

COMPUTER NETWORKS AS SOCIAL NETWORKS: Collaborative Work, Telework, and Virtual Community

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ABSTRACT

When computer networks link people as well as machines, they become social networks. Such computer-supported social networks (CSSNs) are becoming important bases of virtual communities, computer-supported cooperative work, and telework. Computer-mediated communication such as electronic mail and computerized conferencing is usually text-based and asynchronous. It has limited social presence, and on-line communications are often more uninhibited, creative, and blunt than in-person communication. Nevertheless, CSSNs sustain strong, intermediate, and weak ties that provide information and social support in both specialized and broadly based relationships. CSSNs foster virtual communities that are usually partial and narrowly focused, although some do become encompassing and broadly based. CSSNs accomplish a wide variety of cooperative work, connecting workers within and between organizations who are often physically dispersed. CSSNs also link teleworkers from their homes or remote work centers to main organizational offices. Although many relationships function off-line as well as on-line, CSSNs have developed their own norms and structures. The nature of the medium both constrains and facilitates social control. CSSNs have strong societal implications, fostering situations that combine global connectivity, the fragmentation of solidarities, the de-emphasis of local organizations (in the neighborhood and workplace), and the increased importance of home bases.

COMPUTER-SUPPORTED SOCIAL NETWORKS

When computer networks link people as well as machines, they become social networks, which we call computer-supported social networks (CSSNs). Three forms of CSSNs are rapidly developing, each with its own desires and research agendas. Members of virtual community want to link globally with kindred souls for companionship, information, and social support from their homes and workstations. White-collar workers want computer-supported cooperative work (CSCW), unencumbered by spatial distance, while organizations see benefits in coordinating complex work structures and reducing managerial costs and travel time. Some workers want to telework from their homes, combining employment with domestic chores and Arcadian retreats; management foresees reduced building and real estate costs, and higher productivity.

We examine here the extent to which people work and find community on CSSNs. Is it possible to sustain productive or supportive relationships on-line with network members who may never meet in-person? What will the composition and structure of CSSNs be like, with their weaker constraints of distance and time, their easy connectivity, and limited social presence? What are the implications of such changes for the societies within which they are proliferating?

These questions have captured the public's imagination. Pundits argue about whether we will have computer-supported utopias—"the most transforming technological event since the capture of fire" (Barlow 1995:40)—or dystopias—"this razzle-dazzle. . . disconnects us from each other" (Hightower, quoted in Fox 1995:12). The popular media is filled with accounts of life in cyberspace (e.g. Cybergal 1995), much like earlier travellers' tales of journeys into exotic unexplored lands. Public discourse is (a) Manichean, seeing CSSNs as either thoroughly good or evil, (b) breathlessly present-oriented, writing as if CSSNs had been invented yesterday and not in the 1970s, (c) parochial, assuming that life on-line has no connection to life off-line, and (d) unscholarly, ignoring research into CSSNs as well as a century's research into the nature of community, work, and social organization.

The Nets Spread

CSSNs began in the 1960s when the US Defense Department's Advanced Projects Research Agency developed ARPANET to link large university computers and some of their users (Cerf 1993). The Electronic Information Exchange System, modeled after a government emergency communications network, started supporting computerized conferences of scientific researchers (including social network analysts) in the mid-1970s (Freeman 1986, Hiltz & Turoff 1993). Other systems were also proposed and partially implemented in this period.

Since the mid-1980s personal computers have become increasingly connected (through modems, local networks, etc) to central communication hosts. These hosts have become linked with each other through the worldwide "Internet" and the "World Wide Web" (encompassing information access as well as communications). Together with other interconnecting computer networks, the overall network has become known simply as "The Net," a "network of networks" (Craven & Wellman 1973) that weaves host computers (using high-capacity communication lines), each of which is at the center of its own local network. While the Net originally only encompassed nonprofit (principally university) computers, commercial users were allowed on in the early 1990s. Between October 1994 and January 1995, the number of Internet hosts grew by 26% (Treese 1995).

Other computer networks have grown concomitantly, while the cost of access has decreased. Those principally for leisure use range from community bulletin board systems (Marx & Virnoche 1995) to global, for-profit networks such as America OnLine that have developed commercial activity and the structured provision of information (e.g. airline guides, movie reviews). In late 1995, America OnLine had an estimated 4.5 million subscribers worldwide, CompuServe had 4 million, while Prodigy had 1.5 million (Lewis 1996). The development of World Wide Web services may displace such commercial systems. Local low-cost Internet service providers are proliferating, and Windows95 comes ready to connect to the Internet.

Competitive pressures have led these commercial systems to link with the Internet, making the Net even more widely interconnected. The Net has been growing, perhaps doubling its users annually. Its rapid growth and structure as a network of networks makes it difficult to count the number of users, for one must count both the computer systems directly connected to the Net and the users on each system. For example, estimates of recent Internet use in mid-1995 ranged between 27 million and 10 million adults (*Insight New Media* 1995, Lewis 1995). Besides exchanging private e-mail messages, internet members participated (as of January 27, 1996) in 24,237 collective discussion groups (Southwick 1996). There is much scope for growth: In 1994 only 17% of the 2.2 million Canadian computer users logged onto the Net (Frank 1995). Moreover, users vary between those who rarely log on to those who are continuously connected. Given such uncertainties and the tendency of enthusiasts and marketers to forecast high levels of network membership, many estimates of the number of users are unreliable.

