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VIEWPOINT

Computer Networks As Social Networks

Barry Wellman

Computer networks are inherently social networks, linking people, organizations, and knowledge. They are social institutions that should not be studied in isolation but as integrated into everyday lives. The proliferation of computer networks has facilitated a deemphasis on group solidarities at work and in the community and afforded a turn to networked societies that are loosely bounded and sparsely knit. The Internet increases people's social capital, increasing contact with friends and relatives who live nearby and far away. New tools must be developed to help people navigate and find knowledge in complex, fragmented, networked societies.

Once upon a time, computers were not social beings. Most stood alone, be they mainframe, mini, or personal computer. Each person who used a computer sat alone in front of a keyboard and screen. To help people deal with their computers, the field of human-computer interaction (HCI) developed, providing such things as more accessible interfaces and user-friendly software. But as the HCI name says, the model was person-computer.

Computers have increasingly reached out to each other. Starting in the 1960s, people began piggybacking on machine-machine data transfers to send each other messages. Communication soon spilled over organizational boundaries. The proliferation of electronic mail (e-mail) in the 1980s and its expansion into the Internet in the 1990s (based on e-mail and the Web) have so tied things together that to many, being at a computer is synonymous with being connected to the Internet.

As a result, HCI has become socialized. Much of the discussion at current HCI conferences is about how people use computers to relate to each other (*1*). Some participants build "groupware" to support such interactions; others do ethnographic, laboratory, and survey studies to ascertain how people actually relate to each other. This work has slowly moved from the lone computer user to dealing with (i) how two people relate to each other online, (ii) how small groups interact, and (iii) how large unbounded systems operate—the ultimate being the worldwide Internet, the largest and most fully connected social network of them all. Just one small portion of the Internet—Usenet members—participated in more than 80,000 topic-oriented collective discussion groups in 2000. 8.1 million unique participants posted 151 million messages (*2*–*4*). This is more than three times the number identified on 27 January 1996 (*5*)

Computer scientists and developers have come to realize that when computer systems connect people and organizations, they are inherently social. They are also coming to realize that the popular term "groupware" is misleading, because computer networks principally support social networks, not groups. A group is only one special type of a social network; one that is heavily interconnected and clearly bounded. Much social organization no longer fits the group model. Work, community, and domestic life have largely moved from hierarchically arranged, densely knit, bounded groups to social networks.

In networked societies, boundaries are more permeable, interactions are with diverse others, linkages switch between multiple networks, and hierarchies are flatter and more recursive (*6*–*8*). Hence, many people and organizations communicate with others in ways that ramify across group boundaries. Rather than relating to one group, they cycle through interactions with a variety of others, at work or in the community. Their work and community networks are diffuse and sparsely knit, with vague overlapping social and spatial boundaries. Their computer-mediated communication has become part of their everyday lives, rather than being a separate set of relationships.

When computer-mediated communication networks link people, institutions, and knowledge, they are computer-supported social networks. Indeed, if Novell had not gotten there first, computer scientists would be saying "netware" instead of "groupware" for systems that enable people to interact with each other online. Often computer networks and social networks work conjointly, with computer networks linking people in social networks and with people bringing their offline situations to bear when they use computer networks to interact.

The intersection of computer networks with the emerging networked society has fostered several exciting developments. I report here on two developing areas: (i) community networks on- and offline and (ii) knowledge access.

Community Networks On- and Offline

Community, like computers, has become networked. Although community was once synonymous with densely knit, bounded neighborhood groups, it is now seen as a less bounded social network of relationships that provide sociability support, information, and a sense of belonging. These communities are partial (people cycle through interactions with multiple sets of others) and ramify through space [a low proportion of community members in the developed world are neighbors (*7*)]. Where once people interacted door-to-door in villages (subject to public support and social control), they now interact household-to-household and person-to-person (*9*).

Although the support of collaborative work was the initial purpose of the Internet (both e-mail and the Web), it is an excellent medium for supporting far-flung, intermittent, networked communities. E-mail transcends physical propinquity and mutual availability; e-mail lists enable broadcasts to multiple community members; attachments and Web sites allow documents, pictures, and videos to be passed along; buddy lists and other awareness tools show who might be available for communication at any one time; and instant messaging means that simultaneous communication can happen online as well as face-to-face and by telephone.

