

# Computer-Mediated Communication on the Internet

*Susan C. Herring  
Indiana University*

## Introduction

In his 1986 *ARIST* review of computer-mediated communication (CMC) systems, Steinfield (1986) identified a number of gaps in the literature on CMC that he hoped would be filled by future research. Noting that most early CMC work focused on experimental or case studies in organizational contexts (e.g., Rice, 1980), Steinfield called for (1) studies that paid closer attention to the effects of system design features on CMC, (2) empirical research in real-world, rather than laboratory settings, (3) research on CMC use in nontraditional settings, such as on electronic bulletin boards, (4) longitudinal research to capture long-term impacts of CMC, and (5) studies addressing the privacy implications of using CMC as research data.

In the intervening years, researchers have made progress toward filling these gaps, as well as in analyzing new CMC-related phenomena, as part of an explosion in CMC research triggered by the popular expansion of the Internet in the late 1980s and 1990s. (The Internet is not mentioned in Steinfield's review.) The Internet brought millions of people online, and what they did mostly was communicate, in the process generating large amounts of authentic usage data in a variety of modes (e.g., e-mail, listservs, newsgroups, chat, MUDs [Multi-User

Dungeons/Dimensions|) and social contexts (professional, political, recreational, commercial, etc.). Archives of Internet—and earlier, ARPANET (Advanced Research Projects Agency Network)—messages posted to discussion groups are available for the past twenty-five years, making longitudinal studies of Internet use possible. And as more and more researchers have succumbed to the lure of easily accessible Internet data, CMC research ethics has become a topic of increasingly frequent debate.

In addition to providing a test bed for earlier theories and observations about CMC, the Internet increasingly *defines* CMC by providing the context within which many, if not most, CMC applications operate. Over the past fifteen years, the Internet has incorporated into its web of interconnected telecommunications local area networks (LANs) and intranets, as well as wide area networks (WANs) that previously operated semi-independently, such as ARPANET, Bitnet and Usenet. This incorporation came about not through imperialistic spread so much as through groups, organizations, and institutions voluntarily linking to the Internet in order to be able to access its vast information and communication resources. Thus any discussion of CMC today must necessarily reference the Internet.

Albeit a recent phenomenon, CMC on the Internet has already generated a vast, interdisciplinary research literature, a complete coverage of which is beyond the scope of a single review chapter. For other recent reviews of CMC, see Wellman et al. (1996), who survey research on what they call “Computer Supported Social Networks” (CSSNs), and Rice & Gattiker (2000), who take as their object “Computer-Mediated Communication and Information Systems” (CISs). Substantial review sections are also included in Walther (1996), of experimental and organizational CMC research, and Soukup (2000), of early research, empirical Internet research, and critical CMC scholarship.

This review, in keeping with the desiderata outlined by Steinfield (1986), focuses on empirical research on naturally occurring online communication in noninstitutional and nonorganizational contexts from the late 1980s to the present. Such communication arguably best reflects the organic potential of the Internet itself, as a large, geographically dispersed, interconnected, and relatively unstructured medium, to shape human interaction. The general phenomena of

interest within this perspective includes the effects of the Internet on language and communication, on interpersonal relations, and on group dynamics, as well as the emergence of social structures and norms, and macro-societal impacts of Internet communication. The research methods commonly employed to address these phenomena are drawn mostly from language-related disciplines, such as communication, linguistics, and rhetoric, and from the social sciences.

Much of the available research on Internet communication concerns text-based CMC, in which a sender types a message that is transmitted via networked computers and read as text on the recipient's (or recipients') computer screen(s). CMC of this type, which was all that was generally available until the mid-1990s, is interactive and reciprocal, in that recipients can reply in the same manner in which the message was sent. Also reviewed are interactive uses of multimodal CMC—text combined with two-dimensional or three-dimensional graphics, video and/or audio—including communication via the World Wide Web, which combines interaction with features of broadcast media. Nonreciprocally interactive mass media and commercial uses of the Web, however, are excluded from this review.

The body of the chapter is organized into three principal sections. The first section, following immediately below, introduces a classification of CMC types in terms of mode, and reviews the history and characteristics of nine CMC modes on the Internet: e-mail, listservs, Usenet, split-screen talk protocols, chat, MUDs, the World Wide Web, audio- and video-based CMC, and graphical virtual reality (VR) environments. The second section evaluates what Internet CMC research can tell us in relation to claims about CMC—most focusing on its technologically imposed limitations—made on the basis of pre-Internet research. The third section identifies new communicative phenomena enabled by the Internet and surveys research into the opportunities and challenges they raise. The chapter concludes by identifying directions for future CMC research.

## Modes of CMC

Perhaps the most important cumulative finding of Internet research over the past fifteen years is that computer-mediated communication varies according to the technologies on which it is based, and according

to its contexts of use. Thus synchronous CMC (e.g., real-time chat) differs systematically from asynchronous CMC (e.g., e-mail, in which sender and receiver need not be logged on at the same time) in message length, complexity, formality, and interactivity—due, in part, to temporal constraints on message production and processing (Condon & Čech, forthcoming; Ko, 1996). Other system features that influence communication include the granularity of message transmission (message-by-message, as opposed to character-by-character; Cherny, 1999), buffer size, the availability of multiple channels of communication, and default settings regarding the quoting of previous messages (Severinson-Eklundh & Macdonald, 1994).

At the same time, contextual factors associated with the situation of use can cause system-based generalizations to break down. Differences in user demographics, including age, gender, race, and level of education, can result in different communication styles and content, even among users of the same CMC system (Burkhalter, 1999; Herring, in press a). Such differences may cut across technological boundaries, as, for example, gender differences in verbal aggression, which are characteristic of both synchronous and asynchronous CMC (Herring, in press b). Additionally, purpose and topic of communication cause recreational chat, for instance, to differ in coherence and tone from pedagogical chat (Herring & Nix, 1997). Other situational variables found to influence online communication include participant structure (e.g., the number of participants, and whether the communication is public or private; Baym, 1995), social network density (Paolillo, 2001; Wellman, 1997), and language choice (Paolillo, 1996).

These findings suggest that CMC types could be identified for the purposes of study and comparison on the basis of individual technical and contextual variables, e.g., synchronous vs. asynchronous, recreational vs. pedagogical, male vs. female, or as a combination of such variables. In fact, most observation-based Internet research of the sort reviewed in this chapter (in contrast to experimental CMC research) does not classify its object of study purely by abstracting out its variable dimensions, but rather (or additionally) situates it within a popularly recognizable (named) *mode*. A mode is a genre of CMC that combines messaging protocols and the social and cultural practices that have evolved around their use (Herring, in press a; Murray, 1988), although

the “cultures of use” of newer CMC technologies may be emergent or latent. Thus social MUDs are a mode distinct from Internet Relay Chat, in that each has its own history and norms (Cherny, 1999) even though both are forms of synchronous CMC used predominantly by young people for recreational purposes. CMC mode thus provides a cultural context within which observations about online communication can be interpreted. The following subsections review the major CMC modes currently in use on the Internet—their historical origins, their system design features, their typical contexts of use, and a representative sampling of issues that have been researched in relation to each. Examples of communication are provided for newer or less common modes with which some readers may be unfamiliar.

The emergence of CMC modes is closely tied to the history of the Internet itself. For the purposes of this review, the Internet is defined broadly to include its predecessor the ARPANET (see historical overview in Lynch and Preston, 1990), the Usenet (which developed alongside the ARPANET/Internet but was eventually subsumed by it; see Hauben and Hauben, 1997), and the World Wide Web (see Berners-Lee, 1996, for its genesis and subsequent development). Internet history has been chronicled in numerous books, articles, and Web sites that focus variously on the development of computer networking technology and infrastructure (Leiner et al., 1997; Salus 1995), its human inventors and the contexts in which they worked (Hafner & Lyon, 1996), and the genesis of specific modes of CMC such as bulletin board systems (Rheingold, 1993) and MUDs (Reid, 1994). The key events in this history can be situated along a time line as in Figure 3.1. For a more detailed timeline of the development of the Internet, see Dodge & Kitchin (2000).

In what follows, each mode is presented in the approximate chronological order in which the technology on which it is based first appeared.

### *E-Mail*

In the 1960s, a computer professional using a time-sharing system could leave text messages on the system for another user to read when he later logged on (Licklider, Taylor, & Herbert, 1968). The first electronic mail or “e-mail” message to be transmitted between two networked computers was sent in 1972, by engineer Ray Tomlinson as a test of the SNDMSG protocol he was developing (Hafner & Lyon, 1996,

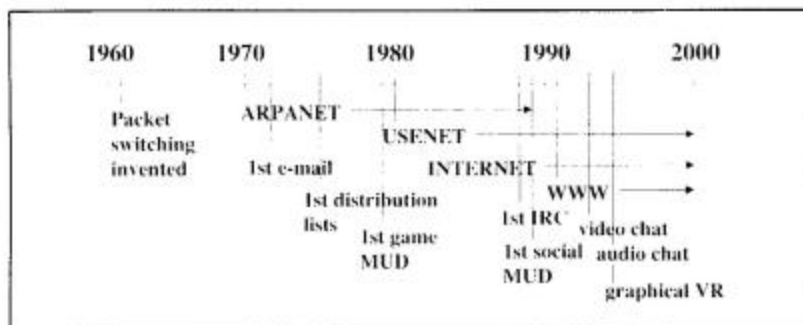


Figure 3.1 The co-evolution of the Internet and CMC

p. 191). By 1973, e-mail had become the most popular use of the U.S. defense-funded ARPANET, to the surprise of its inventors, who had intended the network primarily as a vehicle for the transmission of data and computer programs (Rheingold, 1993; but see Licklider et al., 1968, who foresaw the potential of computer networks to enhance human-to-human communication). Person-to-person e-mail remains one of the most popular uses of CMC on the Internet today (Baron, 2000; Hoffman, Kalsbeek, & Novak, 1996).

E-mail is text-based, asynchronous, and involves message-by-message transmission. A distinctive feature of the e-mail message that dates back to the early 1970s is its header, containing "to," "from," and "subject" lines as well as routing information (Hafner & Lyon, 1996). The presence of the header causes an e-mail message to resemble a written memorandum structurally, although a comparative study conducted by Cho (forthcoming) found that private e-mail messages in an academic workplace setting were stylistically different from memoranda: more informal and nonstandard in their use of spelling and punctuation. E-mail messages also share structural features with letters: they often include epistolary formulae such as greetings (e.g., "Hi"), closings (e.g., "Best,") and signatures (Cho, forthcoming; Herring, 1996b), and, like a letter, tend to display a three-part structure (opening-message-body-closing; Condon & Čech, forthcoming; Herring, 1996b). These features can reveal personal information about the sender and receiver, making e-mail less anonymous than other (i.e., synchronous) textual modes of CMC (Danet, 1998; Donath, 1999).

The asynchronous nature of e-mail allows users to take time to compose and edit their messages, and the casual informality of some users' e-mails is counterbalanced by the existence of e-mail messages that are carefully edited, formal, and linguistically complex (Herring, 1998a). Asynchronicity also means that users can communicate at their temporal convenience, without the requirement that message recipients be logged on. These features, together with a text-only interface that allows users to manage their self-presentation to a greater extent than face-to-face or telephone communication, account in part for e-mail's enduring and widespread popularity for both personal and professional communication (Sproull & Kiesler, 1991; Walther, 1996).

Relatively few studies have been carried out on private e-mail exchanges, due, perhaps, to the ethical issues involved in accessing and studying them. Some exceptions are Cho (forthcoming) on the informality of e-mail messages in comparison to memoranda in a workplace setting; Rowe (forthcoming) on the evolution of a private e-mail style between adult sisters, and Severinson-Eklundh (forthcoming; Severinson-Eklundh & Macdonald, 1994) on the practice of "quoting" parts of messages in e-mail responses. Anecdotal evidence suggests that women send longer and more frequent private e-mails than men, and that geographically dispersed family members who use e-mail communicate more frequently and more openly with one another than they did before e-mail (Cohen, 2001).

### Listserv Discussion Lists

Discussion lists—also called distribution lists and mailing lists—distribute e-mail messages posted to a listserv (or *listserv*) to a list of subscribers. One of the earliest discussion lists, MsgGroup, was started in 1975 by ARPA personnel to share information about the development of electronic messaging protocols, and continued to function with the same moderator, Einar Stefferud, until 1986 (Hafner & Lyon, 1996). Another early discussion list that started around the same time was sf[science fiction]-lovers (Hafner & Lyon, 1996). The late 1980s and early 1990s saw an explosion of listserv discussion lists devoted to more-or-less intellectual topics, reflecting the interests of the primary users of the Internet at that time, people affiliated with universities. In the mid-1990s the range

of topics widened, although listserv lists still tend to attract an academic and professional readership.

Discussion lists, like e-mail, are textual and asynchronous, the primary difference being that in the former, messages are distributed via a listserver to multiple participants as the default. A listserver also maintains a list of subscribers, and can archive messages and other textual resources and make them accessible to subscribers on demand (Millen, 2000). Moderated discussion lists, in which messages are filtered through a person (or persons) who approves them for distribution, offer the possibility for control over message tone and content (Korenman & Wyatt, 1996). For subscribers, electing to receive a day's worth of messages in a single-message "digest" is a means for managing the high message volume generated on some lists (Sproull & Kiesler, 1991).

The culture of discussion lists on the Internet has been influenced by their professional and academic origins. Research has found that discussions tend to focus on information exchange (queries and responses), although debate of issues, including contentious debate, is not uncommon (Herring, 1996b; Hert, 1997; Mabrey, 1997). The tendency for group asynchronous discussions on the Internet to degenerate into polarized disagreement has been attributed variously to the depersonalizing effects of the text-only medium (Kiesler, Siegel, & McGuire, 1984; Kim & Raja, 1990), to male-gendered communicative practices (Herring, 1994), and to reduced social accountability resulting from the fact that, in contrast to private e-mail, participants in Internet discussions are often not previously acquainted and may never meet face to face (Friedman, Kahn, & Howe, 2000). Despite this tendency toward contentiousness, discussion groups are sometimes characterized as "virtual communities," especially when their members have a pre-existing basis for interacting, such as geographical proximity (e.g., residence in the San Francisco Bay Area, in the case of *The WELL*; Rheingold, 1993) or professional affinity (women in computer science, in the case of *Systems-L*; Camp, 1996). This latter perspective emphasizes the positive nonmaterial resources—such as support, advice, and information—that are shared in online groups (Preece, 2000; Wellman & Gulia, 1999).

Because of open membership policies and the availability of public message archives, discussion lists are easily accessible to researchers interested in group computer-mediated communication. In addition to

the topics mentioned above, studies have investigated the functional content of messages (Herring, 1996b; Rafaeli & Sudweeks, 1997); patterns of posting over time (Millen, 2000); group dynamics (Hert, 1997; Korenman & Wyatt, 1996); "netiquette" (Herring, 1994, 1996a); "lurking," or reading messages without posting (Nonnecke & Preece, 2000); topic decay (Lambiase, forthcoming), and the effects of gender on participation (Hall, 1996; Herring, 1993, 1996a, in press b; Herring, Johnson, & DiBenedetto, 1992, 1995; Selfe & Meyer, 1991; Sierpe, 2000). A diachronic study identified changes in formality and politeness over an eleven-year period in an early discussion list (Herring, 1998a).

