Netting Scholars: Online and Offline

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August 2000

Abstract

Has the Internet affected the ways in which people communicate by lessening the effects of distance and affecting how people interact? To examine this question, we study scholarly and interpersonal relationships – communicating in person and by email – in two scholarly networks, one in a large university and one dispersed across North America. Not only are these scholarly networks interesting in their own right, they are harbingers of the turn toward network and virtual organizations. Although the Internet helps scholars to maintain ties over great distances, physical proximity still matters. Those scholars who see each other often or work nearer to each other email each other more often. Frequent contact on the Internet is a complement for frequent face-to-face contact, not a substitute for it. The more scholarly relations network members have, the more frequently they communicate and the more media they use to communicate. Although email helps scholars without strong ties to stay in contact, it is used most by scholars who are collaborators or friends.

Acknowledgments

Scholarly Networks as Invisible Colleges

The Internet's ability to span continents at a single bound has reduced the constraints of time and distance. Global communication is as easy, rapid, flexible, and low cost as chats between neighbors. Except for a few antediluvians and those economically below the digital divide, people in industrialized countries are becoming wired as are substantial segments of developing countries (Hargittai, forthcoming). But, does practice follow possibility? We examine the situation through the study of scholarly networks, academics who, with the Internet at their disposal, have the means and the desire to communicate online as well as offline.

The Internet should profoundly affect scholarly relations because the scholarly life is rarely silent, lonely, or contemplative. Effective scholars do not talk only to themselves. They lecture to undergraduates, mentor graduate students, present papers, knife each other in committees, schmooze at conferences, gossip over lattés, send off grant proposals, and even write articles and books. Scholars have a message to get out to the world, or at least to their corner of it. They cannot leave their work moldering in their desk drawer or on their hard disk if they want to advance scholarship, influence public opinion, advise policymakers, find kindred souls, or promote their careers. Many scholars work together, be they physicists sharing megamillion dollar equipment, computer scientists engaged in collective enterprises, or lonely scholars trading ideas. Through their networks, scholars seek advice, information, help, approval, employment, fame, and fortune.

Scholarly communication has been mostly face to face ever since Eve told Adam about the New Age properties of apples. Babylonian King Nebuchadnezzar summoned his "magicians, enchanters, sorcerers and astrologers" to intepret his dreams[1] (Daniel 2), Socrates strolled the agora with his disciples, Plato fantasized camping with contemplative compatriots in caves, and Samuel Johnson expounded in 18th-century coffee houses. Italian Renaissance scholars held meetings for discussion intended to advance the development of literature, science, philosophy, and technology (Marshall, 1970). Scholarly networks became formalized at the start of the Enlightenment, with the founding of the Royal Society of London in 1660-1662, soon followed by similar societies throughout Europe and America (Price, 1961). These early scholarly networks spanned many disciplines, as witness the French Encyclopedists' attempt to codify all knowledge in the 18th century (Diderot, et al., 1772). Intermittent correspondence and journeys kept scholars in different cities and countries in haphazard contact.

The 19th-century's increase in the scale of scholarship and the Industrial Revolution's turn toward hierarchical bureaucratic organizations made broadly-based scholarly societies less central. The main bases for scholarly organization became spatial proximity or disciplinary affinity. Most scholars work in physically compact universities (or similar research centers), where they meet students and colleagues face-to-face (FTF). Yet universities and their departments are polyglot, physically compact bureaucracies geared for organizing teaching and administering physical resources. Their organization into discipline-based departments was a 19th-century Industrial Revolutionary imposition of formal boundaries between broad areas. Yet a department's faculty is intentionally diverse in order to serve students and the public in a smorgasbord of areas. This diversity promotes lectures and discussion that provoke lateral thinking. Yet it also means that university departments often are too large and diverse to be suitable venues for scholars wanting to discuss a specific problem area.

The 20th-century's proliferation of research, researchers and research publications has meant a global increase in the number of specialists in each area. Increased specialization means that the scholars most interested in each other's work usually live elsewhere because few universities care to employ two experts on the same subject. Intellectually kindred souls find each other by forming professional associations within their discipline or interdisciplinary interest area. Such associations are rarely local. Scholars must go to (often-great) lengths to communicate with distant, kindred souls. They spend time and money junketing to conferences. They read

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[1]Unlike pundits today, their failure meant their death.

periodicals. Or they use the post to circulate preliminary thoughts and findings, and wait impatiently for replies. They avoid telephoning, because it is intrusive, rarely finds the other party in, and is not suited for conveying figures, equations or precise text. They eschew expensive faxes and courier services.

As a set of scholars gets used to seeing each other at conferences and journals and develops the habit of discussing each other's work and perhaps collaborating, all or part of their network becomes crystallized as a less amorphous *invisible college*, defined by a shared interest in a speciality and by friendship ties. Such invisible colleges "function as a scholarly in-group within a given specialization," their research "facilitated by informal exchange of information through contacts within this social network at conferences and other forums" (Gresham, 1994: 38). Their structures are networks with crosscutting ties between sets of scholars on both the core and the periphery. The informal nature of these invisible colleges affords flexible, adaptive structures for exchanging and evaluating new ideas. Their lack of formal structure means that communication depends on the structure, frequency, and quality of scholarly ties.[2]

Invisible colleges provide forums for sharing, disseminating and testing new ideas, as well as for exchanging information about research, funding opportunities, academic bureaucracies, and personal situations. They promote scholarly identity and purpose, and stimulate discussion of theory, methods, and findings. Ideas get transmitted more quickly and innovatively than in formal journals constrained by publication lags and orthodoxy-promoting refereeing.