There is little published information about the demographic composition of Net users, although this should change as it develops as a commercial marketing milieu. There is general agreement that users are largely politically conservative

white men, often single, English-speaking, residing in North America, and professionals, managers, or students (*Newsweek* 1995; Treese 1995). One survey of Web users in Spring 1995 found that women comprised less than one fifth of their sample, although the proportion of women users had doubled in the past six months (Pitkow & Kehoe 1995). Two thirds of this sample had at least a university education, an "average" household income of US \$59,600, and three quarters lived in North America. By contrast, Algeria had 16 registered internet users in July 1995 and Bulgaria had 639 (Danowitz et al 1995). Trends suggest an increasing participation of women, non-English speakers, and people of lower socioeconomic status (Gupta et al 1995, Kraut et al 1995, On-line Research Group 1995). Nevertheless, French President Jacques Chirac (1995) has warned that if English continues to dominate the information highway, "our future generations will be economically and culturally marginalized. . . . To defend the influence of the French language is to defend the right to think, to communicate, to feel emotions and to pray in a different way."

Possibly more people participate in private organizational networks than on the Net, either using CSCW from offices or teleworking from homes. They use proprietary systems such as Lotus Notes or Internet tools adapted for use on private "intranets." In 1991 there were 8.9 million participants in Fortune 2000 companies (Electronic Mail Association 1992). In late 1995, there probably were still more users of private networks than of the Net, but there were no available estimates. There is also no published demographic information about private network participants, but presumably they are even more homogeneous than those on the Net. To protect organizational security, private networks often are not connected to the Net. However, pressure from professional employees to have access to colleagues and information elsewhere is leading many organizations to connect to the Net (Pickering & King 1995).

Types of Systems

Almost all CSSNs support a variety of text-based interactions with messages entered on keyboards and transmitted in lowest-common denominator ASCII code. Basic electronic mail (e-mail) is asynchronous communication from one person to another or from one person to a distribution list. When e-mail messages are forwarded, they concatenate into loosely bounded intergroup networks through which information diffuses rapidly. E-mail is bidirectional, so that recipients of messages can reply with equal ease. By contrast to these single-sender arrangements, "groupware" (Johnson-Lenz & Johnson-Lenz 1978) supports computerized conferencing that enables all members of a bounded social network to read all messages. Many private networks support computerized conferencing as does the Net through "list servers" (such as the Progressive Sociology Network) and leisure-time "Usenet newsgroups."

The on-line storage of most messages allows computer-mediated communication (CMC) to be asynchronous so that participants can be in different places and on different schedules. This gives people potentially more control over when they read and respond to messages. Moreover, the rapid transmission of large files between individuals and among groups increases the velocity of communication, supports collaborative work, and sustains strong and weak ties (Feldman 1987, Finholt & Sproull 1990, Eveland & Bikson 1988, Sproull & Kiesler 1991). On-line storage and digital transmission also help intruders to read files and messages, although computerization does provide cryptographic means of protecting privacy (Weisband & Reinig 1995).

Far fewer people participate in synchronous “real-time” CSSNs, although improved technology should lead to their growth. The “chat lines” of commercial services and the Internet Relay Chat (IRC) system operate in real time, providing multithreaded conversations like cocktail parties (Bechar-Israeli 1995, Danet et al 1996). As widespread Internet access and microcomputer multitasking develop, it is likely that many currently asynchronous users will see messages when they arrive, creating the potential for more widespread synchronic social exchanges. Multi-User Dungeons (MUDs) and kindred systems are a special play form of real-time computerized conferencing. Those who enter MUDs don pseudonymous personas and role play in quests, masquerades, and other forms of intense on-line communal interaction (Danet et al 1995, 1996, Reid 1996, Smith 1996).

Current trends supplement text with graphics, animation, video, and sound, increasing social presence. However, this increases cost and requires good hardware and communication lines. Desktop and group videoconferencing is currently limited to research groups and large-screen corporate meeting rooms (Ishii 1992, Mantei et al 1991, Buxton 1992, Moore 1997). Other experimental systems include video walls (in which large-screen videos link widely separated lounges to promote informal coffee-machine conversation), video hallways (Fish et al 1993, Dourish & Bly 1992) that allow participants to check the availability of others at a glance, and agents or avatars that move, speak and search on-line (Maes 1995, Riecken 1994, Stephenson 1992). Hence we focus in this chapter on the most widely used, text-based, forms of CSSNs such as e-mail and computerized conferences. We look only at interpersonal communication. We do not cover impersonal broadcast e-mail (such as electronic newsletters), distance education, passively accessible sites (such as file transfer [FTP] and Web sites), and the exchange of data on-line (as in manufacturing processes or airline reservation systems).

Research into CSSNs has involved several disciplines—principally computer science, communication science, business administration, and psychology.

There are annual CSCW conferences with published proceedings. Despite the inherently sociological nature of the matter, sociology is underrepresented, and gatekeepers are mostly members of other disciplines (Dillon 1995). Although mutually germane, studies of virtual community, CSCW, and telework generally have not informed each other.