### *Usenet Newsgroups*

Originally intended as a populist alternative to the government-supported ARPANET, which was then available only at a few elite universities, Usenet news was developed in 1979 by three graduate students at Duke University and the University of North Carolina. The name Usenet was meant to represent "Unix Users Network"; instead of packet switching and TCP/IP, Usenet made use of the Unix-to-Unix Copy Program (UUCP) file sharing protocol (Rheingold, 1993). The first four Usenet nodes were established in 1980, and by 1988 had expanded to 11,000 (Hauben & Hauben, 1997); in 1999, posting to Usenet was the third largest activity on the Internet, after e-mail and browsing the Web (Smith, 1999).

Usenet is an asynchronous bulletin board system in which e-mail messages are posted to a publicly available site; users access the messages via a newsreader client (or, since the mid-1990s, a Web browser), which allows them to view messages either in the temporal sequence in which they were posted, or grouped into "threads" according to subject line. Communication takes place within "newsgroups," which are organized into hierarchies by topic and named with identifiers in order of increasing specificity (e.g., comp.sys.mac, soc.culture.jewish, alt.sex.fetish.spanking). In 1999, Smith estimated that there were 79,000 newsgroups worldwide. To create linkage among messages in what is otherwise a vast and potentially fragmented communication space, users frequently cross-post messages to other newsgroups (Smith, 1999) and "quote" portions of other messages (Baym, 1995; Hodsdon, forthcoming; Severinson-Eklundh, forthcoming).

Social accountability is low on Usenet. Unlike listserv lists, which maintain records of subscribers' names and e-mail addresses, unmoderated Usenet newsgroups have no means of monitoring who reads or posts to them. Reduced social accountability, combined with the libertarian value on uncensored speech that Usenet inherited from the hacker culture of its early developers and users (Pfaffenberger, 1996), often gives rise to "flaming," or hostile message content (Ebben, 1994; Kim & Raja, 1990; Spertus, 1997; Sutton, 1994). Other antisocial behaviors common on Usenet include "spamming," or sending the same message multiple times (Marvin, 1995), and "trolling," or pretending to ask a naïve question in order to provoke flaming (Donath, 1999; trollfaq, <http://www.altairiv.demon.co.uk/afaq/posts/trollfaq.html>). In 1992, 95 percent of Usenet users were estimated to be male (Sproull, quoted in Kramarae & Taylor, 1993); today, although male and female Web users in the United States have reached numerical parity (Rickert & Sacharow, 2000), males still make up a majority of Usenet posters.

Usenet messages are publicly accessible, and organizations such as Dejanews have been archiving Usenet postings in searchable databases since 1995. With the recent purchase of Dejanews by Google, the nature of these archives is changing; for example, users may now delete their Usenet posts from Dejanews. The ready availability of data has made Usenet a popular focus of CMC research. In addition to the studies mentioned above, research has investigated participation patterns in very large-scale conversations (Jones & Rafaeli, 2000; Sack, 2000; Smith, 1999); community formation (Baym, 1995; MacKinnon, 1995; McLaughlin, Osborne, & Smith, 1995); identity, authenticity, and deception (Burkhalter, 1999; Donath, 1999); differences between new and experienced participants (Weber, forthcoming); use of languages other than English (Paolillo, 1996, 2000); support groups (King & Moreggi, 1998; Sharf, 1999); and hate speech (Hodsdon, forthcoming; Zickmund, 1997).

### ***Split-Screen Protocols: Talk, Phone, and ICQ***

The earliest synchronous protocol, UNIX "talk," was available in the 1970s alongside e-mail (Hafner & Lyon, 1996). However, it was felt by the ARPANET developers on MsgGroup (see "Discussion Lists" earlier) to be less useful for multiparty conferencing than e-mail, and was not

developed for the Internet until years later. "Talk" and the similar VAX "phone" utility are synchronous protocols in which two (or in the case of "phone," up to three) users logged on to a UNIX or VAX system at the same time can "talk" via text. Each user's monitor screen splits horizontally into two or three sections, and their messages appear character-by-character, scrolling independently within each section. In the mid-1990s, this concept was incorporated as an option into the ICQ ("I Seek You") Internet communication network developed by Mirabilis Ltd. in Israel. Although talk and phone are limited to UNIX and VAX users who know of their existence, ICQ has become widely popular; in 1999, over 11 million people were using ICQ on a daily basis (Zastrow, 1999). This figure includes all ICQ activity, not just chatting. ICQ also has paging and file transmission features (Zastrow, 1999). The official ICQ Web site (<http://www.icq.com/icqtour/rendezvous.html>) listed the total number of users as of November 2000 as over 82 million.

Split-screen protocols differ from other forms of CMC currently available in using character-by-character transmission, rather than message-by-message transmission, as is the case for e-mail (Cherny, 1999, terms this distinction "two-way" vs. "one-way" transmission). Character-by-character (two-way) transmission has consequences for interaction management: Users often anticipate how another's sentence will end, and begin typing before the other finishes, resulting in a high incidence of overlap and more efficient communication (in the sense of requiring fewer words) overall (Anderson, Beard, & Walther, forthcoming; Woodburn, Proctor, Arnott, & Newell, 1991). McGrath (1990) claims that two-way CMC systems render turn-taking "irrelevant." A second feature of such systems that shapes communication is their use of a split-screen interface; this limits the number of participants because of the space required for each scrolling window. Such interfaces are difficult to log and archive (Herring, 1999a), making communication in this mode ephemeral. The screen capture in Figure 3.2 shows the messages produced by two users after approximately five minutes of conversation, but does not preserve the temporal sequence of the messages. ICQ allows users to save logs of their chats, but the logs follow a one-way transmission format, with turns following one another in sequence, and no overlap indicated.

The ephemerality of split-screen conversations combined with their mostly private, one-to-one nature makes them less amenable to study than public, more persistent forms of CMC. No naturalistic

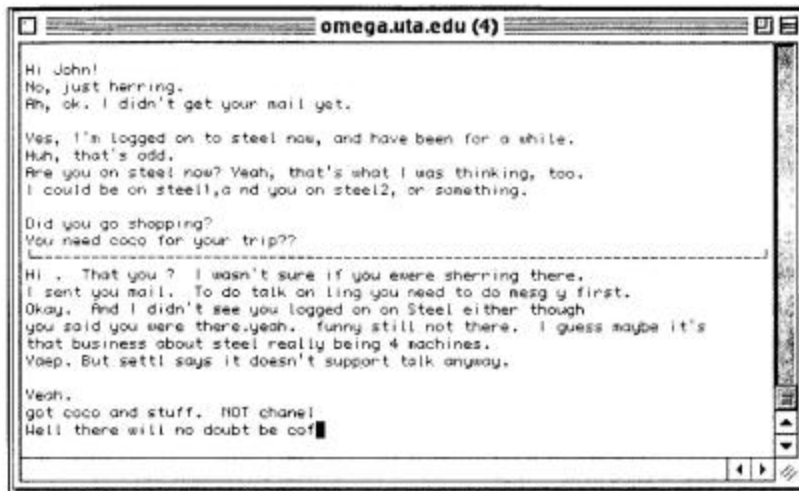


Figure 3.2 An example of UNIX "talk"

(i.e., nonexperimental) studies of use of talk, phone, or ICQ were available to the author at the time of this review.

## Chat

The first chat program, Internet Relay Chat (IRC), was written in Finland in 1988 by Jarkko Oikarinen, a student at the University of Oahu, to enable synchronous communication among multiple participants (Piocch, 1997). The IRC chat protocol was later adapted for use by Internet service providers such as AmericaOnline (AOL), and on Web sites, where it is known as "Web chat." More recent Web-based chat programs make use of color and graphics in addition to text. Over the past decade, chat has become popular on a global scale, especially among younger users (Danet, Ruedenberg-Wright, & Rosenbaum-Tamari, 1997).

Chat is synchronous and involves message-by-message (one-way) transmission. Users connect to a chat site, join "channels" (on IRC) or "rooms" (on AOL), and communicate by typing typically brief (one-line) messages, which are transmitted in their entirety when the user presses the "send" key. Messages are displayed to everyone in the room or channel in the temporal order in which they are received, with the user's nickname appended automatically before each message (Figure 3.3).

Users can scroll back to read earlier messages within a limited buffer, making chat less ephemeral than split-screen protocols, although sessions are not automatically logged. Perhaps one of the most striking features of chat conversations is that they often initially appear chaotic. When multiple participants are involved, messages can scroll quickly up and off the screen. Further, chat systems disrupt patterns of turn taking, due to the tendency of overlapping exchanges to cause an initiating message and its response to become separated by irrelevant messages (Herring, 1999a). However, the same features that render chat fragmented and chaotic also make it popular. Loosened turn-taking fosters playfulness (Danet et al., 1997; Herring, 1999a), and simultaneous multiple conversations foster enhanced interpersonal—what Walther (1996) terms "hyperpersonal"—interactivity (Herring, 1999a).

The culture of chat rooms, although varying according to purpose, is typically sociable, playful, and disinhibited. Much chat content is phatic, indeed banal, and chat conversations tend to be stylistically informal (Werry, 1996). Topics decay quickly, making unstructured chat uncondusive to extended, focused discussion (Herring & Nix, 1997), although users who chat together on a regular basis can develop strategies for maintaining coherence (Herring, 1999a; Schlager, Fusco, & Schank, in press). The requirement on most public chat sites that each user select a nickname (effectively, a pseudonym) creates an environment conducive to play, flirting, and other activities for which the user may wish to avoid being held socially accountable (Bechar-Israeli, 1995; Danet, 1998).

As a very popular and publicly-accessible CMC mode, chat has attracted the attention of a number of Internet researchers. A commonly described feature of chat (and synchronous CMC in general) is the use of abbreviations (e.g., lol "laughing out loud"), nonstandard spellings, and ASCII graphics (Ferrara, Brunner, & Whittemore, 1991; Livia, forthcoming; Murray, 1990; Reid, 1991; Werry, 1996; Wilkins, 1991). Many researchers point to typographic and orthographic innovations as evidence of users' attempts to compensate for the lack of vocal, facial, and gestural cues in text-only CMC (Daft & Lengel, 1984; Herring, in press a; Kiesler et al., 1984; Reid, 1991). Other aspects of group chat that have been researched include choice of nickname (Bechar-Israeli, 1995), influence of social network ties (Paolillo, 2001), community formation (Liu, 1999), expression of gender identity

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<Kayleigh> wulf you never told me you were a man, im
shocked
*** Signoff: d|0_o|b (Off to Hell!)
<hippygirl> hi all
<aOK-88> I demand Fax SEX NOW!!!!!!
*** csyen has left channel #chatzone
*** |PseudO| (xxxx@xxx##.xxx.xxx) has joined channel
#chatzone
<wulferina> lol
<^ducky> you wouldnt know what sex is would you aOK
*** snacks has left channel #chatzone
*** PhoneSex- (XXXXXxx@xxxx.xxx.xxx) has joined channel
#chatzone
*** DelilA has left channel #chatzone
<MARY-J> Hello frod.
*** fartmunch (xxXX@xxx.xx-xxxx.xxx) has joined channel
#chatzone
<smoothman> hello hippygirl

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Figure 3.3. An example of Internet Relay Chat

(Herring, 1998b; Rodino, 1997; Soukup, 1999), and sexual harassment (Herring, 1999b). Figure 3.3 shows an example of Internet Relay Chat from the EFNet channel #chatzone.

### Private Chat

From the outset, IRC allowed users to chat privately. They could use the "/msg" command for occasional private comments, or open a person-to-person dcc (direct client-to-client) connection (Pioch, 1997), enabling backchannel communication to take place in parallel with public group chat. Alternatively, two or more users could create a private channel for extended, independent chat. Similar features are available on MUDs (see below) under the command names "whisper" and "page;" MUD users can also create private rooms (Cherny, 1995, 1999).

However, the versions of chat popularized on AOL and on some Web sites do not preserve these private messaging features. To fill the gap, AOL implemented "instant messaging" (IM), a synchronous means of exchanging short text messages with others logged on to AOL at the same

time. IM has a feature, shared by ICQ, that makes it highly popular: a user can designate a list of people with whom she is potentially interested in communicating, and the system will inform her when any of those people are logged on to the system, and hence potentially available for interaction. IRC has this feature as well, via the "/notify" command (Pioch, 1997). Instant messaging protocols have since been developed for other systems; one of the most widely used is included with the Microsoft Outlook mail software (CyberAtlas, 2001). In 2000, IBM employees sent over one million instant messages a day to each other (Dean, 2001), and the number of instant messaging users worldwide is predicted to reach 180 million by 2004 (CyberAtlas, 2001). Accordingly, the culture of private chat has evolved from primarily social uses among teenagers, to workplace use (Dean, 2001).

Privacy issues surround the study of person-to-person communication, and instant messaging is a relatively recent phenomenon; as a consequence, little research is available that investigates private chat. McRae (1996) interviewed participants on a social MUD about virtual sex, most of which takes place through private conversation. Cogdill, Fanderclai, Kilborn, and Williams (2001) captured text logs from the perspective of a single user on an educational MUD, and analyzed the interplay of private backchanneling with public classroom activities. According to anecdotal report, instant messaging is becoming the preferred mode of CMC in some workplaces (Dean, 2001), its purported advantages over e-mail being "contact management and the ability to configure different levels of availability" (Scevak, 2001, online).

### Multi-User Dimensions (MUDs)

MUDs are multi-user virtual reality environments in which users can navigate a textual representation of a spatial environment and engage in synchronous chat with other participants logged on to the MUD. In some user-extensible MUDs, users also have the option to interact with programmed objects, create new objects, and extend the environment itself. The first MUD, created in 1979 and 1980 by Roy Trubshaw and Richard Bartle, students at the University of Essex in England, was a role-playing adventure game modeled on earlier single-player online games such as "Rogue" and the popular group face-to-face game "Dungeons and Dragons" (Cherny, 1999; Reid, 1994; Rheingold, 1993).



The acronym MUD originally meant "Multi-User Dungeons," but was reinterpreted to mean "Multi-User Dimensions" with the rise in popularity of social MUDs in the late 1980s and early 1990s. MOOs (MUDs, Object Oriented) date to 1991 and represent an advance in MUD programming; today most MUDs are technically MOOs (Cherny, 1999). Access to MUDs is via telnet or one of a number of MUD clients currently downloadable for free from the World Wide Web. Although still somewhat limited to users in the know, adventure MUDs such as EverQuest and Ultima Online enjoy a growing popularity on the Internet (Kolbert, 2001), alongside social MUDs such as LambdaMOO (Curtis, 1992), and educational MUDs such as MediaMOO (Bruckman & Resnick, 1995) and LinguaMOO (Haynes & Holmevik, 1997).

MUDs resemble IRC and other chat systems in their communicative affordances, making available a similar range of textual communication commands (Cherny, 1995, 1999), and often exhibiting overlapping exchanges, abbreviation, and language play (Cherny, 1999; Kendall, 1996). At the same time, MUDs also preserve some game-like features from their origin as adventure role-playing games. By convention, users take on pseudonyms and describe their "characters" in nonrealistic terms. They also navigate through a virtual playing field defined in terms of a geographical metaphor (e.g., a house, a university, a fantasy landscape; Anders, 1999; Giese, 1998), and accrue power and influence, e.g., "wizard" status, the longer they "play" (Cherny, 1999; Reid, 1994). These features, which are present to some extent in all three major MUD genres (educational MUDs generally do not allow students to attain wizard status), encourage playful behavior (Cherny, 1999; Danet, 1998), including the collaborative enactment of narrative fantasies (Kolko, 1995) and experimentation with gender identity (Bruckman, 1993; Danet, 1998; McRae, 1996). The geographical metaphor also symbolically defines the boundaries of interaction within a MUD, leading to a possibly greater perception of groupness or virtual community than in other text-based modes of group CMC (Cherny, 1999; Reid, 1994). This perception, combined with the user-extensible nature of social MUD environments, leads users to commit time and energy to MUDs, reinforcing the users' sense of belonging, and sometimes leading them to resent the presence of outsiders whose commitment to the MUD is perceived to be weaker than theirs (Cherny, 1999).