The Etherization of Scholarly Networks

Before the Internet, travel costs and limited communication channels meant that scholars communicated more with colleagues in other fields at their own universities than they did with specialists in their own fields at other universities (Carley and Wendt, 1991; Friedkin, 1982). At the turn of the millennium, the Internet's characteristics affect – but do not determine – how scholars communicate. We focus here on "*email*" (electronic mail), the computer mediated communication on which the scholars we study rely. Email is usually *asynchronous*, allowing scholars in different time zones or on different schedules to communicate. One study found that computer scientists working in nearby offices used email to compensate for different work schedules (Haythornthwaite and Wellman, 1998). Although instantaneous "chat groups" are becoming popular among the public for recreational use, we do not expect them to become prevalent in scholarly networks except when a few people are collaborating, full-time, in a focused, crash project. Most scholars, like most professional and managerial workers, do not welcome the unlimited communication access that "chat" brings. They want to retain their communication autonomy and control in order to switch between multiple projects and tasks (Wellman, 1997).

Email is *rapid,* fostering a high velocity of exchanges, sometimes ill-considered (Walther, Anderson and Park, 1994). It supports *nuanced* and *complex* interactions, belying early fears that it would be useful only for simple, instrumental exchanges. It has its own *norms,* procedures and ethos. People discussing issues and solving problems online show greater creativity and emotional swings than do those talking face to face (Sproull and Kiesler, 1991). The *absence of direct feedback* in email encourages more extreme forms of communication. Scholars type messages onto screens that they would never say to a palpably present person or on the telephone. This leads to scholarly upsets, feuds and cleavages. The ability of communications to be forwarded supports *transitive* indirect ties that aid flows of information across group boundaries. This integrates scholarly "networks of networks" (Craven and Wellman, 1973) instead of isolating information in tightly bounded groups.

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[2]See the discussions in Breiger, 1976; Gaston, 1973; Crane, 1969, 1972; Crawford, 1970; Cronin, 1982; Finholt and Olson, 1997; Finholt, 1998; Gresham, 1994; Griffith and Mullins, 1972; Hill and Carley, forthcoming; Price and Beaver, 1966; Walsh and Bayama, 1996.

Email supports easy *accessibility*, leading to a leveling of perceived hierarchies with all believing they have access to all. The ease of sending messages to *large numbers* allows scholars to remain in direct communication with many others, without mediation by a core person or oligarchy. The ease of sending messages to focused lists of others allows scholars to be members, perhaps unobtrusively, of *multiple groups*. They do not have to commit to one or a few groups. This enables them to be *brokers and bridges*, transmitting information from one group to another (Burt ,1992). Email is especially useful for maintaining contact with *"weak ties"*: scholars and scholarly networks with whom one does not have close relationships of information exchange, collaboration or friendship. As weak ties are more heterogeneous than strong ties, they connect scholars to diverse intellectual and social milieus by providing a wider range of information. Email's accessibility, ubiquity, velocity and multiple-message characteristics potentially can *connect the entire scholarly world* in five steps or less (White, 1970). In practice, there is significant decoupling so that information diffuses rapidly but neither universally nor uniformly (Valente, 1995; Wellman and Berkowitz, 1988).

The rapid growth in use of email has led to questions about the circumstances under which people use such media. Face-to-face conversations and email exchanges have different capacities to convey social cues, contextual meaning, detailed information and nonverbal communication. Complex, ambiguous, social sensitive or intellectually difficult materials may need the immediate feedback and interactivity of face-to-face communication, while email may be appropriate for the frequent transmission of research information.[3] Yet communication is not solely a product of the medium used. It is also a *social* phenomenon, in which the nature of the relationship, the social network, and the social position of participants influence what is communicated and what media are used to communicate it. If almost everyone is using email, then the recalcitrants will be using email or be left out of the loop.

Email has allowed spatially dispersed, intellectually kindred, scholars to communicate and collaborate with an ease formerly found only within university departments and research centers. Computer networks have become social networks as scholars exchange information, collaborate, administer, and socialize. They use email for rapid exchanges, one-to-one or to small groups; they post announcements, queries, debates, and jokes on group discussion lists (sometimes called "list-serves"); they circulate findings and ideas in ethereal "papers" circulated as "attachments" to email; they use the Web to access data sets and research tools. "The keyboard is my café," MIT's Dean of Architecture and Planning enthuses (Mitchell, 1995), replacing agoras, coffee houses and faculty clubs. Yet while email is widely used, some fundamental questions remain to be answered, including:

- Has the map of the world dissolved so much that distance does not matter in globalized networks?
- Has the Internet replaced or supplemented the post, the telephone, and face-to-face contact?
- Can strong ties be sustained online?
- Has the Internet brought spatial and social peripheries closer to the center?
- Does computer mediated communication facilitate working in networks rather than groups?
- Are scholarly networks harbingers of new forms of loosely-coupled organizations?

Scholarly Networks as Visible Colleges

To address these questions we analyze relationships and media use in two scholarly networks. Although our evidence is limited to these two networks, the information they provide is germane because such scholarly networks are exemplars of the loosely-coupled organizations currently proliferating online and offline.

Technet and *Globenet* (pseudonyms) are more visible than many scholarly networks because they are beneficiaries of the 1990s' fashion for governments, corporations and universities to encourage invisible colleges.

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[3]Fish, Kraut, Root and Rice, 1993; Kiesler and Sproull, 1992; Haythornthwaite and Wellman, 1998; Haythornthwaite, 2000;Rice, 1987; Trevino, Lengel, and Daft, 1990.

Each has been formally founded (developing out of informal scholarly networks), and has a public name, a budget, a director, and some staff time. Each has an identity that is visible both to members and to outside observers. Naming, funding and administering have crystallized these networks as "visible colleges" with more formal channels of communication and defined membership than invisible colleges. At the cost of flexibility, their greater formality provides more stability, institutionalized bases for collaboration, and more opportunities to receive financial support.