COMMUNICATION ON-LINE

Early research developed from "human-computer" analysis of single-person interfaces with computer systems to analyzing how small group communication is mediated by computer systems. Many of these studies examined how the limited "social presence" of CMC (as compared to in-person contact) affects interactions and group decision-making. What are the effects of losing verbal nuances (e.g. voice tone, volume), nonverbal cues (e.g. gaze, body language) physical context (e.g. meeting sites, seating arrangements) and observable information about social characteristics (e.g. age, gender, race)? Research in this approach links the technical characteristics of CMC to task group outcomes such as increased participation, more egalitarian participation, more ideas offered, and less centralized leadership (Hiltz et al 1986, Kiesler et al 1984, Rice 1987, Adrianson & Hjelmquist 1991, Weisband et al 1995). Limited social presence may also encourage people to communicate more freely and creatively than they do in person, at times "flaming" others by using extreme, aggressive language (Kiesler et al, 1984).

Although groups supported by CMC often produce higher quality ideas, reaching agreement can be a lengthy and more complex process as the greater number of ideas and the lack of status cues hinder group coordination (Hiltz et al 1986, Kiesler & Sproull 1992, Valacich et al 1993). However, status cues are not completely absent, as social information is conveyed through language use, e-mail address, and signatures such as "VP-Research" (Walther 1992). As messages are often visibly copied to others, they also indicate social network connections. Some participants prefer in-person contact to CMC for ambiguous, socially sensitive, and intellectually difficult interactions (Culnan & Markus 1987, Daft & Lengel 1986, Rice 1987, Fish et al 1993, Jones 1995). However, CMC is also used to maintain social distance, document contentious issues, or when the message involves fear, dislike, awkwardness, or intimidation (Markus 1994a, Walther 1996).

Much CMC research has been individualistic and technologically deterministic, assuming a single person rationally choosing among media (Lea 1991). To go beyond this, some CMC analysts now consider how social relationships, organizational structures, and local norms affect the use of communication media (Finholt & Sproull 1990, Orlikowski et al 1995, Huber 1990, Markus 1990,

1994b, Sproull & Kiesler 1991, Lea et al 1995, Orlikowski et al 1996b, Zack & McKenney 1995). For example, people do not “choose” to use e-mail in many organizations: It is a condition of employment (Fulk & Boyd 1991). Even when e-mail use is voluntary, a critical mass of users affects the extent to which people use it (Markus 1990). Thus the laboratory basis of most CMC research sets limits for understanding CSSNs in natural settings. Sociological research needs to take into account the social characteristics of participants (e.g. gender, SES), their positional resources (CEO or mail-room clerk, broker or densely knit star), the interplay between ongoing on-line and off-line relationships, and their ongoing social relationships.

SUPPORT ON-LINE

Information

Much of the communication on CSSNs involves the exchange of information. For example, in two weeks of March 1994 the 2295 newsgroups in the top 16 Usenet newsgroup hierarchies received 817,638 messages (Kling 1996b). On-line digital libraries are growing, along with search tools (Kling & Lamb 1996), although locating the right information is difficult in large organizations and communities. The nature of the medium supports a focus on information exchanges, as people can easily post a question or comment and receive information in return. Broadcasting queries through CSSNs increases the chances of finding information quickly and alters the distribution patterns of information. It gives those working in small or distant sites better access to experienced, skilled people (Constant et al 1996).

However, as anyone can contribute information to most newsgroups and distribution lists, the Net can be a repository of misleading information and bad advice, as some health care professionals have charged (Foderaro 1995). Such worries discount the fact that people have always given each other advice about their bodies, psyches, families, or computers (e.g. Wellman 1995, Kadushin 1987). The Net has just made the process more accessible and more visible to others, including experts whose claims to monopolies on advice are threatened (Abbott 1988).

The flow of information through CSSNs itself generates access to new information. On-line information flows spill over unexpectedly through message forwarding, providing access to more people and new social circles, thus increasing the probability of finding those who can solve problems (Kraut & Attewell 1993). People often bump into new information or new sources of information unintentionally through “leaky... quasi social networkds” (Brent 1994: on-line). Information obtained serendipitously helps solve problems before they occur

and helps keep people aware of organizational news. Weak on-line ties are bridges between diverse sources of information. In one large organization, those with more diverse ties obtained better on-line advice (Constant et al 1996).

Social Support

If CSSNs were solely a means of information exchange, then they would mostly contain narrow, specialized relationships. However, information is only one of many social resources exchanged on-line. Despite the limited social presence of CMC, people find social support, companionship, and a sense of belonging through the normal course of CSSNs of work and community, even when they are composed of persons they hardly know (Rice & Love 1987, McCormick & McCormick 1992, Haythornthwaite et al 1995, Walther 1996, Wellman & Gulia 1996). Although providing such types of support often does not require major investments of time, money, or energy, CSSN members have also mobilized goods, services, and long-term emotional support to help each other (e.g. Lewis 1994). Thus while most of the elderly users of the "SeniorNet" virtual community joined to gain access to information, their most popular on-line activity has been companionable chatting (Furlong 1989, see also Hiltz et al 1986, Walther 1994, Rheingold 1993, Meyer 1989, Kraut et al 1995). An informal support group sprang up inadvertently when the "Young Scientists' Network" aimed primarily at providing physicists with job hunting tips and news stories. Similarly, the "Systers" mailing list, originally designed for female computer scientists to exchange information, has become a forum for companionship and social support (Sproull & Faraj 1995). The members of a computer science laboratory frequently exchange emotional support by e-mail. Because much of their time is spent on-line, and many of their difficulties happen at their terminals, it is natural for them to discuss problems on-line (Haythornthwaite et al 1995).