Access to MUDs may be limited formally (one must have a registered "character" in order to carry out a full range of possible behaviors) and informally (guests and newcomers may be treated with suspicion). Despite these potential obstacles to participation, and despite (or perhaps because of) their relatively restricted, "exotic" status, MUDs have attracted the attention of many Internet researchers with interests in, among other topics, antisocial behaviors and sanctions against them (Dibbell, 1993; Reid, 1994); systems of MUD governance (Curtis, 1992; Kolko & Reid, 1998); power hierarchies (Cherny, 1999; Reid, 1998); gender switching (Bruckman, 1993; Danet, 1998; McRae, 1996); virtual sex (Deuel, 1996; McRae, 1996); community social activities, including online weddings (Jacobson, 1996; Turkle, 1995); and psychological issues such as escapism and MUD addiction (Turkle, 1995).

Figure 3.4 displays a sample of a session from a MUD (HoloMUCK) that includes navigation and the use of the "page" command. The "You" in line 8 refers to the user; other players see the name of his character, Kilian.

### The World Wide Web

The World Wide Web, conceptualized in 1989 by British scientist Tim Berners-Lee of the CERN (European Organization for Nuclear Research) in Geneva, was implemented on the Internet in 1991.

```
w
You head west...
Main Street (800W)
This once-desolate section of Main Street is looking busier
these days.
To the north, at 800 W. Main St., stands the Red Dragon Inn.
[Obvious exits: north, w, e]
page dex= are u free tomorrow between 8 Your pager vibrates
slightly. and 10..am??
You page, " are u free tomorrow between 8 and 10..am??" to
Dex.
01) Dex pages: "no, not till tomorrow night"
Time> Tue Oct 31 19:54:33 1995
```

Figure 3.4. An example of MUD Communication (Anders, 1999, pp. 139–140)

Berners-Lee's goal, influenced by Bush's (1945) proposal for the "memex" machine and Nelson's (1967) ideas about "hypertext," was to create a shared information space through which large numbers of people and machines could communicate via associative links (Berners-Lee, 1996). However, it was not until the introduction of the Mosaic graphical Web browser in 1993 that the Web became widely accessible. The cessation of National Science Foundation funding for the Internet backbone in 1995, and the subsequent increase in commercial involvement with the Internet, gave further impetus to the development of the Web, primarily as a marketing medium (Goggin, 2000; McChesney, 2000). Commercial uses currently dominate the Web; according to a recent estimate, at the end of 1999 there were about five million Web sites, some containing up to 100,000 pages, of which 54.7 percent were in the .com domain, as compared to only 6.7 percent with the .edu suffix (Cybermetrics, 2000). In response, in part, to the number and heterogeneity of .com sites, in November 2000 new domain names were approved that added categories such as .info and .biz (Associated Press, 2000). Web browsing is currently the "killer ap" of the Internet, rivaling e-mail in popularity (Pastore, 2000).

In one sense, the Web subsumes and integrates all other CMC modes, making it a "meta" mode (Soukup, 2000; Wakeford, 2000). It can link to chat interfaces, discussion lists, Usenet newsgroups, and e-mail—in addition to Web pages written in Hyper-Text Mark-up Language (HTML)—because of its hypertextual nature (but see Jackson, 1997, who argues that the Web is not hypertextual in a strict sense). The Web also links different communication media (text, graphics, audio, and video), thereby subsuming multimedia CMC applications as well (O'Sullivan, 1999). Viewed from this perspective, the range of characteristics associated with Web communication is very broad. In another sense, we may consider the practices of writing HTML documents, creating links between documents, and navigating the interconnected space defined by those links to be unique to the Web, and describe them alongside other CMC modes.

Surprisingly, given its popularity, the Web has been relatively little studied as an interpersonal communication medium. There appear to be two reasons for this: (1) Web-based communication is less interactive than e-mail, discussion groups, or chat, causing some researchers initially not

to consider it a mode of CMC (Wakeford, 2000); and (2) the Web communicates meaning and structure through nontextual means, for which CMC researchers traditionally lack methods of analysis (Soukup, 2000). However, some researchers have explicitly addressed the extent to which the Web is an interactive, as opposed to a broadcast or mass, medium (Hoffman & Novak, 1995; O'Sullivan, 1999). Authoring and reading a Web page are asymmetrical activities in which the reader interacts with a machine—the page is not affected by the act of being read, nor does it respond. At the same time, the reader has the option to react by creating his own Web page that critiques or comments on the author's page (e.g., Coste, 2000), or by providing feedback via e-mail or other means to the author, who could choose to change his page in response. Moreover, Web sites may incorporate opportunities for direct interaction between users and sites, ranging from information boxes to be filled in, to the possibility of entering content directly onto the site, to intelligent interfaces that "learn" and "remember" visitors' preferences from visit to visit (O'Sullivan, 1999). In these respects, the Web is clearly more interactive than traditional mass media. A second theme is the communication structures created by the web of links themselves, which, as Jackson (1997) points out, involves selection and thus can serve different agendas by focusing users' attention in particular ways. Related to this is the nature of users' navigational choices, and the meanings created by following different paths through a network of links. Other topics researched include the genre conventions of personal home pages (Cheung, 2000), the characteristics of Web sites that cause "fascination" (Smit, 2000), or a "flow" experience for viewers (Hoffman & Novak, 1995), and Web communities (Mallapragada, 2000; Pullen, 2000).

### **Audio and Video**

The World Wide Web enabled the incorporation of sound and moving images into Web pages. In a parallel development to the Web, members of the Cornell University Information Technology Department launched CUseeMe, the first Internet audio and video conferencing software, in 1993 (Dorcey, 1995; Meloan, 1995). CUseeMe combined text-based chat with one-way audio and video transmission, the latter requiring only an inexpensive videocam placed atop each transmitter's computer. Because the CUseeMe program was free and used standard Internet bandwidth,

it caught on quickly, despite the low quality of its transmissions: the small black and white video image was grainy and jerky, the sound frequently broke up, and sound and video were not synchronized (Meloan, 1995; Sloan, 1997). Since being taken over commercially in 1998, CUseeMe (along with Microsoft NetMeeting and other Internet conferencing programs) has taken advantage of the increasing bandwidth of the Internet to improve audio and video transmission (which now includes color and two-way transmission) and added group conferencing, application sharing, and whiteboard features (<http://www.cuseeme.com>).

A related development was the introduction in 1995 of free telephony via the Internet ([www.pulver.com](http://www.pulver.com)). As in the case of video chat, voice calls over the Internet are of lower quality than traditional telephony, being subject to delays, distortion, and break-up of the data stream, but they are inexpensive, requiring only standard sound software and an Internet connection (Hill, Ozer, & Mace, 1996). A number of products has been developed, including Internet Phone, Netscape CoolTalk, and Netspeak WebPhone, all of which allow multiple calls to be conferenced. While currently limited in use, calls made over IP-based networks are predicted to account for 35 percent of all telephone network traffic by the year 2002 (Berat, 1996).

Despite the fact that both involve point-to-point (one-to-one) transmission, video- and audio-based modes of CMC have given rise to communities of users on the Internet. CUseeMe servers (or *reflectors*) list names of persons interested in videochatting with strangers (Sloan, 1997), and individuals maintain Web sites with screen shots of CUseeMe friends with whom they videochat on a regular basis ([www.cheznims.com](http://www.cheznims.com)). According to Sloan (1997), video conferencing bridges distance and builds relationships, due to the greater richness of the channel compared to plain text (see also Neal, 1997; Walther, 1999). Similarly, Internet telephony companies maintain lists at their servers of interest groups—"chat rooms" organized by topic (e.g., programming enthusiasts, sex groups)—where users can initiate and accept conversation. According to Hill, Ozer, and Mace (1996, online), some Internet phone communities "resemble the rough-and-tumble world of Usenet newsgroups."

Because of their one-to-one nature and low degree of persistence, little information exists at present about the nature of communication in

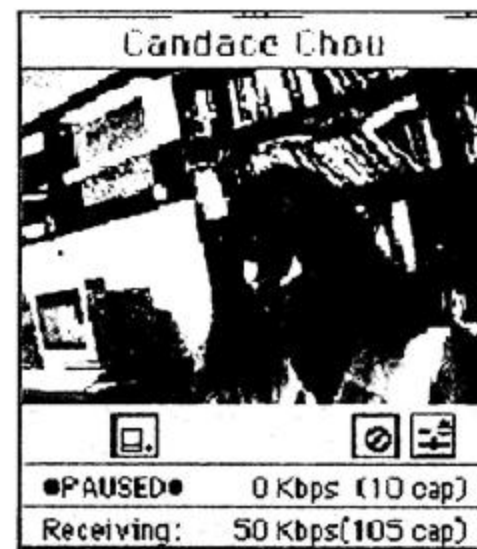


Figure 3.5 A video image on CUseeMe (Chou, 1999)

audio and video chat, apart from anecdotal reports. One suggestive study (Yates & Graddol, 1996) compared CUseeMe, IRC, telephone, and face-to-face conversation, and found that CUseeMe users talked more about themselves and their physical appearance than did conversants in any other mode.

### Graphical Virtual Reality (VR) Environments

Graphical virtual reality environments, introduced to the Internet in the mid-1990s, trace their genesis to developments in networked multi-participant computer gaming—e.g., George Lucas' graphical Habitat environment that ran on Commodore 64 computers in the mid- to late-1980s (Mauz, 2000)—and nonimmersive (desktop) virtual reality simulation (Robertson, Card, & Mackinlay, 1993). Expanding the concept of group chat protocols such as IRC and MUDs, the first graphical VR environments were designed to combine text-based chat with graphics depicting a physical backdrop or space, such as a room in a house or an outdoor scene. An early prototype of the Palace, in fact, made use of an IRC client (Bumgardner, 1994). Users—represented by graphical icons

or *avatars*—navigate through a virtual space using the mouse or computer keyboard, exploring, interacting with the environment, and, if they have permission, building in it. Two of the earliest and best-known such environments are the Palace (two-dimensional graphics), developed by Jim Bumgardner for Time-Warner corporation in 1994 and opened to the public in November 1995, and AlphaWorld (later ActiveWorlds, using three-dimensional graphics), developed by Ron Britvich for Knowledge Adventure Worlds (later Worlds, Inc.) and released publicly in June 1995. Both environments have attracted and maintained active communities of users up to the present, despite difficulties that have arisen due to internal struggles (Scannell, 1999; Suler, 1996), as well as to changes in ownership and technical support (Eep2, 2000; Suler, 1996). The Palace is currently owned by Communities.com (<http://www.communities.com>), and Active Worlds by ActiveWorlds.com (<http://www.activeworlds.com>).

Graphical VR environments make the metaphor of physicality in text-based MUDs literal and explicit. Members, or *citizens*, “own property,” and issues of territoriality may arise in interaction, as, for example, when a gang of disruptive users began vandalizing others’ buildings in the first year of AlphaWorld’s existence (Rookie’s AlphaWorld Report, <http://www.geocities.com/CapitolHill/2333/rookie.html>), or when users of a different system, WorldsAway, began to socialize in their private apartments rather than hanging out in disorderly public places (Scannell, 1999).

The requirement that users take on physical representations of bodies, or avatars, has communicative consequences as well. In the Palace, avatars and backdrops are brightly colored and deliberately cartoonish (the default avatar is a disembodied smiley face [Bumgardner, 1994]), and users can create their own, giving rise to collections of avatars, some humorous, some menacing, some sexy, that a user can “wear” depending on her mood and the nature of the interaction (Suler, 1996). (The similarity to cartoons is reinforced by the fact that users’ words appear as typed text over their avatars’ heads, as well as in a line-by-line chat window (in the case of ActiveWorlds) below the graphics screen. In the Palace, users’ words are further enclosed in cartoonlike speech and thought bubbles.) A WorldsAway avatar can exchange heads with another avatar as a way to express a personal relationship

(Scannell, 1999). In contrast, ActiveWorlds avatars, at least in the U.S., favor realism: humanlike forms can perform automated movements such as dance or fight, and express emotions such as anger and joy through body movement (McClellan, 1996). According to the chairman and founder of Worlds, Inc., Dave Gobel, Americans are more “buttoned-down” in their taste for realism in 3D VR than are the Japanese, who prefer fantasy (Steinhardt, n.d.). In an experimental prototype, Vilhjálmsson (1997) has taken realism to its logical extreme by designing avatars with facial features that modulate to correspond to words typed, or to indicate subtle social meanings such as “recognition” of another avatar. As embodied representations, avatars also have a field of “personal space,” which can be violated by having another avatar located too close; Krikorian, Lee, Chock, and Harms (2000) found that relative distance between avatars in the Palace corresponds to differing degrees of personal liking. As Naper (2001) points out for a Norwegian ActiveWorld, visual design, perspective, location, and movement are semiotic signs that contribute meaning, and thus must be analyzed as part of computer-mediated communication.

Most studies to date of graphical chat environments have been ethnographic. Suler (1996) provides a first-person account of Palace history in its first year, including social tensions within the community based on new-old member status, wizard-nonwizard status, and problems raised by anonymity and an increasing user population. Scannell (1999) interviewed regular users about social practices in the Palace, WorldsAway (Dreamscape), and ActiveWorlds, pointing out tensions between individual and group interests that were also present in the 19th-century settlement of the American West. Another focus is community and the spontaneous social structures that evolve as groups of strangers share virtual space over a period of time. These structures include a police force and a community newspaper in ActiveWorlds (McClellan, 1996), and a social event organizing committee at the Palace (Suler, 1996). Overall, graphical VR environments appear to intensify many of the same social dynamics that have previously been observed in MUDs. Figure 3.6 shows a screen capture of an educational 3D graphical environment that makes use of the Active Worlds platform (used with permission from Katy Börner).



Figure 3.6 An example of a 3D graphical environment

## Early Claims About CMC Revisted

The bulk of the research surveyed in the previous section investigated spontaneous communication in culturally contextualized Internet modes. In contrast, much early CMC research based its claims on experiments in what Walther (1996) calls "zero-history groups," groups of people who have never interacted before (and who are unlikely to interact

again in the future), and who thus lack a shared CMC cultural context. Other influential early CMC studies were speculative in nature, basing their claims on predictive studies of managers' media choices (Walther, 1999), and/or reasoning deductively from the characteristics of the medium (Steinfeld, 1986), rather than making empirical observations (but see Hiltz and Turoff [1978], who made early observations about CMC use via a computer conferencing system). Most of this early research (with the exception of Hiltz and Turoff) focused on the ways in which CMC systems allegedly restricted or limited human communication relative to face-to-face communication. What does Internet communication tell us about the issues raised in previous CMC research and about CMC in general? This section considers the findings of observational Internet-based research in relation to three earlier claims, extending the claims as generalizations and evaluating the extent to which the Internet evidence supports or refutes them.