Technet connects scholars in a large Canadian university who share interests in linking the social sciences with technology. We interviewed its 24 active members 16 men and 8 women, coming from many departments and research institutes, and ranging in age from the late 20s to the late 70s. Graduate students also participate actively. Many members feel that they find kindred souls more in Technet than in their own departments. Membership is voluntary and open to all university members. Technet members receive no financial support, and their participation is voluntary. There are frequent activities: seminars, conferences, committee meetings, proposal writing, retreats, and parties. Some members are working together, submitting joint project proposals, both under the auspices of Technet and through other university institutions.

Unlike Technet, *Globenet* is not associated with one university. It is one of eight multidisciplinary programs within a larger, continent-spanning research institute. Globenet emerged in the early 1990s out of the intellectual outgrowth and informal discussions of two programs at the larger research institute. Much of the research activity is in Canada, although dispersed in five widely-separated provinces. Five members work in the United States, and one works in Europe. Only 10 (4%) of the "pairs"[4] of members work in the same city; 6 in the same department. We interviewed all 16 of its members: 13 men and 3 women, ranging in age from mid-40s to mid-60s. Unlike Technet, Globenet has government and corporate support to reduce the time its members spend teaching and increase the time available for research, collaborating and networking. To join the network, a scholar must be deemed to be doing important research and have a personality that complements existing members' work. Nine "senior fellows" receive full salaries from the program, while seven "associates" receive partial funding. Globenet members usually work autonomously from one another but are expected to make available to each other their expertise, resources and research findings. In addition to common funding and commitment to Globenet's scholarly approach, members have worked together to produce a book integrating its first five years of analysis and findings into a single, coherent account. Globenet funds all members to attend three FTF conferences per year, each lasting four days. A shared vision, the availability of financial support, a formal selection process, defined boundaries, mandatory group meetings have made this scholarly network a visible college.

Data Collection: Interviews in the summer and fall of 1997 elicited both qualitative and quantitative information about scholarly and friendship relations inside and outside Technet and Globenet. During the interviews, each scholar was given a roster of all of the members of the network and asked to describe his/her scholarly and interpersonal relations with each member, and with other scholars important to them who were not members of Technet or Globenet. This method elicited reports about each pair's scholarly work relationship, social closeness, frequency of scholarly and non-scholarly communication, and communication media used.[5] *We obtained usable information about 405 ties within Technet and 240 ties within Globenet – our effective sample sizes.* As most interviews were lengthy and conducted at the members' research offices, we were able to observe the members' styles of work and communication. Koku also attended gatherings and committee meetings of Technet, and Nazer also attended Globenet meetings.

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[4]Two people who have a tie (which means they have one or more relations). The definition is directional: an A => B tie is treated separately from a B => A tie.

[5]The specific questions asked were about: collaborative work, discussing research ideas, reading each other's publications, friendship/colleagueship/acquaintanceship, frequency of communication, and types of media used.

Scholarly Relationships in the Wired World

Mode and Frequency of Communication

Even in these wired times, members of both local Technet and far-flung Globenet rely on face-to-face contact as their primary means of communication, supplemented by other forms of traditional and computer-mediated technologies. At least half the contacts between members of each network are FTF. The statistics in Table 1 underestimate the significance of FTF contact, as FTF contact is usually of longer duration and provides more communication bandwidth.

> Table 1 about here: Media Use <

Technet and Globenet have different communication styles. All Technet members work at one university campus and are easily able to meet FTF for scheduled and unscheduled interactions. Therefore, it is not surprising that FTF interactions connect more Technet members than any other medium: 78% of all pairs have some FTF contact. They are in frequent contact: 90% of all pairs communicate with one another at a mean of 20 times per year and a median of 10 times per year. As all Technet members are comfortable with computers, they use email often: 56% of all Technet pairs have some email contact.

Email supplements face-to-face contact rather than supplants it, with members using it to arrange FTF meetings, disseminate news, and exchange documents. Those Technet members using email send messages to each other at a mean rate of 24 times per year, an average of twice per month. To Technet members, non-FTF communication means computer mediated communication. Only a minority use telephones, faxes and couriers, and those who do use these media, use them infrequently. The most widely used of these are local telephone calls, used by only 25% of the members. Those who telephone do so on the average of once per month (mean = 11 calls per year).

By contrast, Globenet members principally communicate at their formal FTF group meetings. While Globenet's dispersed network makes it harder for its members to be in FTF contact, mandatory attendance at its meetings means that all pairs have at least some FTF contact. Half (52%) of the Globenet pairs only communicate at these meetings, while another 25% also have FTF contact outside of these meetings. Although all members communicate face-to-face (unlike Technet), most do so rarely. They communicate FTF an average of only 4 times per year, probably at the three meetings plus one other time (Table 1). However, those Globenet pairs who do keep in touch outside of the group meetings, do so almost as frequently as Technet members, at a mean rate of 15 times per year and a median rate of 10 times per year. Several Globenet members are less comfortable with email than the more computerized members of Technet. Email is used by a lower percentage of Globenet pairs (32%) than by Technet pairs, and those Globenet pairs who do use it only send an average of 5 messages per year.

Media Multiplexity: Analysts have wondered whether computer-mediated communication replaces or complements FTF, phone and postal means of communication (Carley and Wendt, 1991; Haythornthwaite and Wellman, 1998; Haythornthwaite, 2000). Both Technet and Globenet show complementarity: The frequency of email contact is positively associated with the frequency of FTF and phone contact in both networks, as is the frequency of postal mailings and faxes in Globenet (Table 2).[6] People who are in much contact use all modes of communication: whatever is necessary or is handy.

> Table 2 about here: Correlation Matrix of Frequency of Contact <

Most Technet pairs and some Globenet pairs use a combination of communication media to keep connected. Technet pairs use more kinds of media than Globenet pairs use: 32% use two media while 23% use three or more

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[6]Frequency of contact logged to the base 10. There is a greater substantive impact of communicating twice per year instead of once than there is of communicating 365 days per year instead of 364 days.