Systematic research on what people actually do on the Internet has lagged behind the Internet's development. After a long

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period of pundit supposition, travelers' tales, and laboratory studies of computer-mediated communication, survey-based and ethnographic research is now appearing.

These studies address a vigorous public debate about whether people can find community online. Critics wonder whether relationships between people who never see, smell, or hear each other can be the basis for true community [reviewed in (*10*); examples include (*11*–*13*)]. Other detractors make an opposite argument: The Internet may be so immersive that it lures people away from other pursuits (*14*) and involves them in online interactions that only reinforce their existing opinions.

By contrast, enthusiasts see the Internet as extending and transforming community. John Perry Barlow asserts that "with the development of the Internet . . . we are in the middle of the most transforming technological event since the capture of fire" (*15*). They point to the ability of the Internet to span distances and time zones at low cost, to sustain relationships based on shared interests (even when the participants are residentially dispersed), and to provide powerful links between people and dispersed knowledge (*16*).

Too often the debate has been (i) Manichean: The Internet is bringing heaven or hell, but nothing in between. (ii) Unidimensional: The Internet is such a powerful force that other considerations, such as gender and status in an organization, are ignored. (iii) Parochial: The Internet should be considered as an entity in itself, rather than as fitting into the full range of work, community, and daily life. (iv) Presentist: The Internet is such a transforming force that long-term social trends, such as the pre-Internet move to networked communities, are irrelevant.

As the debate continues, the Internet is now used by a majority of North Americans, although its growth rate is slowing and may stabilize at about 60% of adults. The digital divide is decreasing rapidly in North America, although socioeconomic status (education, occupation, and income) remains an important differentiator (*17*–*20*). The digital divide is much more significant in two ways in less developed countries: (i) A much lower percentage of the population use the Internet and (ii) the users are predominantly well-connected elites (*21*). In the developed world, the amount of time spent online is increasing, per capita as well as overall. For example, the average AOL user spent 31 min per day online in the first quarter of 1997; in 4 years, this had more than doubled to 64 min online in the first quarter of 2001 (*22*). Nor does familiarity breed interpersonal contempt: The more contact people have online, the greater the impression they make on each other (*23*).

Survey-based evidence about the Internet's effect on community has been mixed. Most cross-sectional studies show that those frequently online are more involved in community (*24*–*27*). By contrast, one study (*28*) suggests that extensive online involvement took people away from interaction with household and community members. Moreover, the only true longitudinal study found that some "newbies" became more depressed, alienated, and isolated during the first 6 months of computer use (*29*).

Robust results indicating how the Internet fits into community life are now available (*30*–*32*). It is becoming clear that the Internet is not destroying community but is resonating with and extending the types of networked community that have already become prevalent in the developed Western world. Old ties with relatives and former neighbors are maintained; new ties are developed among people sharing interests. It is not only that time and space become less important in computer-mediated communication, but that it is easy to communicate with large groups of community members (using lists) and to bring unconnected community members into direct contact. The ease with which computer-mediated communication connects friends of friends can also increase the density of interconnections among clusters of network members within communities.

For one thing, as the newbies studied by Kraut *et al.* (*33*) gained more experience with the Internet, their depression and alienation disappeared, and their social contact increased enough to have a positive impact on their overall interactions with community members. A comparative analysis found that social support obtained online helped people to deal with depression (*34*).

Other studies have found that the Internet increased community interaction (*35*, *36*). For example, a large *National Geographic* Web survey found that face-to-face visits and phone calls were neither more numerous nor fewer for people who use e-mail a great deal. E-mail just added to the fund of contact, so that the overall volume of contacts with friends and relatives through all media was higher for people who use e-mail a lot (*27*) (Table 1).

However, another study found that e-mail use is displacing telephone use to some extent (*37*). Perhaps there are differences in the kinds of communication that take place on the Internet or by telephone or face-to-face. Although one study of a dispersed work group found much similarity in what was said by means of each of these media (*26*), another found that among community members, e-mail is preferred more when people want to garner information efficiently.