### Appropriate Uses

An influential early model for the interpretation of CMC was the theory of information richness proposed by Daft and Lengel (1984, 1986). According to this view, "lean" media such as text-based CMC, which make use of a single channel of communication, are best suited for straightforward, concrete tasks (such as scheduling), while rich, multiple channel media such as face-to-face speech are preferred for complex and ambiguous tasks (such as negotiation). The text-only nature of CMC further makes it low in "social presence" (Short, Williams & Christie, 1976; Spears & Lea, 1992), making it better suited for the transmission of factual, impersonal information than for relational communication.

It is difficult to address these claims directly, because nonexperimental research that considers the relationship between task and medium choice is rare (but see the ethnographic research of Murray, 1988 on computer professionals at IBM; and Perry, Fruchter, and Spinelli, 2001). However, indirect evidence can be brought to bear from Internet research. The overall content of communication on the Internet includes a high frequency of relational communication. This was first noted by Rice and Love (1987); in a study of socio-emotional content in a medical discussion list on CompuServ, they found that over 60 percent of messages contained such content, even though the participants were medical

professionals and the topic of the group was serious. More extreme counter evidence can be adduced from the widespread popularity of recreational chat environments (discussed earlier), friendships and marriages initiated through CMC (Jacobson, 1996; Lea & Spears, 1995; Parks & Floyd, 1996), and the perceived usefulness of CMC by many people for maintaining contact with distant friends and family (Hampton & Wellman, 1999). Even academic discussion lists contain more opinions and emotional debate than facts (Herring, 1996b). Thus, if the Internet has revealed one thing clearly, it is that CMC is not restricted to task-oriented, factual exchanges—the overall trend is in the opposite direction. Users are able to adapt to the text-only nature of the medium to express social and personal meanings, intimately and sometimes eloquently, as letter writers and authors of literary texts have done for centuries, suggesting that typed text is not in and of itself inherently impoverished.

Yet stating that relational communication occurs frequently does not exclude the possibility that such communication may be relatively more difficult or less successful in CMC. Here the evidence from the Internet is mixed: Miscommunication has been claimed to be common in CMC, especially with regard to the expression of affect (hence, the alleged need to use emoticons to express what one “really means” [Rivera, Cooke, & Bauhs, 1996]). Nevertheless, some users feel more comfortable communicating intimately via CMC, and prefer it to face-to-face interaction, in which they might not have such conversations at all (for example, with estranged family members). Thus the potential for misunderstanding caused by reduced social cues in CMC is offset, for some users, by the advantages of the editable text-only medium, which allows for greater reflection, distance, and control over impression management (Walther, 1996, 1999).

Conversely, stating that exchange of information is not the primary activity on the Internet is not the same as stating that information exchange is not facilitated by the medium. Indeed, the evidence suggests that the Internet promotes the exchange of information, as it also promotes interpersonal communication (Burnett, 2000; Wellman et al., 1996). At the same time, there is reason to question, in a general sense, the quality of information available on the Internet. The difficulty of verifying the reliability of a source (Donath, 1999; Fallis, 2000), and the lack of quality control on information posted, for example, on a newsgroup or the World Wide Web, means that for some users the ease and convenience

of the Internet may be overridden by concerns about quality and reliability. In short, while it seems intuitively correct that medium choice is sensitive to the nature of the task, other considerations also play a role where CMC is concerned, including those related to properties of the medium other than its text-only nature.

One such property is temporal synchronicity. Synchronous (real-time) CMC fosters significantly different communication behaviors from asynchronous CMC; synchronous messages tend to be shorter, less syntactically complex, more limited in vocabulary, more playful, and contain more phatic social communication (Danet et al., 1997; Ko, 1996; Werry, 1996) than asynchronous messages, which tend to be longer, more edited, more multifunctional, and more linguistically complex (Condon & Čech, forthcoming; Herring, 1999a). In keeping with these differences—which arise because of differences in temporal constraints on message production in the two CMC types—synchronous CMC appears to be better suited for social interaction and asynchronous CMC for more complex discussion and problem solving. Indeed, these respective strengths are reflected in the most common uses of synchronous and asynchronous CMC on the Internet.

It is not clear, however, how this difference reflects information richness, if at all. Arguing from the observed effects, information richness theory seems to suggest that synchronous CMC is “richer” than asynchronous CMC, and has greater social presence, because it is better suited for relational communication. This characterization is inconsistent, however, with the claim that greater social presence enables more complex interactions, in that synchronous CMC enables less complex interactions than asynchronous CMC. That is, synchronous CMC is both simple and highly relational. Thus the synchronicity distinction reveals that task complexity and the richness/social presence of a medium are not necessarily interrelated, contrary to the claim of information richness theory. Overall, the information richness and social presence models, at least as originally formulated, appear to make more incorrect than correct predictions about communication on the Internet. (See Rice & Gattiker [2000] for a somewhat different perspective on this topic.)

### **Social Effects**

Another highly influential early CMC theory is what is known as the cues-filtered-out view (Kiesler et al., 1984; Kiesler, Zubrow, Moses, &

Geller, 1985; Sproull & Kiesler, 1991). According to this view, CMC is characterized by a relative lack of physical and social cues, again due to its text-only nature, and this has consequences for social behavior. Kiesler and her colleagues conducted a number of experimental studies comparing CMC with face-to-face interaction, and found that subjects were more disinhibited and more polarized in arguments when using CMC. They interpreted this to mean that the lack of cues as to the identity of the addressee has a depersonalizing effect, causing users to forget that they are communicating with other human beings. They also proposed that CMC is more anonymous, and therefore more egalitarian, than face-to-face communication, in that cues to people's social status, gender, age, race, physical ability, etc., are absent (see also Barlow, 1996; Graddol & Swann, 1989).

On the face of it, the frequent recurrence of flaming and antisocial, aggressive behaviors in group environments on the Internet appears to support the claim that CMC causes disinhibition and polarization. Moreover, such behaviors tend to be reported most frequently in contexts where anonymity is high and social accountability is low, such as on Usenet (Kim & Raja, 1990; Pfaffenberger, 1996), MUDs (Dibbell, 1993; Reid, 1994), and the Palace in the early days before visitors were assigned registration numbers (Suler, 1996). In a longitudinal study of an early discussion list, Herring (1998a) found an increase in violations of politeness over time, raising the possible interpretation that the medium was to blame.

However, the claim that the computer medium necessarily causes boorish behavior has been challenged in Internet research. Lea, O'Shea, Fung, and Spears (1992) and Rafaeli and Sudweeks (1997) find that flaming is not a statistically predominant behavior in discussion groups, and indeed there are Internet environments in which it is almost completely absent. Moreover, Herring (1994, 1996a) finds that there is a gender component to flaming; it is carried out mostly by males, who also express a more tolerant attitude toward it than do females. In contrast, females tend to be polite and supportive; Hall (1996) suggests that asynchronous CMC exaggerates these behaviors relative to face-to-face communication. The cues-filtered-out model does not explain why anonymity and depersonalization should affect males differently from females, nor indeed why some users behave badly on a regular basis while others never do. A more

nuanced view is required, one that takes into consideration variables such as degree of anonymity, user demographics, topic, and purpose of communication (Baym, 1995; Herring, in press a).

The claim that gender, age, race, etc., are invisible in CMC also receives *prima facie* support from some Internet research. Cases of deception involving aspects of identity are not uncommon (Bell & La Rue, 1995; Bruckman, 1993; Donath, 1999; Turkle, 1995; van Gelder, 1990). At the same time, gender differences have been found in participation and discourse style (Hall, 1996; Herring, 1993, 1996a, 1998b; Savicki, Lingenfelter, & Kelley, 1997; for an overview, see Herring, in press b), and racial identity is also signaled discursively (Burkhalter, 1999; Jacobs-Huey, forthcoming). In general, most people interact in their real-life identities online, even if they choose an anonymous identifier, due in part to the difficulty of convincingly maintaining an identity that is foreign to their real-life experiences (Curtis, 1992; Cherny, 1999; Herring, 1998b). This is especially true in asynchronous discussion lists, where people wishing to enhance their reputations as experts on a given topic must sign their messages in order to receive recognition for their contributions (Donath, 1999). In short, the available evidence suggests that most users do not take advantage of the potential for anonymity that the Internet affords, with the result that some information about user identity is usually available, although the amount of personal detail available varies according to the circumstances and CMC mode. For example, an e-mail message typically conveys considerable information in its header (e-mail address, name, organization, date and time, route the message followed, etc.) and may contain a signature file with fax, phone number, URL to sender's Web page, and other details as well (Donath, 1999). In contrast, IRC messages reveal only senders' (nick)names, although a command allows others to view their e-mail addresses and the names of the servers from which they are logged on.

It follows that if users are not anonymous, differential status may attach to them, and communication will not necessarily be egalitarian and nonhierarchical. In asynchronous group discussion, a minority of users tends to dominate in amount of posting (Herring, 1993, forthcoming; Hert, 1997), with the majority lurking, or reading without contributing (Nonnecke & Preece, 2000). In one intriguing study, Selfe and Meyer (1991) found that the highest status members of an academic discussion

list (male professors) continued to dominate the discussion even during a two-week period when identifiers were stripped from messages as an experiment in anonymity. This suggests that what encourages high rates of participation are factors such as self-confidence and perceived entitlement, rather than anonymity *per se*. Participation rates are more balanced in synchronous CMC modes such as IRC and MUDs, where lurkers are more visible, and the cost involved in sending a message is lower (Herring, 1998b). However, such systems often have hierarchy built in, in the form of roles such as "operator" on IRC (Paolillo, 2001) and "wizard" on MUDs (Reid, 1994; Suler, 1996), who have the power to limit other people's use of the system. Finally, virtual groups sometimes empower individuals from among their ranks by electing them to governance positions, thereby institutionalizing status differences (Kolko & Reid, 1998; MacKinnon, 1995). In addition to status differences based on real-world rank, gender, and role within the virtual community, status is also associated with experience in an online forum, with inexperienced users ("newbies") enjoying fewer rights and sometimes receiving less respectful treatment than experienced users (Naper, 2001; Suler, 1996; Weber, forthcoming).

At the same time, the Internet clearly provides greater opportunities for some people to be heard than would otherwise be the case. Individuals and groups who would not otherwise have access to public media or be taken seriously are able to express themselves on the Internet, including minorities of all types, as well as antisocial elements. Indeed, it is difficult to prevent those with Internet access from posting whatever they like, short of removing their access privileges, and even then they usually have alternative ways to gain access (Dibbell, 1993). The question of whether this is a desirable or undesirable characteristic of Internet communication is controversial. (See "Freedom of Expression" in the next section.)

### **Effects on Language and Communication**

A final early prediction is that communicating via computers affects the nature of language and communication itself. Thus Baron (1984) speculated that CMC could reduce the expressive potential of human language, leading to a more homogeneous, affectless, structurally simpler, and less socially nuanced style of communication over time. Baron's

view was based in part on the observation that text-based CMC lacks the prosodic and nonverbal cues, such as intonation, voice quality, and facial expression, which contribute to the expression of (especially, social) meaning.

Baron's claim involves two parts, one having to do with linguistic complexity and the other with expressiveness. Some writers have observed that e-mail language is structurally simpler than traditional forms of writing, made up of shorter, grammatically less complex sentences, and containing more sentence fragments and typographical errors (Hale, 1996). In partial support of this view, Cho (forthcoming) found e-mail messages to contain fewer passive constructions (such as "the book was written by a young author") and to rank higher than written memoranda on an ease of readability scale. However, e-mail messages posted to professional discussion lists tend to be linguistically sophisticated, making use of complex grammar and containing few errors (Herring, 1998a). This suggests that factors such as level of user education and purpose for communication condition language complexity in asynchronous CMC. In contrast, synchronous CMC is structurally limited: In a study comparing informal spoken conversation, formal written documents, and communication in a synchronous chat system, Ko (1996) found the CMC to be simpler even than spontaneous speech in terms of range of vocabulary used and measures of word and sentence length. We may add to this the observation that chat exhibits abbreviation to a greater extent than e-mail (or speech). Unlike users of e-mail, chat users are under pressure to type at a conversational pace; the cost of speed of production appears to be linguistic complexity.

There is no evidence from Internet research that CMC is stylistically homogeneous. On the contrary, as the above suggests, a great deal of linguistic variation exists, even within a single mode such as e-mail. There is also variation across modes; Cherny (1999) presents evidence that language use in a social MUD follows conventions that differ from those for IRC, even though both are synchronous, recreational chat modes. Nonetheless, conventions do form (such as the abbreviations "u" and "r" for "you" and "are"), and are learned by new users, leading to the possibility that, over time, users converge toward a common usage, and thus, that something like a monolithic chat or e-mail style could eventually emerge. Here, again, there is evidence to suggest the contrary:



Experienced, core users tend to diverge from the norms of the group (Herring, 1998a; Paolillo, 2001), perhaps to distinguish themselves from the crowd. At the same time, at least for professional e-mail, prescriptive norms of use are starting to emerge, as attested by the growing number of e-mail style guides (e.g., Booher, 2001; Hale, 1996). Nonetheless, given that users send e-mail for a variety of purposes, it seems likely that stylistic variety will continue to exist.

Expressivity was touched on briefly earlier, in the discussion of relational communication, where it was observed that social meanings appear to be conveyed effectively through CMC. Users achieve this in part through creative uses of language, such as novel spellings, repeated punctuation, and ASCII graphics designed to convey attitude, nonspeech sounds, and facial expressions (Cho, forthcoming; Livia, forthcoming; Werry, 1996). This is especially common in synchronous chat, despite the fact that expressive language often requires extra keystrokes, and thereby goes against the principle of economy of effort that otherwise conditions chat language. Overall, it appears that CMC is less expressive than face-to-face communication, but more expressive than standard, edited written language. Yates and Graddol (1996) suggest that speech is an overly rich medium that generates inappropriate meanings (through gesture, facial expression, tone of voice, etc.) that must constantly be cancelled. Viewed from this perspective, CMC allows users to express more precisely what they mean, without the interference of unintended physical cues (see also Walther [1999]).

Each of the sets of predictions considered above assumes that communicative consequences follow necessarily from the properties of CMC systems. The evidence from the past fifteen years of Internet research does not support a strong technologically deterministic view, at least as regards the effects of text-only CMC systems. Situational factors can (and regularly do) override the predispositions of the medium, and users can adapt the medium to their communicative needs, just as with communication in other media.

## Current Issues in CMC Research

In contrast with early CMC research that focused on the limitations of the medium for accomplishing traditional communicative ends, recent

research tends to focus on new forms of communication enabled by the Internet. This trend corresponds to a shift in thinking about computer networking in terms of its intended, first-order effects—e.g., to facilitate the transfer of information among geographically dispersed participants—to a growing recognition of its (largely unintended) second-order effects, including its larger societal impacts, as has also occurred in the past with communication technologies such as the telephone (see Sproull & Kiesler, 1991). (The telephone was originally intended to transmit live concerts and public lectures to distant listeners. Only later was its usefulness for interpersonal communication recognized [Sproull & Kiesler, 1991].) The early days of the Internet were characterized by considerable hype and projection, both utopian and dystopian, concerning such notions as democracy, hierarchy, and social behavior. This section presents in overview some of the secondary effects of Internet communication currently represented in the research literature, identifying opportunities and challenges raised by each.