On the other hand, the loosely-structured, voluntary nature of Technet means that 12% of the pairs never communicate. By contrast, all Globenet pairs communicate, although more than half (56%) use only one means of communication: FTF interaction at Globenet meetings while 18% use two media. However, the 26% of Globenet pairs using three or more media is similar to Technet, suggesting that those with intense work involvements use multiple means to communicate.

Location: When Globenet pairs work in the same city, they see each other FTF more often (mean = 18 times per year); those working in different cities who see each other 3 times per year at the Globenet meetings. Although email should not be constrained by distance, Globenet pairs working in the same city communicate by email more often (an average of 12 times per year) than pairs working in different cities (an average of only once per year). In part this is because those working in the same city (and often in the same university and department) have relations with each other in addition to their scholarly Globenet relations. In part, the exchange of email among members bolsters the FTF contact of those who work near each other. Yet most pairs based in different cities rely only on their FTF interactions at Globenet meetings. For example, Andrew Oldfield (a pseudonym) "prefer[s] interacting with members at meetings and discussing research when I see them. I really don't have much contact with them otherwise."

Scholarly and Interpersonal Relationships: The more focused nature of the Globenet network is apparent in that 22% of its scholarly pairs have collaborated as compared with 17% of the Technet pairs (Table 3). Moreover 64% of the Globenet pairs have discussed each other's research, and 60% have read each other's work. Technet is more loosely connected: Although 72% have discussed each other's research, this has been casual as only 17% have actually read each other's work and only 17% have collaborated.

> Table 3 about here: Scholarly and Interpersonal Relationships <

Most Technet and Globenet pairs have good collegial or friendship relationships: 18% of Technet members report friendship ties with other members, 41% report collegial ties (strong, but without friendship), 30% are acquaintances, while 12% have no relationship (Table 3). Globenet pairs tend to have somewhat stronger ties, despite their less frequent communication. While one-quarter (25%) of the pairs are friends and 49% are colleagues, only 21% are acquaintances and only 5% have no relationship at all. Thus, 59% of Technet pairs are friends or colleagues, as compared to fully 74% of Globenet pairs.

In both Technet and Globenet, friends are more likely to communicate by multiple media than do colleagues. While friends use 2.4 media to communicate in Technet and 2.8 in Globenet, Technet acquaintances use 1.5 media and Globenet acquaintances use only one medium of communication – face-to-face contact at Globenet meetings.

Scholarly Multiplexity: About half the pairs in Technet (47%) and Globenet (52%) have more than one scholarly relationship: collaborating, discussing ideas, or reading each other's work (see Table 3 above). Most pairs in both networks have one or two scholarly relationships: a mean of 1.4 for Technet and 1.5 for Globenet. Technet and Globenet pairs who maintain more scholarly relations with each other are in more frequent contact, thereby solidifying their relations. Technet fosters this type of relationship by providing the venue and context for exchanging of ideas and forming collaborative ties. A Technet pair's number of scholarly relations is significantly correlated at 0.38 with the frequency of their FTF contact and at 0.28 with the frequency of their email contact. Similarly, a Globenet pair's number of scholarly relations is significantly correlated at 0.42 with the frequency of their FTF contact and at 0.40 with the frequency of their email contact. Globenet ties who maintain more than one type of scholarly relationship are also more likely to have a higher frequency of communication. However, almost all (96%) of those Globenet pairs who do not have any scholarly relationships do not communicate, except for casual chats at meetings. By contrast, half of those Globenet pairs who maintain all three scholarly relationships are in contact at least once per month.

Those members of both Technet and Globenet who also are friends are more apt to engage in more kinds of scholarly relations: collaboration, discussing research, and reading each other's work (Table 4). The most pronounced effects of the strength of interpersonal relations on scholarly relations are at the extremes. Friends have a mean of 2.2 scholarly relations in Globenet and 1.7 in Technet. By contrast, those who have no interpersonal relation hardly ever have any scholarly relations.

> Table 4 about here: Scholarly and Media Multiplexity by Interpersonal Relationship <

Otherwise, the two networks have different patterns of scholarly and interpersonal relations. Those in Technet who are acquaintances or colleagues have about as many scholarly relations as do friendship pairs in Technet. In Globenet, stronger interpersonal relationships have more scholarly relationships. Reflecting the greater mutual focus of the Globenet core, 80% of Globenet friendship pairs engage in two or more scholarly relations, as compared with 62% of Technet colleagues. Three times as many of Globenet pairs (15%) than Technet pairs (5%) engage in all three types of relationships: collaborating, discussing research, and reading each other's work. The largest difference is between weak acquaintanceship ties (0.5 scholarly relationships) and stronger ties of colleagueship (1.7).

Strong scholarly and friendship relations develop in positive feedback duets. Friends collaborate and discuss each other's work; collaborating scholars develop stronger friendship ties. One observer of this dialectic, cosmologist James Hartle (University of California, Santa Barbara) says of his collaboration with Nobel prize winner Stephen Hawking (Cambridge University): "Generally, `it's the science that drives it' while friendship naturally follows" (quoted in Glanz, 1999: D2). In Globenet, Calvin Scott and David Green had no prior relationship even though they were both working in the same large university. They met at an early meeting and soon they decided to teach an interdisciplinary course jointly. Another member, Jason Smith, "barely knew most of the members, but now I have made several new friends. It has been great for restructuring my personal life."

Interpersonal Relations and Media Use: Technet and Globenet pairs with stronger interpersonal relationships use more types of media to communicate. Friends use more types of media than colleagues who, in turn, use more types than acquaintances (see Table 4 above).

