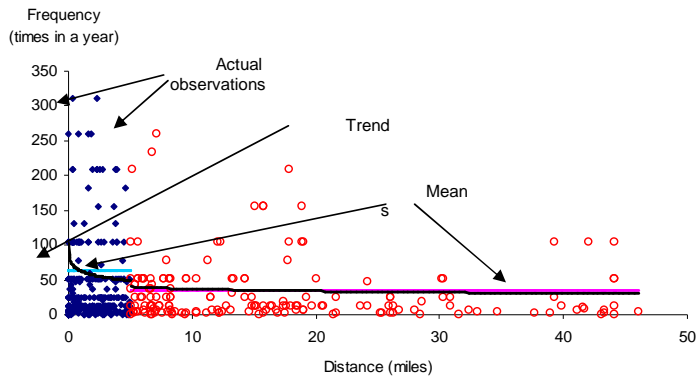
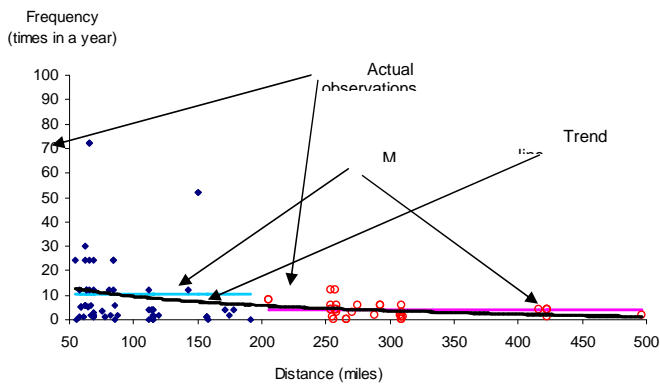


Figure 3. Scatterplot of frequency of face-to-face contact by distance

(a) 0–5 miles and 5–50 miles



(b) 50–500 miles



(c) Beyond 500 miles

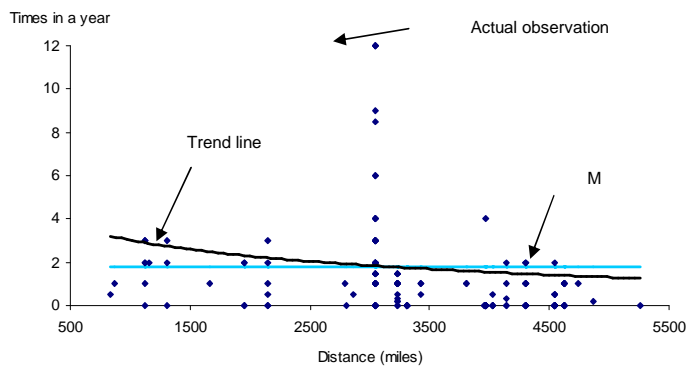
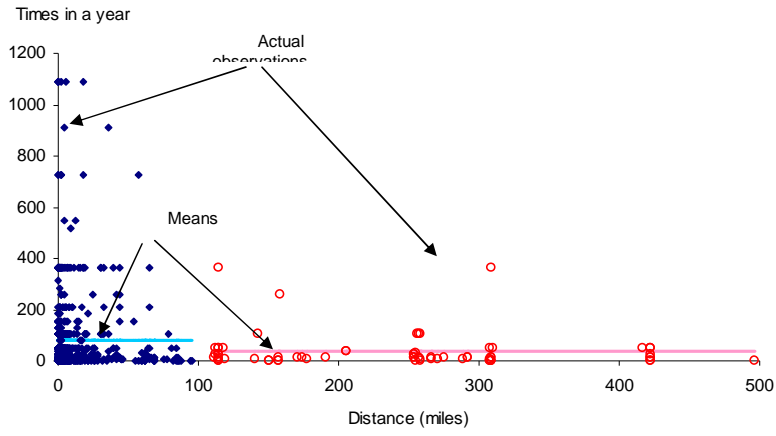
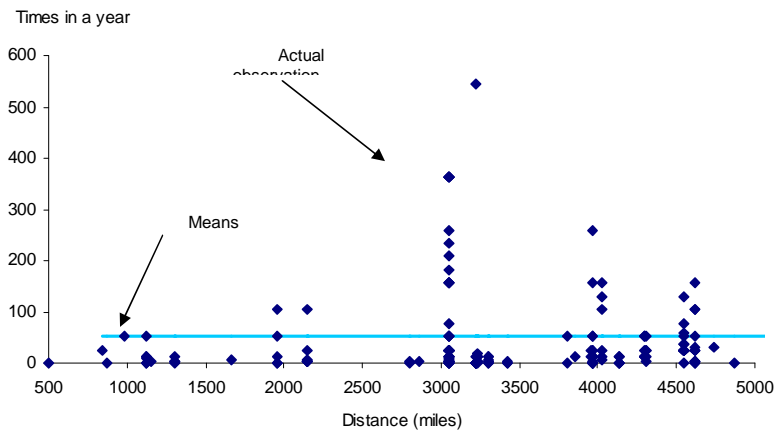