### *Freedom of Expression*

Historically, the culture of the Internet has been shaped by the libertarian philosophy of the mostly young, white, upper-middle-class American males who created it and who made the protocols and software to support CMC available for free (Pfaffenberger, 1996; Turkle, 1988). Along with free software, the creators of the Internet placed a high value on free information exchange, which they believed could come about only with complete freedom of speech. Moreover, they believed that the Internet structurally encouraged free speech, by “routing around censorship” (Barlow, 1996, online). The open nature of Internet communication means that individuals and groups who might otherwise not have an opportunity to make themselves heard can present their views in a public forum, resulting in a diversity of viewpoints being represented online.

However, unconstrained speech in Internet forums has brought with it numerous challenges, including a low “signal-to-noise-ratio” (i.e., more low-quality than high-quality communication) and the difficulty of controlling antisocial CMC behaviors such as spamming (Marvin, 1995), flaming (Kim & Raja, 1990), hate speech (Glassman, 2000; Zickmund, 1997), and sexual harassment (Bell & La Rue, 1995; Dibbell, 1993;

Ferganchick-Neufang, 1998; Herring, 1999b). These behaviors not only harm individuals, but can also be disruptive to online groups (Reid, 1994; Suler, 1996). Accordingly, some propose that the right of the individual to say anything in an online forum should, under certain circumstances, be constrained in the interest of the common good (Ess, 1996). Solutions that have been proposed in response to the challenges inherent in enforcing restrictions on online communication include technical means such as filters (Spertus, 1996, 1997) and social means such as public censure (McLaughlin et al., 1995; Spertus, 1996).

## Community

The 1990s saw the introduction of the term "virtual community" to describe groups of people who communicate primarily—and in some cases exclusively—via the Internet (Rheingold, 1993; Wellman & Gulia, 1999). Some Internet observers suggest that online group communication fills a void left by the decline of face-to-face communities in contemporary urban societies (Barlow, 1995; Rheingold, 1993), although others (S. Jones, 1995; Wellman, 1997) caution against romanticizing a notion of face-to-face community that may never actually have existed. In addition, debate centers around the definition of "community" itself: Is any online group a community, or is community something that arises only under certain conditions? Most CMC scholars support the latter view, pointing to processes of community formation involving, for example, key (often disruptive) incidents leading to the articulation of norms, sanctions, and in some cases, the constitution of systems of governance (Dibbell, 1993; MacKinnon, 1995; McLaughlin et al., 1995; Reid, 1994). Others see evidence of community in linguistic practice; for example, in insider language use (Baym, 1995; Cherny, 1999). Yet other researchers focus on the self-reports of people who experience a sense of engagement and belonging in an online group (Rheingold, 1993; Scannell, 1999), even when they themselves do not participate (Nonnecke & Preece, 2000).

In contrast, others point to the ephemerality of Internet group membership and the low degree of commitment required to participate as evidence that exclusively computer-mediated groups foster pseudocommunity at best (Beniger, 1987; S. Jones, 1995). Consistent with this view, a growing body of evidence points to off-line interaction as a requisite for sustainable online community (Hampton & Wellman, 1999); Virnoche and

Marx (1997) label such forms virtual extensions (of real intermittent communities). Wellman and Gulia (1999) claim that, much as in the "real world," the Net fosters multiple, partial, specialized communities in which social ties are intermittent and varying in strength. Such hybrid communities may combine the best of both worlds: the "interactive broadcasting" capabilities of CMC, with the advantages of face-to-face communication for interpersonal identification, authentication, and accountability (Etzioni, 1999). Others, focusing on the similarities between the two, claim that both the Net and the "real world" foster multiple, partial, specialized communities in which social ties are intermittent and varying in strength (Wellman & Gulia, 1999).

## Personal Impacts

More and more people are spending time online, and CMC is coming to replace other leisure-time activities (Pew Internet and American Life Project, 2000). Participation in CMC has been claimed to be psychologically beneficial, allowing for self-expression (Deuel, 1996), experimentation with identity (Bruckman, 1993; Danet, 1998), and meaningful relationship formation (Lea & Spears, 1995; Parks & Floyd, 1996). Individuals who spend a lot of time online generally have more, not fewer, social contacts, and e-mail may foster more open communication with friends and family than would otherwise take place (Hampton & Wellman, 1999; Wellman, 1997). Generalizations should be made with caution, however, since perceptions of the benefits of Internet communication vary according to age, social class, and ethnic background (Kraut, Scherlis, Mukhopadhyaya, Manning, & Kiesler, 1996).

At the same time, some writers warn that heavy use of CMC can lead to addiction, alienation from face-to-face relationships, and depression (Griffiths, 1998; Stoll, 1995). These claims find support in a self-report study of 169 subjects during their first year or two online (Kraut, Kiesler, Mukhopadhyaya, Scherlis, & Patterson, 1998). However, others suggest that CMC overuse is a symptom, rather than a cause, of these conditions (King, 1996a; Turkle, 1995), and that participation in CMC has no negative psychological impacts for most users. Information overload is another risk associated with Internet use (Chao, 1995, cited in Wellman & Gulia, 1999; Sproull & Kiesler, 1991).

## **Trust and Deception**

On the Internet, an individual can connect easily with multiple sources for information and interaction. Moreover, people are often willing to assist strangers online, perhaps because the risks and costs of intervention are perceived to be lower than they are offline (Wellman & Gulia, 1999). However, in order to engage in safe, meaningful interaction, one must trust that one's interlocutor is generally truthful and sincere. Deception is easy to carry out in a mediated environment such as the Internet, in that hard physical evidence is generally lacking to confirm that someone is who and what they claim to be (Bell & La Rue, 1995; Donath, 1999; van Gelder, 1990). Virtual reality environments, whether text-based or graphical, may further increase vulnerability to deception, in that they require users to suspend disbelief in order to interact with their virtual surroundings (Anders, 1999). Even in CMC environments where identity play is common, participants may feel deceived when they discover that the "woman" they have befriended is really a man (McRae, 1996). The adverse consequences of gullibility can range from minor (in the case of identity play and trolls [Donath [1999]]) to potentially serious (in the case of scams and stalkers [D'Amico, 1997; Federal Trade Commission, 2000]).

Trust may be enhanced in online forums through face-to-face contact (Diani, 2000). Olson and Olson (2000, p. 42) summarize the findings of experimental research on trust and communication medium as follows: "In the lab, face-to-face interaction promotes the greatest trust, followed by the telephone, then text-chat, then e-mail, until with e-mail, test subjects behave mostly in a self-serving way." Other means for enhancing trust include having (known) participants vouch for unknown participants as a criterion for membership (Levien, 2000), and discouraging anonymous communication (Perrole, 1991). However, anonymity can also be a legitimate means to protect a participant's privacy (Donath, 1999; Friedman, Kahn, & Howe, 2000); a challenge is to foster social accountability without sacrificing privacy protections.

## **Privacy**

Many people reveal personal information in online interaction, an observation variously attributed to the medium's inherent tendency to

foster disinhibition (Kiesler et al., 1984), naive users' perceptions that group CMC is private (King, 1996b), or a sense that one's words will not be noticed in the vast data flow, especially when posted to an obscure newsgroup or chat room.

However, the reality is that most types of computer-mediated messages leave a persistent trace, which enables them to be archived and traced back to the system that mailed them. E-mail messages can also be intercepted or misdirected (Meeks, 1999). Moreover, most Internet groups are technically accessible by people other than the intended members of the group, who may use them for purposes ranging from benign to malevolent. Thus a user should consider when it is appropriate to self-disclose and when it is prudent to be cautious in online interaction (Friedman et al., 2000).

The persistence of electronic communication, in combination with the ease with which it can be observed invisibly, also makes the Internet a powerful vehicle for surveillance and tracking. The U.S. government's proposed Carnivore/DCS1000 system would monitor electronic communication through Internet service providers for purposes of law enforcement (Kerr, 2000), and commercial Web sites place "cookies" on users' computers to track their Web usage patterns for marketing purposes (Berghel, 2001). As awareness of these practices grows, Internet users increasingly report feeling concerned about threats to their privacy (Pew Internet and American Life Project, 2000).

## **Internet Research Ethics**

The Internet is an unprecedented boon to the scientific study of communication and related social processes. Data from authentic interactions of a wide variety of types are available for analysis without the presence of the researcher biasing the data collection process (Herring, 1996c). Moreover, the persistent nature of textual CMC encourages reflection and study, such that even people who would not have undertaken empirical research before are now drawn to Internet research.

At the same time, the very ease of data collection on the Internet raises ethical concerns. Participants may not be aware that their words are being collected and studied. Moreover, even when their identities are masked through the use of pseudonyms, it may be possible to link their

words with their (online) identities by searching archives such as Dejanews (in the case of postings to Usenet). Further, inexperienced researchers may engage in ethically dubious data collection practices, putting CMC users at risk of harm (Frankel & Siang, 1999).

Currently there is considerable debate about appropriate ethical practice in Internet CMC research. For a balanced exposition of the issues, see Mann and Stewart (2000). Some researchers advocate obtaining informed consent from subjects prior to conducting any CMC research (Frankel & Siang, 1999), regardless of whether researcher intervention is involved. Others recommend asking permission to quote particular messages prior to including them in presentations or publications (Sharf, 1999), and/or masking all identifying information about the users and the groups (King, 1996b). However, informed consent poses practical problems due to the shifting membership of Internet groups, and could have a chilling effect on critical research (Herring, 1996c). The challenge is to strike a balance between allowing researchers to carry out quality CMC research, and protecting users from potential harm. A further issue concerns whether users have a right to privacy when posting to discussion groups and chat rooms, even if the research places them at no risk of harm. Underlying the debate are questions concerning the definition of "harm," and how the traditional public-private distinction should be applied to CMC (Herring, 1996c; King, 1996b).

### **Very Large Scale Conversations**

Another affordance of the Internet is the extent to which it makes possible, on a heretofore unprecedented scale, simultaneous conversations among large numbers of people. These "very large scale conversations" (Sack, 2000) offer ready access to the combined expertise of many people, and enable efficient one-to-many as well as many-to-many communication (Sproull & Kiesler, 1991).

Large-scale online conversations also raise new challenges. Coherence is difficult to maintain, in that conversation management (turn taking, exchange tracking, topic maintenance) tends to be fragmented in multiparticipant groups (Herring, 1999a, forthcoming). In the absence of a strong moderator, computer-mediated groups tend toward disagreement and polarization, making consensus among large numbers of participants difficult to achieve (Sudweeks & Rafaeli, 1996), except on

noncontroversial, status quo maintaining topics (Diani, 2000). The constraints on large online groups—their optimal size (Jones & Rafaeli, 2000), their natural life cycles (Lambiase, forthcoming)—also need to be understood, in order to maximize group viability. Finally, there is a need to analyze how reputation is achieved and influence exerted in large computer-mediated groups (Donath, 1999; MacKinnon, 1995).

### **E-Democracy**

From the beginning, enthusiasts have seen in the Internet a potential means to increase the involvement of ordinary people in the democratic process. Åström (2001) distinguishes among "thin" democracy (the elite competing for citizens' votes, e.g., through campaigning), "quick" democracy (direct citizen input into decision making, without the intermediary of elected representatives), and "strong" democracy (an active citizenry informed by public deliberation of issues), asserting that the Internet can, and should, facilitate each type. Others distinguish status quo maintaining from novel or transformative political communication on the Internet, valuing the latter over the former (Becker, 2000; Lax, 2000).

However, while examples of political uses of the Internet abound (e.g., Knudson, 1998; Lax, 2000; Ogan, 1993; Stubbs, 1998), some researchers doubt its transformative power. Diani (2000) claims that online groups are unlikely to generate sufficient trust to motivate radical social movements without extensive face-to-face interaction. A more serious reservation is that elite ruling groups are better positioned than ordinary people to exploit Internet technology to further their ends (Diani, 2000). Others question the "strong democracy" premise that exchanging information in open debate will necessarily lead to a more involved or informed citizenry, citing the lack of interest of the ordinary citizen in political processes, and the uneven accessibility of online information (Åström, 2001; Lax, 2000). To this could be added the often dubious quality of public online discussions (see earlier discussion of freedom of speech and very large scale conversations).

### **Globalization**

From its origins in the United States, the Internet has, since the 1990s, been spreading to other countries at a seemingly relentless pace

(Petrazzini & Kibati, 1999). Globalization is welcomed by humanists who embrace the potential of an interconnected "global village" to promote information exchange and cross-cultural understanding (Ess, 2001; Hawisher & Selfe, 2000), as well as by capitalists eager to access foreign markets (Global Reach, <http://www.greach.com>). However, while there is a general sense that the Internet will bring about important changes on a global scale, its likely impacts are as yet little understood.

One question concerns the extent to which current inequalities in access will eventually level out. Less than 4 percent of the world's population now has Internet access, and fewer than 50 percent have telephone access (Gauntlett, 2000a). Moreover, the majority of Internet traffic is still routed through North America (Petrazzini & Kibati, 1999; Yates, 1996), and in 2000, 87 percent of all Web pages were written in English, even though native speakers of English accounted for only about 7 percent of the world's population (Cybermetrics, 2000). Some scholars fear that Internet communication will spread the cultural values and the language of its dominant, and historically prior, group of users—North American English speakers—at the expense of smaller, politically and economically weaker groups (Buszard-Welcher, 2000; Mattelart, 1996; Nunberg, 2000; Yates, 1996). In the meantime, speakers of different languages are coming increasingly in contact (if only by encountering Web sites in foreign languages), creating a rising demand for automated, online translation (Silberman, 2000).

Another challenge raised by globalization is determining legal jurisdiction over information and communication on the Internet. King (1999) points out that local community standards (for example, with respect to pornography and hate speech) tend to be supplanted by the lowest common denominator (i.e., whatever is legal anywhere in the world is effectively available everywhere through the Net). At the same time, the research literature contains a growing number of examples of peoples, including minority groups, adapting and regulating Internet technology for their own purposes (e.g., Arnold & Plymire, 2000; Hongladarom, 2001).

### **Commercialization**

Since the end of U.S. National Science Foundation funding of the Internet backbone in 1995, the costs of operating the Internet have

increasingly been taken up by commercial interests (for a critique, see McChesney, 2000). E-commerce is now the dominant use of the Web (Cybermetrics, 2000), and access to CMC is increasingly via commercial Internet service providers and Web browsers, which intersperse e-mail and chat interfaces with advertising (Goggin, 2000). The commercialization of the Internet—and especially the Web—has undeniably expanded its reach and potential (Goggin, 2000). Moreover, advocates of commercialization argue that it encourages small businesses and fosters competition, making new and better products available to consumers at lower prices; in addition, online shopping offers convenience. Finally, the ability to handle business transactions electronically (such as purchasing airline tickets) eliminates middlemen, resulting, theoretically, in savings passed on to consumers (McChesney, 2000). Some see in these developments the potential for large media and corporate monopolies to be crushed, consistent with the democratic potential of the Internet itself (Barlow and Negroponte, cited in McChesney, 2000).

Most Internet scholars who have written on the topic, however, consider commercialization a regrettable (if inevitable) development, one more likely to reinforce the ownership and control of media by large corporate interests than to promote online democracy. McChesney (2000) points out that, rather than encouraging competition, corporations engage in mergers and other activities to create monopolies. Monopolies tend to distribute mainstream, mass media content, resulting in a depoliticization of online culture (see also Brown, 2000). Moreover, the prevalence of advertising on the Web leads to the development of increasingly manipulative technologies such as interactive banners and pop-up ads, which potentially interfere with CMC, especially when attached to search engines and servers (Goggin, 2000). A major challenge for the future will be to preserve a commerce-free public sphere on the Internet, alongside the growing number of commercial initiatives.