The two networks have different patterns of media use. Almost all Technet pairs with strong friendship ties (92%) use at least two media to communicate, as do 65% of collegial pairs:(Table 5). They typically use FTF, email, and perhaps phone or printed paper. By contrast, many Globenet pairs only communicate FTF, and most use fewer types of media than Technet pairs. While 87% of Globenet friends use two or more media, only 43% of collegial pairs do so. Moreover, acquaintances communicate face-to-face only at Globenet meetings. On the other hand, a much higher percentage of friends in Globenet use four or five media to communicate: 33% as compared to 1% in Technet. This is because Technet pairs use the Internet rather than faxes or the post to exchange documents.

> Table 5 about here: Number of Media Used by Interpersonal Relationship <

The more types of scholarly relationships network members have, the more types of media they use to communicate. The significant correlations are 0.44 for Technet and 0.53 for Globenet. The higher correlation coefficient for Globenet suggests that the greater distance between its members leads them to use a variety of media to communicate. In short, the strength of interpersonal relationships, the number of scholarly relationships engaged in, and the number of media used are all positively associated in both networks.

Scholarly Relations, Interpersonal Relations and Media Use: All predictors analyzed account for a substantial amount of the variance in FTF contact: 42% for Technet and 31% for Globenet. Similarly, they account for a substantial amount of the variance in email contact: 39% in Technet and 36% in Globenet.

Neither Technet nor Globenet scholars are all work and no play. Perhaps more accurately, their play is intertwined with their work, and for these high-achievers, their play is often their work. Whatever the dynamics, friendship is the single strongest predictor to both face-to-face and email contact in both Technet and Globenet (Table 6).

> Table 6 about here: Regression of Scholarly and Interpersonal Relationships on Frequency of Media Use <

In Technet, friendship is the strongest predictor to the frequency of FTF contact. Although collaboration is strongly related to the frequency of FTF contact, it is unrelated to the frequency of email contact. As scholars are on the same campus, walking to each other's offices to collaborate is easy, where they can use more communication bandwidth.[7] This is congruent with the theories of media use suggesting that tasks requiring complex negotiations are better conducted via richer media such as face-to-face contact. Technet members use FTF contact when possible, using email to file in temporal and informational gaps. Thus, those Technet members who often read each other's work communicate more frequently by email. Where FTF contact is easily done, it is the preferred medium for collaborative work. Yet colleagues can now easily share their ideas and their work – or announce its existence – by email and web postings. They do not have to walk over to each other's offices to do this, although Canadian winters can inhibit in-person visits (see Michelson 1971).

Not only are collaborative and friendship ties associated with high levels of face-to-face interaction, face-to-face contacts can develop collaborative and friendship relations. For example, Sharon Julia discovered at Technet seminars that she shared research interests with Danny Perot and Jessica Fleet. She believes that this may lead to collaboration.

The situation is different in Globenet. The distance between a pair's universities, collaboration and friendship are statistically significant predictors to the frequency of FTF and email contact. In addition, reading each other's work is also significant for the frequency of email contact (see also Haythornthwaite and Wellman, 1998; Haythornthwaite, 2000.) Globenet members use both FTF and email to get their joint projects done. The dispersion of Globenet members across North America (and England) leads them to use email as a collaborative tool more than Technet members. However, Table 6's negative coefficients for distance suggests that the geographically closer two members of scholarly pairs are, the more they will communicate.[8] This is not surprising for FTF contact, but it is for email in which a pair working far apart should be able to communicate as easily those emailing in the same building.

Centralization

As email makes it easy for any network member to communicate directly with any other, email networks should be less centralized than face-to-face networks (Rice 1994, Wellman, 1997). We analyze the extent to which the two networks are centralized or decentralized.

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[7]The authors of this paper similarly found they needed to be working FTF to handle complex queries about data analysis.

[8]Distance is logged to the base 10 for the consequences for being 20 miles apart rather than 10 are much greater than the consequences for being 1,020 miles apart rather than 1,010.

The most *central* actor (highest "indegree") in both the Technet FTF and email networks is the founder and then-director of Technet.[9] Other central members of the FTF and email networks are members of the executive committee who represent important disciplinary clusters. Different disciplines at the university are connected to each other indirectly by means of the many ties that Technet's executive committee members have with each other. In Globenet as in Technet, the director has the highest indegree in the email network, almost twice as high as anyone else. The assistant director and the co-editor of the central Globenet book have the second highest number of members contacting them by email. However, the co-editor as well as the director have higher indegrees in the FTF network because they both deal heavily with all the members contributing to the Globenet book. Both also work in universities where one or two other Globenet members also work, providing more opportunity for FTF contact.

Variation in individual centrality scores to describe how *centralized* is a network's connectivity. This is true for Technet, where the email network is less centralized (centralization score = 34) than the FTF network (score = 56). Most Technet members send and receive emails, but FTF contact between them is more variable. By contrast, Globenet's centralization is lower for FTF contact (score = 32) than for email contact (score = 61). This is because all Globenet members gather for meetings where having FTF contact with each other is easy. Email contact is more focused in Globenet, with many more messages going to and from the network's leaders. This leads to a high centralization score. That Globenet's FTF network is less centralized than its email network shows that the effects of communication media can only be understood in the context of the networks' social structures and environing contexts.

Toward a Geography and Sociology of the Wired World

Has the Map of the World Dissolved So Much That Distance Does Not Matter in Globalized Networks?

Distance still matters, because scholars continue to chat face-to-face when convenient. There is "*glocalization*" (Hampton and Wellman, 1999; Wellman, 2001), with email expanding local interactions as well as global reach. These scholars use email as much to arrange and follow-up on local FTF meetings as they do to keep in long-range email contact. Globenet relies more on FTF communication than Technet even though it is more geographically dispersed. Network communication and solidarity is accomplished by supporting the travel of all members to three Globenet FTF meetings per year.