Some CSSNs are explicitly set up to be support groups that provide emotional aid, group membership, and information about medical treatment and other matters (Foderaro 1995, King 1994). One therapist who provides one-to-one counseling through a bulletin board reports that, while she has less social presence and cues than through in-person sessions, the greater anonymity of CMC allows her clients to reveal themselves more (Cullen 1995). For example, Peter and Trudy Johnson-Lenz (1990, 1994) have organized on-line groups for 20 years, working to build self-awareness, mutually supportive activities, social change, and a sense of collective well-being. Their software tools, such as passing around sacred "talking sticks," rearrange communication structures, vary exchange settings, mark group rhythms, and encourage lurkers to express themselves.

RELATIONSHIPS ON-LINE

Specialized and Multiplex Ties

CSSNs contain both specialized and multiplex relationships. The structure of the Net encourages specialized relationships because it supports a market approach to finding social resources in virtual communities. With more ease than in almost all real life situations, people can shop for resources from the safety and comfort of their homes or offices, and with reduced search and travel time. The Usenet alone houses more than 3500 newsgroups (Kling 1996b) to which anyone may subscribe, with diverse foci including politics (e.g. feminism), technical problems (e.g. SPSS), therapeutics (e.g. alcoholism), socializing (e.g. singles), and recreation (e.g. BMWs, sexual fantasies). Net members can browse through specialized channels on synchronous chat lines before deciding to join a discussion (Danet et al 1996). Relationships in these virtual communities are often narrowly defined.

The narrow focus of newsgroups, distribution lists, and chat lines allows people to take risks in specialized relationships that may only exist in a single partial on-line community. Some CSSNs even allow people to be anonymous or use nicknames when they want to speak freely or try on different personas (Hiltz & Turoff 1993). However, the inclusion of e-mail addresses in most message headers provides the basis for more multiplex relationships to develop. In the absence of social and physical cues, people are able to get to know each other on the Net on the basis of their communication and decide later to broaden the relationship or move it off-line (Rheingold 1993). Thus more than half of the recovering addicts on electronic support groups also contact each other by phone or in-person (King 1994). Soon after an especially intense computerized conference, many "of the participants altered their business and vacation travel plans to include a face-to-face meeting with one another" (Hiltz & Turoff 1993:114).

Strong Ties

Can the medium support the message if the limited social presence of computer-mediated communication works against the maintenance of socially close, strong ties on CSSNs? Many on-line ties do meet most of the criteria for strong ties. They facilitate frequent, reciprocal, companionable, and often supportive contact, and the placelessness of CSSN interactions facilitates long-term contact without the loss of relationships that often accompanies residential mobility. Virtual communities are quite voluntary, while CSSN participation varies between voluntary and mandatory in CSCW and telework (Hiltz & Turoff 1993, Johnson-Lenz & Johnson-Lenz 1994, Rheingold 1993). Certainly many accounts report great involvement in on-line relationships. Community members

came to regard each other as their closest friends even though they seldom or never met in-person (Hiltz & Turoff 1993). Net members tend to base their feelings of closeness on shared interests rather than on shared social characteristics such as gender and SES. That the siren call of CSSNs sometimes lures net members away from "real-life" argues for the potential strength of on-line relationships and networks.

Many computer-mediated communication ties are moderately strong "intimate secondary relationships" that are frequent and supportive but only operate in one specialized domain (Wireman 1984). Over time, some of these relationships become more personal and intimate. Perhaps the limited social presence and asynchronicity of CMC only slows the development of intimacy, with on-line interactions eventually developing to be as sociable and intimate as in-person ones (Walther 1995).

In part, concerns about whether on-line ties can be strong ties are wrongly specified. Although CSSNs do transcend time and space, not all ties are either totally on-line or off-line. Much on-line contact is between people who see each other in person and live locally. At work, computer scientists intermingle in-person and e-mail communication. At some offices, employees chat privately by e-mail while they work silently side-by-side (Garton 1995, Labaton 1995). In such situations, conversations started on one medium continue on others. As with the telephone and the fax (Wellman & Tindall 1993), the lower social presence of CMC may be sufficient to maintain strong ties between persons who know each other well. For example, kinship networks use the Net to arrange weddings and out-of-town visits (Hiltz & Turoff 1993), while an American woman gave up her job and flew to Britain to marry a Net friend whom she had never met in person (Toronto News Radio 680, Sept. 3, 1995).

Weak Ties

There are low logistical and social costs to participating in CSSNs. People can participate within the comfort and safety of their own homes or offices, at any time, and at their own convenience. Limited social cues on-line encourage contact between weak ties. Very often, the only social characteristic that people learn about each other on-line is a Net address, which provides very little information. The egalitarian nature of the Net encourages responses to requests. It also generates a culture of its own, as when humorous stories sweep CSSNs, possibly fostering a revival of folk humor.

On the face of it, CSSNs should not support much reciprocity. Many on-line ties are between persons who have never met face to face, who are weakly tied, socially and physically distant, and not bound into densely knit work or community structures. Computerized conferences allow free-rider "lurkers" to read others' messages invisibly without contributing (Kollack & Smith 1996a).