Second-order technology effects are like the ripples that spread outward when a pebble is tossed into a pond, continuing to spread for some time in ever-widening circles (Sproull & Kiesler, 1991). The Internet is still new enough that its wider impacts are only starting to be felt. The evidence available thus far suggests that neither utopian nor exclusively dystopian scenarios will likely come about in the foreseeable future; Internet communication raises both opportunities and dangers. Rather

than, "Will the Internet ultimately prove beneficial or detrimental to human society?," the most important questions for the future, which current research is already starting to address, are, "Who will benefit, who will be harmed, in what ways?"

## Directions for Future Study

Internet research is still in its infancy. More questions have been raised than have yet been definitively answered, and new CMC technologies are emerging faster than researchers can describe them, let alone investigate their natural use. Among the emergent technologies that cry out for future study is wireless Web access via mobile phones and handheld devices (J. Jones, 2000). Future research also urgently needs to address multimodal CMC technologies (Soukup, 2000). At the same time, researchers should not prematurely abandon the older, text-based modes, for textual CMC will continue to be important (Walther, 1999).

To date, Internet CMC research has had a text bias. This was appropriate in the early days of the Internet, when most CMC was text only, but the situation is rapidly changing as increased bandwidth makes high-quality audio, video, and graphics easier to transmit and hence more common. Methods need to be developed for analyzing the meaning communicated by visual layout and graphic design in Web pages (Schmid-Isler, 2000; Soukup, 2000). Video and graphical VR environments additionally require methods for analyzing dynamic spatial relations (Krikorian, Lee, Chock, & Harms, 2000), perspective, gesture, and movement—not just as design issues, but as channels of communication. Moreover, the phenomenon of multimodality itself has yet to be systematically addressed: How do different channels of communication interact to construct rich, multilevel meanings? One of the goals of such study should be to identify the advantages and limitations of different channels for different uses (Lombard & Ditton, 1997; Neal, 1997; Walther, 1999).

Internet CMC research currently also has an interactive bias; that is, it focuses mostly on CMC media that enable reciprocal and symmetrical interaction. While it is currently fashionable to talk about the "interactivity" of the World Wide Web (see, e.g., O'Sullivan, 1999), Web pages are

not symmetrically interactive (Jackson, 1997). However, as the Web increasingly subsumes other CMC modes, this distinction is becoming blurred. Some researchers are starting to focus on the Web as a communication medium in its own right (Coste, 2000; Gauntlett, 2000b; Herman & Swiss, 2000; Mitra & Cohen, 1999), but much more needs to be done. This includes developing methods for analyzing (1) the multimodal text (textual dimension), (2) patterns of available links (spatial dimension), (3) users' navigational trajectories (temporal dimension), and (4) the patterns of human-human interaction grounded in Web sites (social dimension).

Internet CMC research also tends to display a group bias. Many studies have analyzed data from discussion groups, chat rooms, and MUDs, for the practical reason that such data are easily accessible; in this sense, the Internet provides us with an unprecedented opportunity to study group processes (Korenman & Wyatt, 1996; Sudweeks & Rafaeli, 1996). However, we cannot assume that the findings for large Internet groups will necessarily scale to small groups or one-to-one communication. Research is needed that systematically investigates the effects of number of participants on communicative phenomena such as amount of participation, turn taking, coherence, politeness, sociability, influence, and power dynamics. Given their enormous popularity, much more research is needed on one-to-one e-mail and instant messaging and how each varies according to characteristics of users and communicative purposes.

As CMC practices evolve at a rapid rate, it is imperative that we preserve records of their evolution. This is being done by default for much asynchronous group CMC (and no doubt some private e-mail collections), for which the technology requires the user actively to delete messages or else they will remain. Capitalizing on this persistence, asynchronous messages have been collected since 1975 in public archives and databases, where with foresight and good management they will remain for purposes of future study. However, the situation is very different for synchronous CMC, which disappears unless the user actively intervenes to log it. Only sparse corpora of chat exist from the early 1990s, and no serious longitudinal study of chat has yet been attempted. As digital data storage capacities increase, CMC researchers should make preserving and analyzing extended samples of synchronous CMC a high priority.

Finally, the Internet has often been represented in CMC research as though it were a self-contained environment, a "virtual" world apart from "real life." Phenomena such as online communities and identity play have made it tempting to do this, especially in the early days when a relatively small percentage of the population had access to the exotic "cyberspace" realm. Such a fiction can no longer be maintained; today Internet use is increasingly a part of everyday routine for large numbers of people around the world. How is CMC integrated into the complex whole of people's communicative activities? When do they choose to communicate via the Internet and when face-to-face, by telephone, fax, etc.; and how does choice of modality affect the communication (Murray, 1988)? Comparative studies of face-to-face conversation and CMC, telephone conversation and CMC, and Short Message Service (SMS) via cell phones and CMC over the Internet—preferably involving the same individuals—are needed to address the ubiquitous claims that "CMC causes people to do X more/less than they would otherwise do in modality Y." In all such studies, of course, different modes of CMC also need to be distinguished.

In conclusion, much work remains, even though we know a great deal more about CMC now than we did fifteen years ago. It has been said that Internet years are like dog years—one Internet year is equivalent to seven pre-Internet years in terms of the amount of change that takes place. If that is so, then we have already experienced in the past fifteen years more than a century's worth of change—longer than the average human life span. And many of us are not yet old, meaning that we can look forward to more change (and more learning) in the future. One of the great promises of CMC research, with all its interdisciplinary diversity, is that it will eventually reveal to us the underlying principles, the systematic dimensions of variation, that can account for the relationship between features of communication media and human communication more generally.

## Bibliography

- Anders, P. (1999). *Envisioning cyberspace: Designing 3D electronic spaces*. New York: McGraw-Hill.
- Anderson, J. F., Beard, F. K., & Walther, J. B. (forthcoming). The local management of computer-mediated conversation. In S. Herring (Ed.), *Computer-mediated conversation*.
- Arnold, A. L., & Plymire, D. C. (2000). The Cherokee Indians and the Internet. In D. Gauntlett (Ed.), *Web.studies: Rewiring media studies for the digital age* (pp. 186-193). London: Arnold.
- Associated Press. (2000, November 16). New domain names approved. *CNN.com*. Retrieved June 15, 2001, from the World Wide Web: <http://www.cnn.com/2000/TECH/computing/11/16/internet.names.ap>
- Åström, J. (2001). Should democracy online be quick, strong, or thin? *Communications of the ACM*, 44(1), 49-51.
- Barlow, J. P. (1995). Is there a there in cyberspace? *Utne Reader*, 68. Retrieved June 15, 2001 from the World Wide Web: [http://www.eff.org/pub/Publications/John\\_Perry\\_Barlow/HTML/utne\\_community.html](http://www.eff.org/pub/Publications/John_Perry_Barlow/HTML/utne_community.html)
- Barlow, J. P. (1996). Declaration of the independence of cyberspace. Retrieved June 15, 2001 from the World Wide Web: [http://www.eff.org/pub/Censorship/Internet\\_censorship\\_bills/barlow\\_0296.declaration](http://www.eff.org/pub/Censorship/Internet_censorship_bills/barlow_0296.declaration)
- Baron, N. S. (1984). Computer mediated communication as a force in language change. *Visible Language*, 18 (2), 118-141.
- Baron, N. S. (2000). *Alphabet to e-mail: How written English evolved and where it's heading*. London: Routledge.
- Baym, N. (1995). The emergence of community in computer-mediated communication. In S. Jones (Ed.), *Cybersociety: Computer-mediated communication and community* (pp. 138-163). Thousand Oaks, CA: Sage.
- Bechar-Israeli, H. (1995). From <Bonehead> to <cLoNehEAd>: Nicknames, play and identity on Internet Relay Chat. *Journal of Computer-Mediated Communication*, 1 (2). Retrieved June 15, 2001 from the World Wide Web: <http://www.ascusc.org/jcmc/vol1/issue2>
- Becker, T. (2000). Rating the impact of new technologies on democracy. *Communications of the ACM*, 44(1), 39-43.
- Bell, V. & de La Rue, D. (1995). Gender harassment on the Internet. Retrieved June 15, 2001 from the World Wide Web: <http://www.gsu.edu/~lawppw/lawand.papers/harass.html>
- Beninger, J. (1987). Personalization of the mass media and the growth of pseudo-community. *Communication Research*, 14(3), 25-34.
- Berat, J. (1996, May 20). Sorting out Internet telephony. *ZDNet Anchor Desk*. Retrieved June 15, 2001 from the World Wide Web: [http://www.zdnet.com/anchordesk/story/story\\_2113.html](http://www.zdnet.com/anchordesk/story/story_2113.html)
- Berghel, H. (2001). Caustic cookies. *Communications of the ACM*, 44(5), 19-22.
- Berners-Lee, T. (1996). The World Wide Web: Past, present and future. Retrieved June 15, 2001 from the World Wide Web: <http://www.w3.org/People/Berners-Lee/1996/ppf.html>
- Booher, D. (2001). *E-Writing: 21st century tools for effective communication*. New York: Pocket Books.
- Brown, J. (2000, August 25). What happened to the women's Web? *Salon*. Retrieved June 15, 2001 from the World Wide Web: [http://www.salon.com/tech/feature/2000/08/25/womens\\_web.html](http://www.salon.com/tech/feature/2000/08/25/womens_web.html)

- Bruckman, A. S. (1993). Gender swapping in cyberspace. *Proceedings of INET '93*. Retrieved June 15, 2001 via anonymous ftp from media.mit.edu in pub/MediaMOO/papers.gender-swapping
- Bruckman, A. S., & Resnick, M. (1995). The MediaMOO project: Constructionism and professional community. *Convergence*, 1(1), 94-109.
- Bumgardner, J. (1994). A little Palace history. Retrieved June 15, 2001 from the World Wide Web: <http://www.jbum.com/jbum/history>
- Burkhalter, B. (1999). Reading race online. In M. Smith & P. Kollock (Eds.), *Communities in cyberspace* (pp. 60-75). London: Routledge.
- Burnett, G. (2000). Information exchange in virtual communities: A typology. *Information Research*, 5(4). Retrieved June 15, 2001 from the World Wide Web: <http://www.shef.ac.uk/~is/publications/infres/paper82a.html>
- Bush, V. (1945). As we may think. *Atlantic Monthly*, 176, 101-108.
- Buszard-Welcher, L. (2000). Can the Web help save my language? Retrieved June 15, 2001 from the World Wide Web: <http://www.potawatamilang.org/Reference/endlgweb4.htm>
- Camp, L. J. (1996). We are geeks, and we are not guys: The Systems mailing list. (with A. Borg). In L. Cherny & E. R. Weise (Eds.), *Wired women: Gender and new realities in cyberspace* (114-125). Seattle, WA: Seal Press.
- Chao, J. (1995, June 20). Net loss: The pioneers move on. *Toronto Globe and Mail*, p. A13.
- Cherny, L. (1995). The modal complexity of speech events in a social MUD. *Electronic Journal of Communication / La revue électronique de communication*, 5(4). Retrieved June 15, 2001 from the World Wide Web: <http://www.cios.org/www/ejc/v5n495.htm>
- Cherny, L. (1999). *Conversation and community: Chat in a virtual world*. Stanford, CA: Center for the Study of Language and Information.
- Cheung, C. (2000). A home on the Web: Presentations of self on personal homepages. In D. Gauntlett (Ed.), *Web.studies: Rewiring media studies for the digital age* (pp. 43-51). London: Arnold.
- Cho, N. (forthcoming). Linguistic features of electronic mail. In S. Herring (Ed.), *Computer-mediated conversation*.
- Chou, C. C. (1999, January). Computer-mediated communication systems for synchronous online learning. Paper Presented at the Pan-Pacific Distance Learning Association Annual Conference. Retrieved June 15, 2001 from the World Wide Web: <http://www2.hawaii.edu/~cchou/ppdla99/index.htm>
- Cogdill, S., Fanderclai, T. L., Kilborn, J., & Williams, M. G. (2001) Backchannel: Whispering in digital conversation. *Proceedings of the 34th Hawaii International Conference on System Sciences*. Retrieved June 15, 2001 from the World Wide Web: [http://www.hic.ss.hawaii.edu/HICSS\\_34/PDFs/DDPTC03.pdf](http://www.hic.ss.hawaii.edu/HICSS_34/PDFs/DDPTC03.pdf)
- Cohen, J. (2001, May 17). He-mails, she-mails: Where sender meets gender. *The New York Times*, pp. D1, D9.
- Condon, S. L., & Čech, C. G. (1996). Discourse management strategies in face-to-face and computer-mediated decision making interactions. *Electronic Journal of Communication*, 6(3). Retrieved June 15, 2001 from the World Wide Web: <http://www.cios.org/www/ejc/v6n396.htm>
- Condon, S. L., & Čech, C. G. (forthcoming). Discourse management in three modalities. In S. Herring (Ed.), *Computer-mediated conversation*.
- Coste, R. (2000). Fighting speech with speech: David Duke, the Anti-Defamation League, online bookstores, and hate filters. *Proceedings of the 33rd Hawaii International Conference on System Sciences*. Retrieved June 15, 2001 from the World Wide Web: <http://dlib.computer.org/conferen/hicss/0493/pdf/04933012.pdf>
- Curtis, P. (1992). Mudding: Social phenomena in text-based virtual realities. *Proceedings of DIAC92*. Retrieved June 15, 2001 from the World Wide Web: <ftp://ftp.lambda.moo.mud.org/pub/MOO/papers/DIAC92.ps>
- CyberAtlas. (2001, May 1). Hardware: Evolution of instant messaging increases stakes for Microsoft, AOL. Retrieved June 15, 2001 from the World Wide Web: [http://cyberatlas.internet.com/big\\_picture/hardware/article/0,,5921\\_756111,00.html](http://cyberatlas.internet.com/big_picture/hardware/article/0,,5921_756111,00.html)
- Cybermetrics. (2000). Measuring the Internet. *Cybermetrics: International Journal of Scientometrics, Informetrics and Bibliometrics*, 4. Retrieved June 15, 2001 from the World Wide Web: <http://www.cindoc.csic.es/cybermetrics/links22.html>
- Daft, R. L., & Lengel, R. H. (1984). Information richness: A new approach to managerial behavior and organization design. *Research in Organizational Behavior*, 6, 191-233.
- Daft, R. L., & Lengel, R. H. (1986). Organizational informational requirements, media richness and structural design. *Management Science*, 32, 554-571.
- D'Amico, M. (1997). *The law vs. online stalking*. Retrieved June 15, 2001 from the World Wide Web: <http://www.madcapps.com/Writings/cybersta.htm>
- Danet, B. (1998). Text as mask: Gender and identity on the Internet. In S. Jones (Ed.), *CyberSociety 2.0: Revisiting computer mediated communication and community* (pp. 129-158). Thousand Oaks, CA: Sage.
- Danet, B., Ruedenberg-Wright, L., & Rosenbaum-Tamari, Y. (1997). Hmmm ... where's that smoke coming from? Writing, play and performance on Internet Relay Chat. In S. Rafaeli, F. Sudweeks, & M. McLaughlin (Eds.), *Network and netplay: Virtual groups on the Internet* (pp. 41-76). Cambridge, MA: AAAI/MIT Press.
- Dean, K. (2001, January 25). Instant messaging grows up. *Wired News*. Retrieved June 15, 2001 from the World Wide Web: <http://www.wired.com/news/print/0,1294,33736,00.html>
- Deuel, N. (1996). Our passionate response to virtual reality. In S. Herring (Ed.), *Computer-mediated communication: Linguistic, social and cross-cultural perspectives* (pp. 129-146). Amsterdam: John Benjamins.
- Diani, M. (2000). Social movement networks virtual and real. *Information, Communication & Society*, 3, 386-401.