Figure 4. Scatterplot of frequency of phone contact by distance

(a) 0–100 miles and 100–500 miles

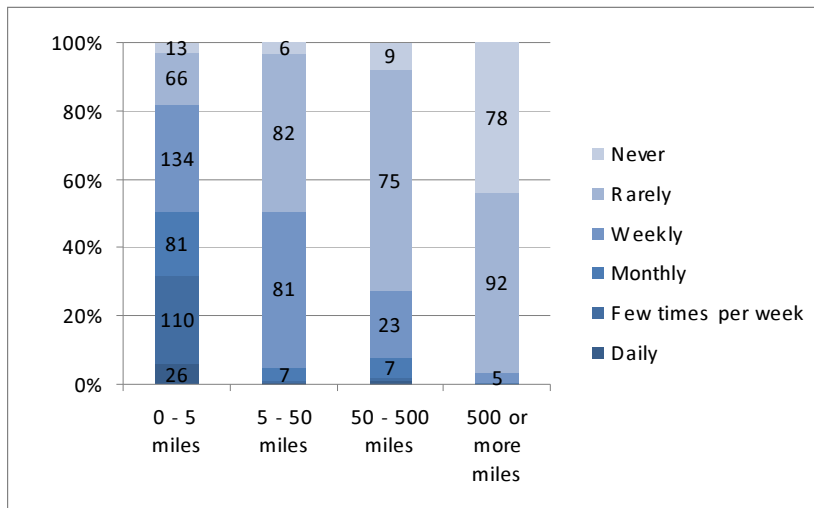


(b) Beyond 500 miles



Note: The trend lines are flat lines almost overlapping with the means. They are excluded for clarity purposes.

Figure 5. Frequency of Face to Face Contact by Distance



Formatted: Left: 1", Right: 1", Top: 1", Bottom: 1", Width: 8.5", Height: 11"

Figure 6. Frequency of Phone Contact by Distance

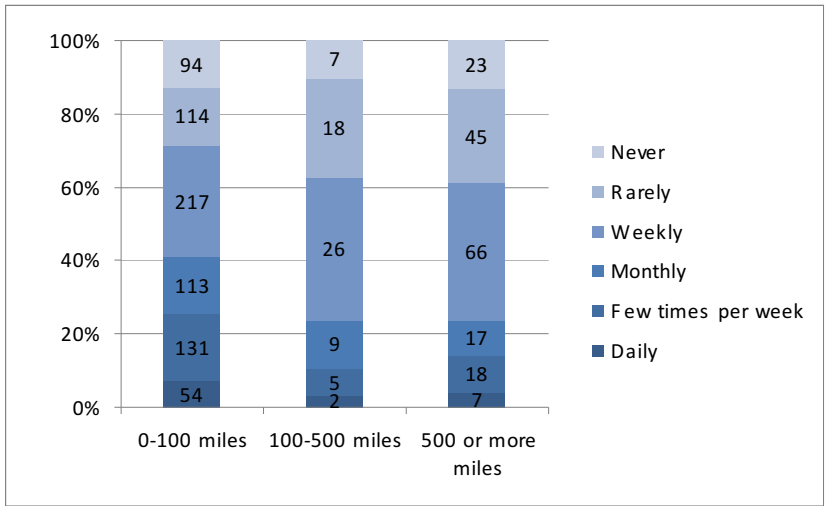


Figure 7. Frequency of Email Contact by Distance