Nevertheless, there is evidence of reciprocal supportiveness on CSSNs, even between people with weak ties (Hiltz et al 1986, Walther 1994). Providing reciprocal support and information on-line is a means of increasing self-esteem, demonstrating technical expertise, earning respect and status, and responding to norms of mutual aid (e.g. Constant et al 1994, 1996, Kraut & Attewell 1993, Kollock & Smith 1996b). In some organizations, employees are encouraged to help each other or to direct those in need to others who could help. Computerized conferences and public archives reinforce this supportiveness by making it visible to all co-workers and managers (Constant et al 1995, Kraut & Attewell 1993, Kollock & Smith 1996b). Such processes also arise in densely knit virtual communities and are common among frequent contributors to computerized conferences. People having a strong attachment to an organization or electronic group will be more likely to participate and provide assistance to others. For example, computer hackers involved in illegal activities are reluctant to change their pseudonyms because the status they gain through on-line demonstrations of technical expertise accrues to that pseudonym (Meyer 1989).

Some commentators have warned about the consequences of making connections on CSSNs teeming with strangers whose biographies, social positions, and social networks are unknown (Stoll 1995). Nevertheless CSSN members tend to trust strangers, much as people gave rides to hitchhikers in the flowerchild days of the 1960s. This willingness to engage with strangers on-line contrasts with in-person situations where bystanders are often reluctant to intervene and help strangers (Latané & Darley 1976). Yet bystanders are more apt to intervene when they are the only ones around and they can withdraw easily in case of trouble. Analogously, on-line requests for aid are read by people alone at their screens. Even if the request is to a newsgroup and not by personal e-mail, as far as the recipient of the request knows, s/he is the only one who could provide aid. At the same time, on-line intervention will be observed by entire groups and will be positively rewarded by them. It is this visibility that may foster the kindness of strangers. Just as physical proximity provides the opportunity for observing face-to-face interaction, CSSNs provide social exemplars to large numbers of passive observers as well as to active participants. Individual acts can aggregate to sustain a large community because each act is seen by the entire group and perpetuates a norm of mutual aid (Rheingold 1993, Barlow 1995, Lewis 1994).

Stressful Ties

Most research into antisocial behavior on-line has studied uninhibited remarks, hostile flaming, nonconforming behavior, and group polarization (Hiltz et al 1978, Kiesler et al 1985, Siegal et al 1986, Sproull & Kiesler 1991, Lea et al 1992, Walther et al 1994). The limited social presence of computer-mediated

communication encourages the misinterpretation of remarks, and the asynchronous nature of most conversations hinders the immediate repair of damages, stressing and even disrupting relationships. There are numerous anecdotes about antisocial behavior on-line. Hackers disseminate viruses, entrepreneurs “spam” (flood) the Net with unwanted advertisements, stalkers harass participants on-line, and scoundrels take on misleading roles such as men posing on-line as women to seduce others electronically (Cybergal 1995, Slouka 1995).

SOCIAL NETWORKS ON-LINE

In what kinds of social networks are on-line relationships embedded? Because they operate somewhat differently, we separately discuss virtual community and computer-supported work groups. For both community and work, we consider the composition of computer-supported social networks—the nature of the participants in them, and the structure of CSSNs—the network pattern of relationships and hierarchies of power.

Size and Composition

VIRTUAL COMMUNITY Although contemporary people in the western world may know 1000 others, they actively maintain only about 20 community ties (Kochen 1989). Easy access to distribution lists and computerized conferences should enable participants to maintain more ties, including more strong ties. Communication also comes unsolicited through distribution lists, newsgroups, and forwarded messages from friends. These provide indirect contact between previously disconnected people, allowing them to establish direct contact. Newsgroups and distribution lists also provide permeable, shifting sets of members, with more intense relationships continued by private e-mail. The resulting relaxation of constraints on the size and proximity of one’s personal community can increase the diversity of people encountered (Lea & Spears 1995). Thus the Net facilitates forming new connections between people and virtual communities.

The relative lack of social presence on-line fosters relationships with Net members who have more diverse social characteristics than are normally encountered in person. It also gives participants more control over the timing and content of their self-disclosures (Walther 1995). This allows relationships to develop on the basis of shared interests rather than to be stunted at the onset by differences in social status (Coate 1994, Hiltz & Turoff 1993, Jones 1995, Kollock & Smith 1996a). This is a technologically supported continuation of a long-term shift to communities organized by shared interests rather than by shared neighborhoods or kinship groups (Fischer 1975, Wellman 1979, 1994). When their shared interests are important to them, those involved in the same virtual

community may have more in common than those who live in the same building or block (Rheingold 1993). Indeed, people have strong commitments to their on-line groups when they perceive them to be long-lasting (Walther 1994). There is a danger, though, that virtual communities may develop homogeneous interests (Lea & Spears 1992). Furthermore, the similarity of social characteristics of most current Net participants also fosters cultural homogeneity.

This emphasis on shared interests rather than social characteristics can be empowering for members of lower-status and disenfranchised social categories (Mele 1996). Yet although social characteristics have become less apparent on CSSNs, they still affect interactions. Women often receive special attention from males (Shade 1994, Herring 1993, O'Brien 1996). In part, this is a function of the high ratio of men to women on-line. "Reveal your gender on the Net and you're toast" claims one (fictional) female participant (Coupland 1995:334).