Table 1. E-mail use by total annual communication. [Source: Survey2000; see (*27*) for details]

E-mail use	Kin					Friends				
	F2F*	Phone	Letters	E-mail	Total	F2F	Phone	Letters	E-mail	Total
					Within 50 km					
Never	77	117	6	1	201	104	136	6	1	247
Rarely	65	116	6	5	192	84	112	8	5	209
Monthly	61	113	6	7	187	74	98	5	9	186
Weekly	62	120	6	13	201	76	99	7	20	202
Few times/week	63	115	7	24	209	83	113	7	37	240
Daily	60	118	8	52	178	92	126	9	118	345
Total	61	117	7	39	224	88	120	9	86	303
					Beyond 50 km					
Never	12	37	8	1	58	13	25	7	1	46
Rarely	10	36	8	5	59	11	19	7	4	41
Monthly	9	35	7	10	61	8	16	6	8	38
Weekly	9	36	9	19	73	8	17	6	16	47
Few times/week	10	39	9	35	93	9	19	7	30	65
Daily	10	43	10	72	135	10	25	8	85	128
Total	10	41	10	55	116	10	23	8	62	103

*F2F, face to face.

The positive impact of the Internet on community ties is true for those living both nearby and far away. The proportionate gain in contact is greatest for contact with friends and relatives living at a distance (*9*, *38*), as one might expect from a system able to cross time zones at a single bound and in which there is no differentiation between short-distance and long-distance messages. Yet online as well as offline contact is highest with those living nearby (*9*, *38*). Cyberspace does not vanquish the importance of physical space. For example, many e-mail and chat messages arrange face-to-face meetings (*26*, *39*).

The recent case of "Netville" (a suburb of Toronto) is especially interesting, because here neighborhood access to a high-speed Internet service helped bring neighborhood members together for face-to-face get-togethers, from visits in private homes to semi-public barbeques (*40*, *41*). Those who were part of the high-speed service knew three times as many neighbors as the unwired and visited with 1.6 times as many. Nor was the Internet only used socially: Netville residents used their local discussion list to mobilize against the real estate developer and the local Internet service provider (*40*). To be sure, Netville may be a special case because the residents were newly arrived and excited to be part of an Internet experiment. Yet recent work in Michigan (*42*) and Los Angeles (*43*) shows how the Internet can reinforce traditional community development approaches.

Despite the past decade's excitement about the Internet, as it pervades life it may become as taken for granted as that once-transforming technology, the telephone (*44*). One indication is that those who have been on the Internet the longest and the most frequently are least apt to feel that they are a part of an online community, although their overall sense of community remains (*27*). This may reflect their greater likelihood of encountering distasteful situations, such as flaming, hacking into accounts, virus transmission, or unwanted junk mail "spam." Or it may mean that those with much Internet experience do not privilege it as a special form of community. Or it may support the fears of those who believe that computer-mediated communication is not a satisfactory surrogate for face-to-face contact.

Thus, preliminary findings create new questions. At present, Internet studies of community are in full swing: The Pew Internet and American Life project does a monthly tracking study (*35*). The Stanford Institute for the Quantitative Study of Society is doing frequent surveys (*14*, *45*). The U.S. General Social Survey, which is central to social science research, included an Internet module in 2000 and may do so again. The 2001 Canadian General Social Survey has an Internet module. The large-scale international National Geographic Survey2000 data are available for use [(*27*, *46*); see http://survey2000.nationalgeographic.com]. The National Geographic Society (in conjunction with Clemson University and the University of Toronto) is doing an even larger and more comprehensive Web survey in fall 2001. A University of Maryland "Web institute" is archiving many surveys online with statistical software available for reanalysis (*47*). Along with such survey efforts, there is scope for ethnographic community studies [such as what Hampton and Wellman have done in Netville (*38*, *40*, *47–49*)].

Finding Knowledge in a Networked Society

Many organizations are similar to networked communities in having multiple sets of work team members (including multiple superiors), physically dispersed relationships, and teams of co-workers shifting by the day and week as employees get involved in multiple projects. The situation is different from that dealt with by traditional organizational theory, which comprehends densely knit workgroups neatly structured in bureaucratic, hierarchical organizational trees (*6*, *50–52*).