Although some Globenet members rely heavily on email for long-distance collaborations, this is the exception and not the rule. Despite the globe-spanning potentiality of email, it reduces the constraints of distance on contact but does not eliminate them. In practice, distance continues to matter for email contact, as those who working nearer to each other use email more often to communicate. Email is not the basis for a separate system of relationships, but operates jointly with FTF contact. The nearer they are, the more they get together, and the more they use email to arrange get togethers and to follow up on face-to-face discussions.

Has the Internet Replaced or Supplemented the Post, the Telephone, and Face-to-Face Contact?

Email is used by network members near and far to speed their scholarly exchanges. It has added to the amount of communication between scholars rather than shifting communication away from face-to-face contact. This conclusion is suggested by the positive correlation of email with all other means of communication: face-to-face (the principal means used), telephone, fax, and the post. Face-to-face and computer mediated communication --

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[9] "Indegree" counts the number of people who send messages to each network member (Wasserman and Faust, 1994). It is an indicator of a scholar's position and activity in a network. An "indegree centralization" score is a measure of the range of network members' choices of other network members, comparing each member's indegree score to the maximum attained value. It reaches a maximum of 100% when one network member chooses all other members and the other members choose only this one central member (Wasserman and Faust, 1994: 180).

the two dominant modes -- reinforce each other. This helps explain why our group has found that local email predominates among Globenet members working in the same university and among highly wired computer and information science students at the University of California, Berkeley (Wellman, 1999).

The impact of email is not so much in what is communicated, but in who communicates with whom, how frequently, and over what distances. Email is a complement to in-person, face-to-face (FTF) communication, and not an alternative. It fills in the gaps between face-to-face meetings, allowing more communication among scholars faraway and even those nearby. This increase in the velocity of communication – its speed and frequency – can affect the quality as well as the quantity of the information exchanged, as new techniques and findings get disseminated and false trails become abandoned more quickly. We suspect that the social impact of email and other forms of computer mediated communication will be like the telephone. Its more important impacts will not be in the novelty of the means of communication but in the subtle ways in which it facilitates changes in the fabric of relationships, networks, and societies.

Can Strong Ties Be Sustained Online?

The stronger the tie – in friendship and in scholarship – the more online (and FTF) contact there is. It is not as if FTF or email contact is found only among certain types of ties: All of the ties in Technet and Globenet connect by email as wll as FTF. These networked scholars use email for a wide range of things: exchanging drafts among coauthors, setting up meetings, asking for information, or gossiping about colleagues. Although pundits worried a decade ago about whether merely textual email could sustain a wide range of interactions -- from information seeking to emotional stroking -- it is the social context, more than the nature of the media, that affects whether email will be used. Expectations only a decade ago that email would only be used for purely instrumental communication appear to have been a product of early fascination with the novelty of email and an overemphasis on Marshall McLuhan's (1964) speculation that the medium is the message. For example, Globenet members are required to attend three face-to-face meetings annually. As most work alone the rest of the year, email is used only among those who are strongly tied through friendship or collaboration. By contrast, Technet members routinely use email among themselves – it is part of their interest in computer mediated communication – and it is the strongly-tied pairs who are most apt to have voluntary face-to-face get-togethers.

The nature of the tie predicts media use more than the nature of the communication task does. Strongly-tied collaborators and friends use whatever communication means are necessary to interact, exchange information, and coordinate. The more types of relationships they have, the more frequently they use both FTF and email. Even when working nearby, they often find email communication handier for spontaneous communication than walking a few hundred meters to talk FTF. These ties are strong enough that they can be maintained extensively through the narrower bandwidth of email and refreshed through occasional FTF meetings.

Has the Internet Brought Spatial and Social Peripheries Closer to the Center?

The Internet's speed and ubiquity has led the cofounder of the Electronic Frontier Foundation to hail it as "the most transforming technological event since the capture of fire" (Barlow, et al., 1995: 36). The ability of all to communicate rapidly with all, no matter where located, has created hopes that peripheries would become as well-connected as centers. As distance essentially does not matter for computer mediated communication, spatial isolation should not be a problem. As all are connected to all, heretofore disconnected persons, groups and branch plants should be equally as able as those at the center to communicate with others. This should affect the structure of scholarly networks: As email helps maintain direct ties, social density increases and the periphery – whether spatial, social or scholarly – can become better connected with the core (Garton and Wellman, 1995).

Although some studies have shown that peripheries are more active online than FTF, these studies have used laboratory experiments to compare groups communicating only FTF with groups communicating only by email

(Wellman, et al., 1996). Yet people in the real world use both FTF and email to communicate, and the social situations that they are in are more important than the communication media they use in affecting how centralized they are. For example, although Technet's members do have less centralized communication by email, it is FTF communication that is less centralized for Globenet's members. Globenet's annual meetings create the opportunity, the reason, and the expectation that all will speak with all. These conditions are not found in Globenet's more sporadic email exchanges. In short, email creates opportunities for all to communicate, but it does not necessarily create reasons to communicate, or force people to communicate. In many situations, FTF can create more favorable situations for widespread communication, with email encouraging lurking unnoticed. Ubiquitous connectivity does not mean universal communication. As cyber-euphoria fades, software agents will provide background detail about computer mediated communicators and prioritize callers (Wellman, 2001). They will re-enact a situation at least as old as Shakespeare's *King Henry IV, Part I* where Glendower brags, "I can call spirits from the vasty deep." To which Hotspur replies, "Why, so can I, or so can any man; But will they come when you do call for them?" (III, 1).

Does Computer Mediated Communication Facilitate Working in Networks Rather than Groups?