COOPERATIVE WORK The evidence is mixed about whether CSSNs reduce the use of other communication media, add to the total amount of communication, or boost the use of other communication media (Garton & Wellman 1995). One study found that work groups using CMC have a higher level of communication than those that do not (Bikson & Eveland 1990), while another found that heavy CMC use reduces face-to-face and telephone communication (Finholt et al 1990).

People can greatly extend the number and diversity of their social contacts when they become members of computerized conferences or broadcast information to other CSSN members. In one large, physically dispersed organization, four fifths of the e-mail messages were from electronic groups and not individuals. More than half of these messages were from unknown people, different buildings, or people external to their department or chain of command (Finholt & Sproull 1990, Kiesler & Sproull 1988). In another study, an on-line work team formed more subcommittees than did an off-line team and was better able to involve its members in its activities (Bikson & Eveland 1990). Where the organizational climate fosters open communication, the lack of status cues fosters connections across hierarchical or other forms of status barriers (Sproull & Kiesler 1991, Eveland & Bikson 1988).

Structure

VIRTUAL COMMUNITY The architecture of the Net may nourish two contradictory trends for the structure of virtual communities. First, the Net fosters membership in multiple, partial communities. People often belong to several computerized conferences, and they can easily send out messages to separate personal distribution lists for different kinds of conversations. Moreover, they can vary in their involvements in different communities, participating actively

in some and occasionally in others. Second, the ease of responding to entire groups and forwarding messages to others foster the folding in of on-line networks into broader communities (Marx & Virnoche 1995). Moreover, MUDs and similar role-playing environments resemble village-like structures if they capture their members' attention.

The proliferation of CSSNs may produce a trend counter to the contemporary privatization of community. People in the western world are spending less time in public places waiting for friends to wander by, and where they can to introduce them to other friends (Wellman 1992, Economist 1995). Community has moved indoors to private homes from its former semi-public, accessible milieus such as cafés, parks, and pubs. This dispersion and privatization means that people must actively contact community members to remain in touch instead of visiting a café and waiting for acquaintances to drop by. By contrast, computerized conferences support connections with large numbers of people, providing possibilities for reversing the trend to less public contact. Because all members of newsgroups and discussion groups can read all messages—just as in a café conversation—groups of people can talk to each other casually and get to know the friends of their friends. “The keyboard is my café,” William Mitchell enthuses (1995:7). Moreover, each participant's personal community of ties connects specialized, partial communities, providing cross-cutting links between otherwise disconnected groups.

WORK GROUPS There has not been much research into how widespread use of CSSNs affect broad organizational structures of management and control. Research has focused more narrowly on CSSNs themselves. For example, organizational CSSNs are maintained by system administrators who may support management goals by monitoring on-line activities and devising procedures that affect social outcomes. Some administrators promote the “appropriate” use of the CSSN and admonish those who use it for recreational or noncompany purposes (Chiu 1995, Orilowski et al 1995). Managers fear that CSSNs will threaten control by accelerating the flow of (mis)information, including rumors, complaints, jokes, and subversive communications (Finholt & Sproull 1990). For example, management closed an employee “Gripenet” when group discussions challenged long-standing corporate practices (Emmett 1982). Even when organizations support informal electronic groups, managers often view them with distrust (Perin 1991). When women in a large corporation established a computerized conference to discuss careers, management monitored the messages because they feared it would lead to demands for unionization and affirmative action (Zuboff 1988).

Nevertheless, CSSNs support a variety of agendas, not only those sanctioned by the organization. For example, striking Israeli university professors used

both private and group messages to coordinate their nationwide strike (Pliskin & Romm 1994). Less confrontationally, managers and staff use discussion groups to cross status and power boundaries by exchanging information about shared leisure interests. In one decentralized corporation, more than half of those surveyed use e-mail at least occasionally to keep in touch, take work breaks, and take part in games and other entertaining activities (Steinfeld 1985). Such groups are larger, more dispersed, and more spontaneous than the distribution lists which the organization requires employees to be on, and their exchanges emphasize fun rather than displays of competence (Finholt & Sproull 1990). Such informal messaging may reduce work stress (Steinfeld 1985), integrate new or peripheral employees (Eveland & Bikson 1988, Rice & Steinfeld 1994, Steinfeld 1985), and increase organizational commitment (Huff et al 1989, Kaye 1992, Sproull & Kiesler 1991).

Much "groupware" has been written to support the social networks of densely knit and tightly bounded work groups in which people work closely with a focused set of colleagues. For example, video conferencing systems enable spatially dispersed coworkers to confer instantly (Moore 1997), while co-writing systems support joint authorship (Sharples 1993). Yet both the Internet and within-organization intranets are also well-suited to support work relationships in sparsely knit, loosely bounded organizations whose members switch frequently and routinely among the people with whom they are dealing throughout the day, as they move between projects or need different resources (Fulk & DeSanctis 1995, Kling & Jewett 1994, Koppel et al 1988, Weick 1976, Wellman 1996). In such organizations, work outcomes depend more on the ability of people and groups to bridge cognitive distances than on having people and other resources located in the same place (Mowshowitz 1994). This relatively autonomous mode of work is often found among professionals, scholars, or academics who have to make multiple, often unexpected, contacts with colleagues within and outside their own organizations (Abbott 1988, Burt 1992, Hinds & Kiesler 1995, Star 1993, Walsh & Bayama 1996).