How do people work together in large, sprawling, networked organizations where they are simultaneously members of multiple, transitory, physically dispersed teams? In particular, how do people in such organizations obtain knowledge from others when they do not know whom to ask?

These questions are of immediate practical importance for complex organizations. Hence, computer-supported solutions are developing for working through trusted interpersonal relationships to identify, locate, and receive information within and between communities and organizations. It is not surprising that work in this area has been driven by computer scientists and communication scientists interested in building tools for knowledge access and management.

One issue is finding out who knows what; a more complex task in networked organizations (*53*). Normally, one attempts to examine the documentation or other help sources and then wanders out into a hallway in search of friendly colleagues. The problem becomes acute, however, in distributed communities [(*54*), p. 97].

How do people wander the hallway when their team or other supports are physically distributed? One approach is to build awareness tools (*55*). Two of these, Cruiser (*56*) and Postcards/Telepresence (*57*, *58*), provided low-resolution video pictures of offices or cubicles. The picture told others whether people were in their offices and perhaps available. The low resolution of the picture was not able to show what people were doing and afforded some privacy.

Another approach, Babble, builds on the traditional groupware approach, which facilitates a small defined group working together (*59*). Babble shows each person as an animated and colored circle that moves closer to the center as the person gets more involved in team activities.

When people are asked about the size of their networks, they consistently report them as smaller than the 1000 or more others that they probably know well enough to converse with (*60–62*). Rolodexes and their database equivalents are some help, but the listing can be computer-supported. ContactMap (*52*) looks at ongoing Internet exchanges to record a person's contacts.

Such memory aids typically record each person as a discrete entity. New developments record the connections of network members (*63*, *64*). As such approaches develop, they have the potential to do primitive automated social network analysis—identifying clusters, boundaries, centrality, bridges, and blocks—by analyzing who jointly receives an e-mail and who forwards e-mails to whom.

Who holds the organizational or community memory, now that the veteran employee—the fount of work lore—is neither known nor accessible? Often people ask their workmates. But what if they do not know? People then wonder whether friends of friends know, yet most people do not possess a list of all of their friends' friends, much less are aware of what their friends' friends know. Yet it is reasonable to assume that the number of friends of friends is 100,000, assuming that each person knows approximately 1000 others and that 10 percent of each person's ties are unique. These are too many names to keep track of, yet people often want a personal touch when giving and getting information. They may want to talk to the information holder to supply a nuanced or confidential request; the information holder may only be willing to release such information to a friend or a friend of a friend.

IKNOW is software that stores information about friends of friends; not only who they are but what information they know (*65*). It seeks to answer the question: "Who knows who knows what?" The hope is that through the use of such indirect but personal ties, people will supply reliable and appropriate information. Issues remain. The first is about software that is scalable to map and supply such contact information for a large amorphous organization. The second is about data collection: How do systems compile information about who knows what? The third is about privacy: Do people want to reveal their friends and their skill sets to strangers?

The Answer Garden (*54*) addresses such issues of data collection and privacy, although it does not deal with interpersonal

connections. It provides tools for people to build repositories of commonly requested questions and answers, in part by building up these repositories from ongoing question-and-answer sessions. Thus, only the information that has been publicly provided is available. However, this provides only limited access to the files of each work team member. Good solutions are not yet available that balance team needs to have access to personal files with the needs of each person to limit a team's access to only the germane portions of his or her entire files.

With so much potential and need to connect, there is the need to prioritize communication. Does my boss supersede my peers? Does my wife or husband have higher priority than my sister or brother? Dealing with such matters would be an advanced implementation for the simple filter rules now commonly available for e-mail. Important, as yet unpublished, work is being done to establish rules for prioritizing computer-mediated contact, both deductively setting a priori rules and inductively watching which messages a person takes first.

An Internet year is like a dog year, changing approximately seven times faster than normal human time. Nevertheless, I expect the transition from a group-based to a networked society to continue (*66*). Although technology does not change society—it only affords possibilities for change—powerful forces are shaping the Internet: increased broadband use, global ubiquity, portability, 24/7 availability, personalization, and the switch from place-to-place to person-to-person connectivity. These suggest the accelerating need for social network concepts and tools for engaging with the Internet.

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