We are living in a paradigm shift in the way in which people and institutions are becoming more connected through social networks and less so through groups. Members of old-paradigm societies deal only with fellow members of the few groups to which they belong: at home, in the neighborhood, at work, or in voluntary organizations. They belong to a discrete work group in a single organization; they live in a household in a neighborhood; they belong to one or two kinship groups, and to discrete voluntary organizations: churches, bowling leagues, professional associations, and the like. All of these are hierarchically-structured bodies with precise boundaries for inclusion.

By contrast, in new-paradigm networked societies: boundaries are more permeable, interactions are with diverse others, linkages switch between multiple networks, and hierarchies are flatter and more recursive (Wellman 1988, 1997; Castells 1996). Although computer networks have not caused this paradigm shift, they have aided it. Email and the Web let people move between their different social networks and interests. Hierarchical barriers are lower online and much less apparent. While Globenet has strict inclusion criteria, it and Technet claim only a portion of their members' time, energy, allegiance and contacts. It is easy for their members to maintain an email address book with thousands of names and to maintain multiple lists of like-minded scholars whom they can contact at the drop of an email alias. Email gives them ease and flexibility in who communicates with whom, what means they use to communicate, what they communicate, and when they communicate.

Are Scholarly Networks Harbingers of New Forms of Loosely-Coupled Organizations?

Although scholarly networks have been with us for half a millennium, they have moved online. The Internet is providing a technological basis for new forms of spatially-dispersed, loosely-bounded, networks of scholars that are more connected than the fitful, amorphous anarchies of the past and less physically proximate and bureaucratically structured than contemporary universities. The velocity of communication is more rapid, distant scholars stay in touch more, and email and attachments fill gaps between FTF meetings. This greater connectivity does not happen automatically. Those who avoid the medium – as do some Globenet members – do not get the message. But the Internet is available, used often, and used for all kinds of communication by many of the scholars we studied.

Who cares about scholars anyway, in these days of stock market booms, economistic hegemony, anti-intellectualism, and targeted, applied research? In addition to our interest in our own tribe, we see scholarly networks as harbingers of the turn away from tightly-bounded, highly-structured bureaucracies to social networks with amorphous boundaries and shifting sets of work relationships, inside and outside of organizations. Scholarly networks are windows into a widespread phenomenon: the development of organizations as network and virtual

organizations (see also Nardi, Whittaker and Schwartz, 2000). The change from groups to networks can be seen at multiple scales. Trading and political blocs have lost their monolithic character in the world system; organizations form complex networks of alliance and exchange; workers (especially professionals, technical workers, and managers) report to multiple peers and superiors.

By contrast to traditional organizational structures, employees in *network organizations* have multiple, shifting work partners and partial involvements with shifting sets of workgroups (Powell, 1990; Wellman, 1997). Work relations are dispersed, with ties often extending across cities, provinces, nations, and even continents. Structurally, these ties extend to multiple units within the organization and, at times, to organizations elsewhere. Like scholars in a university, employees of network organizations often have a good deal of discretion about whom with they deal, how they are going to interact, and the time and place of their interactions (Salaff, Wellman and Dimitrova, 1998). As organizations become more globalized, such flexibility is necessary and is best afforded by computer mediated communication.

Technet, operating within its university, is a network organization. Its members are constantly juggling commitments to it, and attempting to convince their supervisors and colleagues of its legitimacy and usefulness. On the go, shifting collegial ties by the day and the hour, Technet's members make use of whatever means of communication are at hand to connect with each other. As they are physically dispersed on campus, this often takes the form of electronic mail. Face-to-face contacts would involve long walks; telephone calls are intrusive and have a low probability of finding the peripatetic Technet members in their offices.

Unlike network organizations that operate within a single organizational structure, *virtual organizations* are temporary task networks whose participants are members of multiple organizations. These networks extend between organizations as they develop partnerships that mesh expertise, locale and access to resources to pursue "specific opportunities, or mutually beneficial relationships in the market" (Roberts and Grabowski, 1996: 418). The participants in virtual organizations are supposed to work as a team even though they are paid by, and subject to, the discipline of, their separate organizations. Typically this is a team with partial commitment, as the participants do not give their full time or dedication to the virtual organization. They have other projects and task groups in which they are involved (Ahuja and Carley, 1998).

Globenet, operating between universities and across the continent (and the Atlantic Ocean), is a virtual organization whose boundaries are more social than geographical. Although its members are seconded to Globenet, their careers are also built around their university homes. Interaction patterns reveal the members' multiple commitments. When they are at Globenet meetings, members participate eagerly and actively. Yet most rarely communicate between these meetings unless they are collaborating on a research project or are at the same university. To be sure, a fair portion of their time is spent working on Globenet-relevant activities, but the inexorable pressures of the physically proximate university structure and their university colleagues compete actively with their more ethereal scholarly relationships within Globenet. Computer mediated communication can help deal with differences in distance and time zones; it cannot wipe away the lure of the proximate and the press of the university's social and power structures.

Despite these caveats, network and virtual organizations proliferate as they provide organizations with internal flexibility and better ability to form coalitions. These new organizational forms are responses to changes in globalized post-industrial economies that have created unstable environments in which bureaucratic organizations are less effective. They operate in a business environment that often requires organizations to be distributed, decentralized, team based, and rapidly reacting to threats and opportunities (Castells, 1996; DeSanctis and Jackson, 1994; Miles and Snow 1986; Nohria and Eccles, 1992; Powell, 1990). Just as Globenet and Technet have shifting scholarly alliances and information exchanges, the flexibility of network and virtual organizations allow them to respond more effectively than hierarchies to changing conditions. This comes at the cost of divided loyalties and

weakened control. No one unit controls the participants' behavior, and participants do not have a single situation to which they belong and with which they identify.