From an organizational perspective, dispersed work teams require social as well as technical support (Wellman et al 1994, Garton 1995). Studies of collaboration among scientific communities suggest that an initial period of physical proximity is necessary to build trust and to come to consensus on the focus of proposed projects (Carley & Wendt 1991). Such collaborations may need different forms of CMC support at different points in a project. For example, work groups tightly focused on a single project need different types of CSCW support than do individuals switching among multiple tasks and relationships (Mantei & Wellman 1995).

Shifting boundaries characterize networked virtual organizations, not only within the organizations but between them. Interorganizational CSSNs can help an organization in negotiations between buyers and sellers and in coordinating joint projects. They also help managers and professionals maintain a large network of potentially useful contacts, stockpiling network capital for the time when they need to obtain information externally. These interorganizational networks also help employees to maintain a sense of connection with former colleagues and can provide support during job changes and other stressful events. CSSNs blur organizational boundaries, supporting "invisible colleges" of dispersed professionals. (Constant et al 1994, 1996, Hesse et al 1993, Hiltz & Turoff 1993, Kling 1996, Meyer 1989, Carley 1990, Kaufer & Carley 1993, Huff et al 1989, Kaye 1992, Rice & Steinfield 1994, Walsh & Bayama 1996). They can knit scientific researchers into "highly cohesive and highly cooperative research groups, . . . geographically dispersed yet coordinated" (Carley & Wendt 1991:407). However, there is less use of CSSNs in disciplines such as chemistry where practitioners want to protect unwanted commercial use of their knowledge (Walsh & Bayama 1996).

TELEWORK ON-LINE

Implementation

To date, most developments in organizational CSCW have been to improve connections between existing workplaces. However, CSSNs provide opportunities for developing relatively new forms of work organization. Thus, telework (aka "telecommuting") is a special case of CSCW in which CMCs link organizations to employees working principally either at home or at remote work centers (Fritz et al 1994). Most writing about telework has been programmatic, forecasting, or descriptive, assuming that the technology of telework will determine its social organization (e.g. Hesse & Grantham 1991, Helms & Marom 1992, Grey et al 1993). Yet teleworking's growth has been driven by new market conditions that are promoting organizational restructuring, reducing employees, eliminating offices, and giving more flexibility to remaining employees (Salaff & Dimitrova 1995a,b). Although teleworkers now comprise a tiny fraction of the work force (DiMartino & Wirth 1990), their growing number includes many salespeople, managers, professionals, and support personnel. Entire offices of data entry clerks and telephone services have moved to home or other remote offices (Kugelmass 1995).

Research is moving from technological determinism to studying the interplay between telework and work organization. Several analysts have shown managerial inertia and organizational lethargy to be barriers to telework. Many

employees favor telework to gain more work autonomy or to accommodate family, but many managers feel their power threatened (Kraut 1988, 1989, Olson 1988, Huws et al 1990, Grantham & Paul 1994, Tippin 1994). Although there have been concerns that the careers of teleworking managers and professionals would suffer because of less visibility in organizations, this has not yet been the case (Tolbert & Simons 1994). Despite the proliferation of telework and great public interest in the subject, there has not been much systematic research into what teleworkers actually do, their connections with their main offices, their links with coworkers (peers, subordinates, and supervisors), and the implications of their physical isolation for their careers within organizations or for labor solidarity.

Communication

Teleworkers do not communicate more frequently on-line with coworkers or supervisors than do similarly occupied nonteleworkers (Kinsman 1987), although teleworkers do have less postal and in-person contact (see also Olszewski & Mokhtarian 1994). However, teleworking leads to more structured and formalized communication with supervisors and, to a lesser extent, with coworkers. This may be due as much to physical separation from the organizational office as to the use of CMC (Olson 1988, Heilmann 1988, Huws et al 1990, Olson & Primps 1984).

There has been contradictory evidence about how teleworking affects informal communication among coworkers. One study notes that personal conversations among teleworking programmers have decreased and their informal relationships have deteriorated (Heilmann 1988). Another study finds that the restructuring of work accompanying the shift to telework among pink-collar workers curtails informal communication (Soares 1992). By contrast, university employees, both white- and pink-collar, who work at home have more informal contact with other employees (McClintock 1981). At the same time, teleworkers can increase autonomy by being slow to respond to on-line messages (Wellman et al 1994). The nature of informal communications by teleworkers appears to depend on the employees' social status, their previous relationships, and the support of the organization. For example, British Telecom reports (1994) that pink-collar teleworkers complain less about isolation than about the slowness of help in fixing computers and the lack of news about main office events (see also Shirley 1988).

Telework may only be a continuation of existing task independence and work flows already driven by messages and forms on computer screens (Dimitrova et al 1994). This may explain why some studies find that professional teleworkers maintain work-related networks, but pink-collar clerical workers become more isolated (Durrenberger et al 1996). New work force hierarchies that emerge from teleworking segregate those who lack informal contacts, while

those that have them benefit richly (Steinle 1988). In this way, CSSNs may further bifurcate the work force.