- Dibbell, J. (1993, December 21). A rape in cyberspace, or how an evil clown, a Haitian trickster spirit, two wizards, and a cast of dozens turned a database into a society. *Village Voice*, pp. 36-42.
- Dodge, M., & Kitchin, R. (2000). *Mapping cyberspace*. London: Routledge. [Internet timeline can also be found at [http://www.mappingcyberspace.com/gallery/figure1\\_1.html](http://www.mappingcyberspace.com/gallery/figure1_1.html)]
- Donath, J. (1999). Identity and deception in the virtual community. In M. Smith & P. Kollock (Eds.), *Communities in cyberspace* (pp. 29-59). London: Routledge.
- Dorcey, T. (1995). The CU-SeeMe desktop videoconferencing software. *ConneXions*, 9(3), 42-45.
- Ebben, M. M. (1994). *Women on the net: An exploratory study of gender dynamics on the soc.women computer network*. Unpublished doctoral dissertation, University of Illinois at Urbana Champaign.
- Eep2. (2000). Active Worlds history. Retrieved June 15, 2001 from the World Wide Web: <http://tnic.com/eep/aw/history.html>
- Ess, C. (1996). Beyond false dilemmas: Men and women on the net—a plea for democracy and understanding. *Computer-Mediated Communication Magazine*, 3(1). Retrieved June 15, 2001 from the World Wide Web: <http://www.december.com/cmc/mag/1996/jan/ess.html>
- Ess, C. (2001). What's culture got to do with it? Cultural collisions in the electronic global village, creative interferences, and the rise of culturally-mediated computing. In C. Ess & F. Sudweeks (Eds.), *Culture, technology, communication: Towards an intercultural global village* (pp. 1-30). Albany, NY: SUNY Press.
- Etzioni, A. (1999). Face-to-face and computer-mediated communities, a comparative analysis. *The Information Society*, 15, 241-248.
- Fallis, D. (2000). Veritistic social epistemology and information science. *Social Epistemology*, 14, 305-316.
- Federal Trade Commission. (2000). Law enforcers target "top 10" online scams. Retrieved June 15, 2001 from the World Wide Web: <http://www.ftc.gov/opa/2000/10/topten.htm>
- Ferganchick-Neufang, J. (1998). Virtual harassment: Women and online education. *First Monday*, 3(2). Retrieved June 15, 2001 from the World Wide Web: [http://www.firstmonday.dk/issues/issue3\\_2/fergan/](http://www.firstmonday.dk/issues/issue3_2/fergan/)
- Ferrara, K., Brunner, H., & Whittemore, G. (1991). Interactive written discourse as an emergent register. *Written Communication*, 8(1), 8-34.
- Frankel, M. S., & Siang, S. (1999). *Ethical and legal aspects of human subjects research on the Internet* [Workshop report]. American Association for the Advancement of Science. Retrieved June 15, 2001 from the World Wide Web: <http://www.aaas.org/spp/dspp/sfrl/projects/intres/main.htm>
- Friedman, B., Kahn, P., & Howe, D. (2000). Trust online. *Communications of the ACM*, 43 (12), 34-40.
- Gauntlett, D. (2000a). The future: Faster, smaller, more, more, more. In D. Gauntlett (Ed.), *Web.studies: Rewiring media studies for the digital age* (pp. 212-217). London: Arnold.
- Gauntlett, D. (Ed.). (2000b). *Web.studies: Rewiring media studies for the digital age*. London: Arnold.
- Giese, M. (1998). Constructing a virtual geography: Narrative of space in a text-based environment. *Journal of Communication Inquiry*, 22 (2), 152-176.
- Glassman, E. (2000). Cyber hate: The discourse of intolerance in the new Europe. In L. Lengel (Ed.), *Culture @nd technology in the new Europe: Civic discourse in transformation in post-communist nations* (pp. 145-164). Stamford, CT: Ablex.
- Goggin, G. (2000). Pay per browse? The Web's commercial futures. In D. Gauntlett (Ed.), *Web.studies: Rewiring media studies for the digital age* (pp. 103-112). London: Arnold.
- Graddol, D., & Swann, J. (1989). *Gender voices*. Oxford: Basil Blackwell.
- Griffiths, M. (1998). Internet addiction: Does it really exist? In J. Gackenbach (Ed.), *Psychology and the Internet: Intrapersonal, interpersonal, and transpersonal implications* (pp. 61-75). San Diego, CA: Academic Press.
- Hafner, K., & Lyon, M. (1996). *Where wizards stay up late: The origins of the Internet*. New York: Simon & Schuster.
- Hale, C. (Ed.). (1996). *Wired style: Principles of English usage in the digital age*. San Francisco: HardWired.
- Hall, K. (1996). Cyberfeminism. In S. Herring (Ed.), *Computer-mediated communication: Linguistic, social and cross-cultural perspectives* (pp. 147-170). Amsterdam: John Benjamins.
- Hampton, K. N., & Wellman, B. (1999). Netville online and offline. *American Behavioral Scientist*, 43, 475-492.
- Hauben, M., & Hauben, R. (1997). *Netizens: On the history and impact of Usenet and the Internet*. Los Alamitos, CA: IEEE Computer Society.
- Hawisher, G., & Selfe, C. (2000). Introduction: Testing the claims. In G. E. Hawisher & C. L. Selfe (Eds.), *Global literacies and the World-Wide Web* (pp. 1-18). New York: Routledge.
- Haynes, C., & Holmevik, J. R. (Eds.). (1997). *High wired: On the design, use, and theory of educational MOOs*. Ann Arbor, MI: University of Michigan Press.
- Herman, A., & Swiss, T. (Eds.). (2000). *The World Wide Web and contemporary cultural theory*. New York: Routledge.
- Herring, S. C. (1993). Gender and democracy in computer-mediated communication. *Electronic Journal of Communication*, 3 (2). Retrieved June 15, 2001, from the World Wide Web: <http://www.cios.org/www/ejc/v3n293.htm>
- Herring, S. C. (1994). Politeness in computer culture: Why women thank and men flame. In M. Bucholtz, A. Liang, L. Sutton, & C. Hines (Eds.), *Cultural performances: Proceedings of the Third Berkeley Women and Language Conference* (pp. 278-94). Berkeley, CA: Berkeley Women and Language Group.

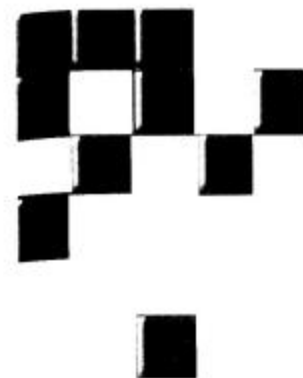
- Herring, S. C. (1996a). Posting in a different voice: Gender and ethics in computer-mediated communication. In C. Ess (Ed.), *Philosophical perspectives on computer-mediated communication* (pp. 115-145). Albany, NY: SUNY Press.
- Herring, S. C. (1996b). Two variants of an electronic message schema. In S. Herring (Ed.), *Computer-mediated communication: Linguistic, social and cross-cultural perspectives* (pp. 81-106). Amsterdam: John Benjamins.
- Herring, S. C. (1996c). Linguistic and critical research on computer-mediated communication: Some ethical and scholarly considerations. *The Information Society*, 12(2), 153-168.
- Herring, S. C. (1998a). Le style du courrier électronique: variabilité et changement. *Terminogramme*, 84-85, 9-16.
- Herring, S. C. (1998b, September 25). *Virtual gender performances*. Talk presented to Discourse Studies Program, Texas A&M University, College Station.
- Herring, S. C. (1999a). Interactional coherence in CMC. *Journal of Computer-Mediated Communication*, 4(4). Retrieved June 15, 2001, from the World Wide Web: <http://www.ascusc.org/jcmc/vol4/issue4>
- Herring, S. C. (1999b). The rhetorical dynamics of gender harassment on-line. *The Information Society*, 15(3), 151-167.
- Herring, S. C. (in press a). Computer-mediated discourse. In D. Tannen, D. Schiffrin, & H. Hamilton (Eds.), *Handbook of discourse analysis*. Oxford: Blackwell.
- Herring, S. C. (in press b). Gender and power in online communication. In J. Holmes & M. Meyerhoff (Eds.), *Handbook of language and gender*. Oxford: Blackwell.
- Herring, S. C. (forthcoming). Who's got the floor in computer-mediated conversation? Edelsky's gender patterns revisited. In S. Herring (Ed.), *Computer-mediated conversation*.
- Herring, S. C., Johnson, D. A., & DiBenedetto, T. (1992). Participation in electronic discourse in a "feminist" field. In K. Hall, M. Bucholtz, & B. Moonwomon (Eds.), *Locating power: The Proceedings of the Second Berkeley Women and Language Conference* (pp. 250-262). Berkeley, CA: Berkeley Women and Language Group.
- Herring, S. C., Johnson, D. A., & DiBenedetto, T. (1995). "This discussion is going too far!" Male resistance to female participation on the Internet. In M. Bucholtz & K. Hall (Eds.), *Gender articulated: Language and the socially constructed self* (pp. 67-96). London: Routledge.
- Herring, S. C., & Nix, C. G. (1997, March). *Is "serious chat" an oxymoron? Academic vs. social uses of Internet Relay Chat*. Paper presented at the meeting of the American Association of Applied Linguistics, Orlando, FL.
- Hert, P. (1997). Social dynamics of an on-line scholarly debate. *The Information Society*, 13, 329-360.
- Hill, J., Ozer, J., & Mace, T. (1996, October 8). Real-time communication. *PC Magazine*, 15 (17). Retrieved June 15, 2001, from the World Wide Web: <http://www.zdnet.com/pcmag/issues/1517/pcmg0023.htm>
- Hiltz, R. S., & Turoff, M. (1978). *The network nation: Human communication via computer*. New York: Addison-Wesley.
- Hodsdon, C. B. (forthcoming). Conversations within conversations: Intertextuality in racially antagonistic dialogue on Usenet. In S. Herring (Ed.), *Computer-mediated conversation*.
- Hoffman, D. L., Kalsbeek, W. D., & Novak, T. P. (1996). Internet and Web use in the U.S. *Communications of the ACM*, 39 (12), 36-46.
- Hoffman, D. L., & Novak, T. P. (1995). *Marketing in hypermedia computer-mediated environments: Conceptual foundations*. Retrieved June 15, 2001, from the World Wide Web: <http://www2000.ogsm.vanderbilt.edu/cmepaper.revision.july11.1995/cmepaper.html>
- Hongladarom, S. (2001). Global culture, local cultures, and the Internet: The Thai example. In C. Ess (Ed.), *Culture, technology, communication: Towards an intercultural global village* (pp. 307-324). Albany, NY: SUNY Press.
- Jackson, M. (1997). Assessing the structure of communication on the World Wide Web. *Journal of Computer-Mediated Communication*, 3 (1). Retrieved June 15, 2001, from the World Wide Web: <http://www.ascusc.org/jcmc/vol3/issue1/jackson.html>
- Jacobs-Huey, L. (forthcoming). ...BTW, how do YOU wear your hair? Identity, knowledge and authority in an electronic speech community. In S. Herring (Ed.), *Computer-mediated conversation*.
- Jacobson, D. (1996). Contexts and cues in cyberspace: The pragmatics of naming in text-based virtual realities. *Journal of Anthropological Research*, 52, 461-481.
- Jones, J. (2000, April 28). A brief history of wireless. *ZDNet*. Retrieved June 15, 2001, from the World Wide Web: <http://icq.zdnet.com/special/stories/wireless/0,10676,2557092,00.html>
- Jones, Q., & Rafaeli, S. (2000). What do virtual "tells" tell? Placing cybersociety research into a hierarchy of social explanation. *Proceedings of the 33rd Hawaii International Conference on System Sciences*. Retrieved June 15, 2001 from the World Wide Web: <http://dlib.computer.org/conferen/hicss/0493/pdf/04931011.pdf>
- Jones, S. (1995). Understanding community in the information age. In S. Jones (Ed.), *Cybersociety: Computer-mediated communication and community* (pp. 10-35). Thousand Oaks, CA: Sage.
- Jones, S. (Ed.). (1999). *Doing Internet research: Critical issues and methods for examining the net*. Thousand Oaks, CA: Sage.
- Kendall, L. (1996). MUDder? I hardly know 'er! Adventures of a feminist MUDder. In L. Cherny & E. R. Weise (Eds.), *Wired women: Gender and new realities in cyberspace* (pp. 207-223). Seattle, WA: Seal Press.
- Kerr, D. M. (2000, September 6). Statement for the record of Donald M. Kerr, Assistant Director, Laboratory Division, Federal Bureau of Investigation on Carnivore diagnostic tool. Retrieved June 15, 2001 from the World Wide Web: <http://www.fbi.gov/congress/congress00/kerr090600.htm>