The ability of computer networks to connect people beyond immediate organizational and community groups can provide an enhanced basis for an "organic solidarity" of cross-cutting ties that early sociologist Émile Durkheim (1893) saw as the key to social cohesion. This will not be globalization in the sense of each individual and organization maneuvering alone in social and cyberspace. The globe will continue to be structured, but more by multiple, integrative links among social networks than by a series of bounded groups. There will be a continuing dialectic between local and global allegiances and interactions. Relationships will be based more on shared interest than on shared territory or office space. This wired, networked world should be a more multifaceted -- albeit uncertain -- place than the world of palpable, solidary groups.

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Barry Wellman has been networking with scholars for forty years. Wellman's work became formalized when he founded the International Network for Social Network Analysis in 1976 and headed it until 1988 (Wellman, 2000). He is Professor of Sociology at the University of Toronto where he studies personal communities, virtual communities, and computer-supported cooperative work. He is currently preoccupied with thinking about computer networks as social networks and the extent to which we are experiencing the rise of networked individualism. Wellman is the co-editor of *Social Structures: A Network Approach* (rev. ed., JAI Press, 1998) and the editor of *Networks in the Global Village* (Westview Press, 1999).

Table 1: Media Use

Medium	Technet			Globenet		
		Mean Annual Frequency of Use			*Mean Annual Frequency of Use*	
	% of All Pairs Using Medium	*All Pairs*	*All Pairs Using Medium*	*% of All Pairs Using Medium*	*All Pairs*	*All Pairs Using Medium*
Face-to-Face	78	16	19	100	4	4
Email	56	13	24	32	2	5
Phone	25	3	11	21	1	5
Post/Courier	0.2	0	1	21	0.7	3
Fax	0	0	0	15	0.7	5
	N = 405			*N = 240*		

Table 2: Correlation of Frequency of Contact by Medium
Technet / *Globenet*

	Phone	*Email*	*Fax***	*Post*
Face-to-Face	0.31*/0.37*	0.52*/0.40*	N.A./0.35*	- 0.00/0.27*
Phone		0.61*/0.27*	N.A./0.43*	0.60/0.48*
Email			N.A./0.17*	0.00/0.37*
Fax*				N.A./0.45*

* Significant at p < 0.01   **No Technet Member Uses Fax

Table 3: Scholarly and Interpersonal Relationships

Relationship	Technet	Globenet
Percent Having Scholarly Relationship		
Collaborate	17	22
Discuss Research	72	64
Read Work	17	62
Percent Having Interpersonal Relationship		
Friend	18	25
Colleague	40	49
Acquaintance	30	21
No Interpersonal Relation	12	5
Scholarly Multiplexity (%)		
No Scholarly Relation	10	20
One Relation	43	28
Two Relations	42	36
Three Relations	5	16
	N = 405	*N = 240*

Table 4: Mean Number of Scholarly and Media Relationships by Interpersonal Relationship

	Technet				Globenet		
	Mean # of Relationships				*Mean # of Relationships*		
Interpersonal Relationship	*Scholarly Multiplexity*	*Media Multiplexity*	*N*		*Scholarly Multiplexity*	*Media Multiplexity*	*N*
Friend	1.7	2.4	47		2.2	2.8	61
Colleague	1.5	1.9	123		1.7	1.8	117
Acquaintance	1.6	1.5	160		0.5	1.0	50
No Relation	0.06	0.0	75		0.08	1.0	12
	F = 102.5*	*F = 193.4**	*405*		*F = 65.5**	*F = 32.1**	*240*

* p < 0.05

Table 5: Number of Media Used by Interpersonal Relationship

		0	*1*	*2*	*3*	*4*	*5*	*Total*
				Number of Media Used				
Interpersonal Relationship		*0*	*1*	*2*	*3*	*4*	*5*	*Total*
Technet	**Friend**	0	8	39	52	1	0	100% (75)
	Colleague	0	34	39	26	0	0	100% (160)
	Acquaintance	2	59	29	10	0	0	100% (123)
	No Relation	100	0	0	0	0	0	100% (47)
	Total	*12%*	*33%*	*32%*	*23%*	*0.2%*	*0%*	*100%*
	N	*49*	*134*	*128*	*93*	*1*	*0*	*405*
Globenet	**Friend**	0	13	27	27	25	8	100% (61)
	Colleague	0	57	20	13	3	7	100% (117)
	Acquaintance	0	94	4	2	0	0	100% (50)
	No Relation	0	100	0	0	0	0	100% (12)
	Total	*0%*	*56%*	*18%*	*13%*	*8%*	*5%*	*100%*
	N	*0*	*134*	*43*	*32*	*18*	*13*	*240*

D2 test omitted because of abundant cells with zeroes

Table 6: Regression of Scholarly and Interpersonal Relationships on Frequency of Media Use

	Technet				*Globenet*			
	Face-to-Face[1]		*Email[1]*		*Face-to-Face[1]*		*Email[1]*	
Predictors:	˘	*p-value*	˘	*p-value*	˘	*p-value*	˘	*p-value*
Collaborate	0.50*	0.00	0.08	0.65	0.19*	0.00	0.22*	0.00
Discuss Research	0.38	0.06	-0.04	0.83	0.06	0.37	0.03	0.60
Read Work	0.05	0.15	0.08*	0.04	0.17*	0.00	0.06	0.35
Friend	0.51*	0.00	0.70*	0.00	0.30*	0.02	0.41*	0.00
Colleague	0.38	0.09	0.42	0.07	0.26	0.07	0.09	0.50
Acquaintance	0.36	0.10	0.21	0.34	0.13	0.23	-0.01	0.95
Distance[1]	*not applicable*		*not applicable*		-0.32*	0.00	- 0.15*	0.00
Adjusted R²	*0.42*		*0.39*		*0.31*		*0.36*	
N	*405*				*240*			

[1]*Distance and the frequency of face-to-face and email contact logged to the base 10*