Work Organization

Most research on the impact of telework addresses workplace issues such as the control and autonomy of teleworkers, flexibility of work schedules, job redesign, remote supervision, and productivity. Although much post-Fordist hype suggests that teleworking will liberate workers (e.g. Toffler 1980), research supports the neo-Fordist conclusion that managers retain high-level control of planning and resources but decentralize the execution of decisions and tasks. Companies that implement teleworking to cut costs often tighten control. This strategy is most effective with abundant pink-collar labor, typically women with children. The more severe the employees' personal constraints (e.g. child-care, disabilities) and the less the demand for their skills, the more likely they are to experience tighter control (Olson 1987). Thus management has increasing control of clerks who become teleworkers, while professionals have gained more autonomy (Olson & Primps 1984, Simons 1994, Soares 1992).

Thus the divergent impact of telework on control and job design follows the logic of the dual nature of labor markets, with company strategy determining the outcome (Steinle 1988, Huws et al 1990). Where a company seeks to retain scarce skills by reducing personal constraints, teleworking provides more discretion over work arrangements. Professionals often obtain greater autonomy, flexibility, skills, and job involvement, but they may have more uncertainties about their careers and incomes (Olson 1987, Simons 1994, Bailyn 1989).

Telework, Domestic Work, and Gender

Telework is part of changing relationships between the realms of work and nonwork: a high proportion of women working, more part-time and flextime work, and the bifurcation of workers into the information-skilled and -deskilled (Hodson & Parker 1988, Olson 1988, Steinle 1988). Women and men often experience telework differently, although the evidence is somewhat contradictory.

Telework reinforces the gendered division of household labor because women teleworkers do more family care and household work. Women are more likely to report high stress over the conflict of work and family demands, and the lack of leisure time (Olson & Primps 1984, Christensen 1988). Women say they are satisfied with teleworking, possibly because blending work and family space may ease role strain between family and work, and it may improve family relations (Falconer 1993, Higgins et al 1992, Duxbury 1995). Thus, female teleworking clerks are more family oriented than are their office counterparts (French 1988, DuBrin 1991).

Yet fusing domestic and work settings can be disruptive and can embed women more deeply in the household (Ahrentzen 1990, Calabrese 1994, Heck et al 1995). Women doing paid work at home spend a similar amount of time on domestic work regardless of their job status, number and ages of their children, part-time or full-time employment, or the structure of their household (Ahrentzen 1990). Although teleworking women may benefit from flexibility in their "double load," managers and researchers alike claim that doing paid work at home is not a good way to provide early childcare (Christensen 1988). Teleworkers are almost as likely to use paid childcare, and indeed most have higher childcare expenses than do office workers (Falconer 1993). Yet mothers with older children are better able to work while their children are in school, to greet them after school, and to be available in emergencies.

Fathers who telework report better relationships with their children than do comparable nonteleworkers. They have more leisure time and less stress than before they began teleworking, and they play more with their children (Olson & Primps 1984). Yet gender dynamics are different. Men see teleworking as a privilege because they want more autonomy, and they get more interaction with their families as a bonus. Women see teleworking as a compromise because family responsibilities limit their employment opportunities, and they want flexible scheduling (Olson 1987, Gerson & Kraut 1988).

GLOBAL NETWORKS AND LITTLE BOXES

Despite their limited social presence, CSSNs successfully maintain strong, supportive ties with work and community as well as increase the number and diversity of weak ties. They are especially suited to maintaining intermediate-strength ties between people who cannot see each other frequently. On-line relationships are based more on shared interests and less on shared social characteristics. Although many relationships function off-line as well as on-line, CSSNs are developing norms and structures of their own. They are not just pale imitations of "real life." The Net is the Net.

Organizational boundaries are becoming more permeable just as community boundaries already have. The combination of high involvement in CSSNs, powerful search engines, and the linking of organizational networks to the Net enables many workers to connect with relevant others elsewhere, wherever they are and whomever they work for. If organizations grow toward their information and communication sources (Stinchcombe 1990), CSSNs should affect changes in organizational structures.

Social networks are simultaneously becoming more global and more local as worldwide connectivity and domestic matters intersect. Global connectivity de-emphasizes the importance of locality for work and community; on-line

relationships may be more stimulating than suburban neighborhoods and alienated offices. Even more than before, on the information highway each person is at the center of a unique personal community and work group.

The domestic environment around the workstation is becoming a vital home base for neo-Silas Marner sitting in front of their screens day and night. Nests are becoming well feathered. Telework exaggerates both trends. Although it provides long-distance connections for workers, it also moves them home, providing a basis for the revival of neighborhood life. Just as before the Industrial Revolution, home and workplace are being integrated, although gender roles have not been renegotiated.

The privatization of relationships affects community, organizational, and coworker solidarity. Virtual communities are accelerating the ways in which people operate at the centers of partial, personal communities, switching rapidly and frequently between groups of ties. Whether working at home or at an office workstation, many workers have an enhanced ability to move between relationships. At the same time, their more individualistic behavior means the weakening of the solidarity that comes from working in large groups.

Such phenomena give sociologists wonderful opportunities. A Bellcore vice president says that when "scientists talk about the evolution of the information infrastructure, . . . [we don't] talk about. . . the technology. We talk about ethics, law, policy and sociology. . . . It is a social invention" (Lucky 1995:205). Yet there has been little sociological study of computer-supported social networks. Research in this area engages with important intellectual questions and social issues at all scales, from dyadic to world system. It offers stimulating collaborations with other disciplines, industry, labor, and government. It provides opportunities to develop social systems and not just study them after the fact. As our computer science colleague William Buxton tells us, "the computer science is easy; the sociology is hard."

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