- Kiesler, S., Siegel, J., & McGuire, T. W. (1984). Social psychological aspects of computer-mediated communication. *American Psychologist*, 39, 1123-1134.
- Kiesler, S., Zubrow, D., Moses, A. M., & Geller, V. (1985). Affect in computer-mediated communication: An experiment in synchronous terminal-to-terminal discussion. *Human Computer Interaction*, 1, 77-104.
- Kim, M.-S., & Raja, N. S. (1990). Verbal aggression and self-disclosure on computer bulletin boards. Washington, DC: ERIC Clearinghouse on Languages and Linguistics. (ERIC Document No. ED334620).
- King, S. (1996a). Is the Internet addictive, or are addicts using the Internet? Retrieved June 15, 2001, from the World Wide Web: <http://www.concentric.net/~Astorm/iad.html>
- King, S. (1996b). Researching Internet communities: Proposed ethical guidelines for the reporting of results. *The Information Society*, 12, 119-127.
- King, S. (1999). Internet gambling and pornography: Illustrative examples of the psychological consequences of communication anarchy. *CyberPsychology & Behavior*, 2 (3), 175-193.
- King, S., & Moreggi, D. (1998). Internet therapy and self-help groups—The pros and cons. In J. Gackenbach (Ed.), *Psychology and the Internet* (pp. 77-109). London: Academic.
- Knudson, J. (1998). Rebellion in Chiapas: Insurrection by Internet and public relations. *Media, Culture, and Society*, 20, 507-518.
- Ko, K.-K. (1996). Structural characteristics of computer-mediated language: A comparative analysis of InterChange discourse. *Electronic Journal of Communication*, 6(3). Retrieved June 15, 2001, from the World Wide Web: <http://www.cios.org/www/ejc/v6n396.htm>
- Kolbert, E. (2001, May 28). Pimps and dragons: How an online world survived a social breakdown. *The New Yorker*, 77(13), 88-98.
- Kolko, B. (1995). Building a world with words: The narrative reality of virtual communities. *Works and Days*, 13(1/2), 105-126. Retrieved June 15, 2001, from the World Wide Web: <http://acorn.grove.iup.edu/en/workdays/toc.html>
- Kolko, B., & Reid, E. (1998). Dissolution and fragmentation: Problems in online communities. In S. Jones (Ed.), *Cybersociety 2.0: Revisiting computer mediated communication and community* (pp. 212-229). Thousand Oaks, CA: Sage.
- Korenman, J., & Wyatt, N. (1996). Group dynamics in an e-mail forum. In S. Herring (Ed.), *Computer-mediated communication: Linguistic, social and cross-cultural perspectives* (pp. 225-242). Amsterdam: John Benjamins.
- Kramarae, C., & Taylor, H. J. (1993). Women and men on electronic networks: A conversation or a monologue? In H. J. Taylor, C. Kramarae, & M. Ebben (Eds.), *Women, information technology, and scholarship* (pp. 52-61). Urbana, IL: Center for Advanced Study.
- Kraut, R., Patterson, M., Lundmark, V., Kiesler, S., Mukhopadhyay, T., & Scherlis, W. (1998). Internet paradox: A social technology that reduces social involvement and psychological well-being. *American Psychologist*, 53, 1017-1031.
- Kraut, R., Scherlis, W., Mukhopadhyaya, T., Manning, J., & Kiesler, S. (1996). The HomeNet field trial of residential Internet services. *Communications of the ACM*, 39 (12), 55-63.
- Krikorian, D., Lee, J.-S., Chock, T. M., & Harms, C. (2000). Isn't that spatial? Distance and communication in a 2-D virtual environment. *Journal of Computer-Mediated Communication*, 5(4). Retrieved June 15, 2001, from the World Wide Web: <http://www.ascusc.org/jcmc/vol5/issue4/krikorian.html>
- Lambiase, J. J. (forthcoming). Hanging by a thread: Topic development and death in an electronic discussion of the Oklahoma City bombing. In S. Herring (Ed.), *Computer-mediated conversation*.
- Lax, S. (2000). The Internet and democracy. In D. Gauntlett (Ed.), *Web.studies: Rewiring media studies for the digital age* (pp.159-169). London: Arnold.
- Lea, M., O'Shea, T., Fung, P., & Spears, R. (1992). "Flaming" in computer-mediated communication: Observations, explanations, implications. In M. Lea (Ed.), *Contexts of computer-mediated communication* (pp. 89-112). New York: Harvester Wheatsheaf.
- Lea, M., & Spears, R. (1995). Love at first byte? Building personal relationships over computer networks. In J. T. Wood & S. Duck (Eds.), *Understudied relationships: Off the beaten track* (pp. 197-233). Thousand Oaks, CA: Sage.
- Leiner, B. M., Cerf, V. G., Clark, D. D., Kahn, R. E., Kleinrock, L., Lynch, D. C., Postel, J., Roberts, L. G., & Wolff, S. S. (1997). The past and future history of the Internet. *Communications of the ACM*, 40 (2), 102-108.
- Levin, R. (2000). Advogato's trust metric. Retrieved June 15, 2001, from the World Wide Web: <http://www.advogato.org/trust-metric.html>
- Licklider, J. C. R., Taylor, R. W., & Herbert, E. (1968). The computer as a communication device. *Science and Technology*, 76, 21-31.
- Liu, G. Z. (1999). Virtual community presence in Internet Relay Chatting. *Journal of Computer-Mediated Communication*, 5(1). Retrieved June 15, 2001, from the World Wide Web: <http://www.ascusc.org/jcmc/vol5/issue1/liu.html>
- Livia, A. (forthcoming). BSR ES TU F? Brevity and expressivity on the French Minitel. In S. Herring (Ed.), *Computer-mediated conversation*.
- Lombard, M., & Ditton, T. (1997). At the heart of it all: The concept of presence. *Journal of Computer-Mediated Communication*, 3(2). Retrieved June 15, 2001, from the World Wide Web: <http://www.ascusc.org/jcmc/vol3/issue2/lombard.html>
- Lynch, C. A. & Preston, C. M. (1990). Internet access to information resources. *Annual Review of Information Science and Technology*, 25, 263-312.
- Mabrey, E. A. (1997). Frames and flames: The structure of argumentative messages on the net. In S. Rafaeli, F. Sudweeks, & M. McLaughlin (Eds.), *Network and netplay: Virtual groups on the Internet* (pp. 13-26). Cambridge, MA: AAAI/MIT Press.
- MacKinnon, R. C. (1995). Searching for the Leviathan in Usenet. In S. Jones (Ed.), *Cybersociety: Computer-mediated communication and community* (pp. 112-137). Thousand Oaks, CA: Sage.

- Mallapragada, M. (2000). The Indian diaspora in the USA and around the Web. In D. Gauntlett (Ed.), *Web studies: Rewiring media studies for the digital age* (pp. 179-185). London: Arnold.
- Mann, C., & Stewart, F. (2000). *Internet communication and qualitative research: A handbook for researching online*. Thousand Oaks, CA: Sage.
- Marvin, L.-E. (1995). Spoof, spam and lag. *Journal of Computer-Mediated Communication*, 1 (2). Retrieved June 15, 2001, from the World Wide Web: <http://www.ascusc.org/jcmc/vol1/issue2/marvin.html>
- Mattelart, A. (1996, October). Les enjeux de la globalisation des réseaux. *Internet: L'extase et l'effroi* [special issue of *Le Monde Diplomatique*], 10-14.
- Mauz. (2000). Mauz's Active Worlds pages: History. Retrieved June 15, 2001, from the World Wide Web: <http://tnic.com/mauz/awhistory.html>
- McChesney, R. (2000). So much for the magic of technology and the free market: The World Wide Web and the corporate media system. In A. Herman & T. Swiss (Eds.), *The World Wide Web and contemporary cultural theory* (pp. 5-35). New York: Routledge.
- McClellan, J. (1996). Alpha World: Police pages. Retrieved June 15, 2001, from the World Wide Web: <http://binky.paragon.co.uk/it/issue19/Alpha/Alpha.html>
- McGrath, J. E. (1990). Time matters in groups. In J. Galegher, R. E. Kraut, & C. Egido (Eds.), *Intellectual teamwork: Social and technical foundations of cooperative work* (pp. 23-61). Hillsdale, NJ: Lawrence Erlbaum.
- McLaughlin, M. L., Osborne, K. K., & Smith, C. B. (1995). Standards of conduct on Usenet. In S. Jones (Ed.), *Cybersociety: Computer-mediated communication and community* (pp. 90-111). Thousand Oaks, CA: Sage.
- McRae, S. (1996). Coming apart at the seams: Sex, text and the virtual body. In L. Cherny & E. Weise (Eds.), *Wired women: Gender and new realities in cyberspace* (pp. 242-263). Seattle: Seal Press.
- Meeks, B. (1999). The privacy hoax. *Communications of the ACM*, 42(2), 17-19.
- Meloan, S. (1995). CU-SeeMe. *Urban Desires*, 1.6. Retrieved June 15, 2001, from the World Wide Web: <http://desires.com/1.6/Toys/Cuseeme/cuseeme.html>
- Millen, D. (2000). Community portals and collective goods: Conversation archives as an information resource. *Proceedings of the 33rd Hawaii International Conference on System Sciences*. Retrieved June 15, 2001 from the World Wide Web: <http://dlib.computer.org/conferen/hicss/0493/pdf/04933030.pdf>
- Mitra, A., & Cohen, E. (1999). Analyzing the Web: Directions and challenges. In S. Jones (Ed.), *Doing Internet research: Critical issues and methods for examining the net* (pp. 179-202). Thousand Oaks, CA: Sage.
- Murray, D. E. (1988). The context of oral and written language: A framework for mode and medium switching. *Language in Society*, 17, 351-373.
- Murray, D. E. (1990). CmC. *English Today*, 23, 42-46.
- Naper, I. (2001). System features of an inhabited 3D virtual environment supporting multimodality in communication. *Proceedings of the 34th Hawaii International Conference on System Sciences*. Retrieved June 15, 2001 from the World Wide Web: [http://www.hicss.hawaii.edu/HICSS\\_34/PDFs/DDPTC08.pdf](http://www.hicss.hawaii.edu/HICSS_34/PDFs/DDPTC08.pdf)
- the World Wide Web: [http://www.hicss.hawaii.edu/HICSS\\_34/PDFs/DDPTC10.pdf](http://www.hicss.hawaii.edu/HICSS_34/PDFs/DDPTC10.pdf)
- Neal, L. (1997). *Virtual classrooms and communities*. Paper presented at the Group'97 Conference of the Association for Computing Machinery, Phoenix, AZ. Retrieved June 15, 2001, from the World Wide Web: <http://www3.ncsu.edu/dox/NBE/neal/nealtitle.htm>
- Nelson, T. (1967). Getting it out of our system. In G. Schechter (Ed.), *Information retrieval: A critical review*. Washington, DC: Thompson Books.
- Nonnecke, B., & Preece, J. (2000). Persistence and lurkers in discussion lists: A pilot study. *Proceedings of the 33rd Hawaii International Conference on System Sciences*. Retrieved June 15, 2001 from the World Wide Web: <http://dlib.computer.org/conferen/hicss/0493/pdf/04933031.pdf>
- Nunberg, G. (2000). Will the Internet always speak English? *The American Prospect*, 11(10). Retrieved June 15, 2001, from the World Wide Web: <http://www.prospect.org/print/V11/10/nunberg-g.html>
- Ogan, C. (1993). Listserv communication during the Gulf War: What kind of medium is the electronic bulletin board? *Journal of Broadcasting and Electronic Media*, 37, 177-196.
- Olson, J. S., & Olson, G. M. (2000). i2i trust in e-commerce. *Communications of the ACM*, 43 (12), 41-44.
- O'Sullivan, P. B. (1999). "Personal broadcasting:" Theoretical implications of the Web. Retrieved June 15, 2001, from the World Wide Web: <http://www.ilstu.edu/~posull/PersBroad.htm>
- Paolillo, J. C. (1996). Language choice on soc.culture.punjab. *Electronic Journal of Communication*, 6(3). Retrieved June 15, 2001, from the World Wide Web: <http://www.cios.org/www/ejc/v6n396.htm>
- Paolillo, J. C. (2000). Visualizing Usenet: A factor-analytic approach. *Proceedings of the 33rd Hawaii International Conference on System Sciences*. Retrieved June 15, 2001 from the World Wide Web: <http://dlib.computer.org/conferen/hicss/0493/pdf/04933033.pdf>
- Paolillo, J. C. (2001). Language variation on Internet Relay Chat: A social network approach. *Journal of Sociolinguistics*, 5(2), 180-213.
- Parks, M., & Floyd, K. (1996). Making friends in cyberspace. *Journal of Communication*, 46(1), 80-97.
- Pastore, M. (2000, May 12). Women use Web to change social landscape. *CyberAtlas*. Retrieved June 15, 2001, from the World Wide Web: [http://cyberatlas.internet.com/big\\_picture/demographics.html](http://cyberatlas.internet.com/big_picture/demographics.html)
- Perrole, J. A. (1991). Conversations and trust in computer interfaces. In C. Dunlop & R. Kling (Eds.), *Computerization and controversy* (pp. 350-363). Boston: Academic Press.
- Perry, M. J., Fruchter, R., & Spinelli, G. (2001). Spaces, traces and networked design. *Proceedings of the 34th Hawaii International Conference on System Sciences*. Retrieved June 15, 2001 from the World Wide Web: [http://www.hicss.hawaii.edu/HICSS\\_34/PDFs/DDPTC08.pdf](http://www.hicss.hawaii.edu/HICSS_34/PDFs/DDPTC08.pdf)

- Petrizzini, B., & Kibati, M. (1999). The Internet in developing countries. *Communications of the ACM*, 42(6), 31-36.
- Pew Internet and American Life Project. (2000). Trust and privacy online: Why Americans want to rewrite the rules. Retrieved June 15, 2001, from the World Wide Web: <http://www.pewinternet.org/reports/toc.asp?Report=19>
- Pfaffenberger, B. (1996). "If I want it, it's OK." Usenet and the (outer) limits of free speech. *The Information Society*, 12, 365-386.
- Pioch, N. (1997). A short IRC primer. Retrieved June 15, 2001, from the World Wide Web: <http://www.irchelp.org/irchelp/ircprimer.html>
- Preece, J. (2000). *Online communities: Designing usability, supporting sociability*. Chichester, U.K.: John Wiley.
- Pullen, K. (2000). I-love-Xena.com: Creating on-line fan communities. In D. Gauntlett (Ed.), *Web.studies: Rewiring media studies for the digital age* (pp. 52-61). London: Arnold.
- Rafaeli, S., & Sudweeks, F. (1997). Networked interactivity. *Journal of Computer-Mediated Communication*, 2(4). Retrieved June 15, 2001, from the World Wide Web: <http://www.ascusc.org/jcmc/vol2/issue4>
- Reid, E. M. (1991). *Electropolis: Communication and community on Internet Relay Chat*. Unpublished senior honours thesis, University of Melbourne, Australia. Retrieved June 15, 2001, from the World Wide Web: <http://www.crosswinds.net/~aluluei/electropolis.htm>
- Reid, E. M. (1994). *Cultural formations in text-based virtual realities*. Unpublished master's thesis, University of Melbourne, Australia. Retrieved June 15, 2001, from the World Wide Web: <http://home.earthlink.net/~aluluei/cult-form.htm>
- Reid, E. M. (1998). Hierarchy and power: Social control in cyberspace. In M. Smith & P. Kollock (Eds.), *Communities in cyberspace* (pp. 107-133). London: Routledge.
- Rheingold, H. (1993). *The virtual community: Homesteading on the electronic frontier*. Reading, MA: Addison-Wesley. Retrieved June 15, 2001, from the World Wide Web: <http://www.rheingold.com/vc/book>
- Rice, R. E. (1980). The impacts of computer-mediated organizational and interpersonal communication. *Annual Review of Information Science and Technology*, 15, 221-250.
- Rice, R. E., & Gattiker, U. E. (2000). New media and organizational structuring. In F. Jablin & L. Putnam (Eds.), *The new handbook of organizational communication* (pp. 544-581). Thousand Oaks, CA: Sage.
- Rice, R. E., & Love, G. (1987). Electronic emotion: Socioemotional content in a computer-mediated network. *Communication Research*, 14, 85-108.
- Rickert, A., & Sacharow, A. (2000). *It's a woman's World Wide Web*. Media Metrix and Jupiter Communications report. Retrieved June 15, 2001, from the World Wide Web: <http://www.mediametrix.com/data/MMXI-JUP-WWWW.pdf>
- Rivera, K., Cooke, N. J., & Bauhs, J. A. (1996). The effects of emotional icons on remote communication. *Human Factors in Computing Systems: CHI '96 Conference Proceedings*. Retrieved June 15, 2001, from the World Wide Web: [http://www.uni-paderborn.de/StaffWeb/chi96/E1Pub/WWW/chi96www/intpost/Rivera/rk\\_txt.htm](http://www.uni-paderborn.de/StaffWeb/chi96/E1Pub/WWW/chi96www/intpost/Rivera/rk_txt.htm)
- Robertson, G. G., Card, S. K., & Mackinlay, J. D. (1993). Nonimmersive virtual reality. *Computer*, 26, 81-83.
- Rodino, M. (1997). Breaking out of binaries: Reconceptualizing gender and its relationship to language in computer-mediated communication. *Journal of Computer-Mediated Communication*, 3(3). Retrieved June 15, 2001, from the World Wide Web: <http://www.ascusc.org/jcmc/vol3/issue3/rodino.html>
- Rowe, C. (forthcoming). Genesis and evolution of an e-mail driven sibling code. In S. Herring (Ed.), *Computer-mediated conversation*.
- Sack, W. (2000). Discourse diagrams: Interface design for very large-scale conversations. *Proceedings of the 33rd Hawaii International Conference on System Sciences*. Retrieved June 15, 2001 from the World Wide Web: <http://dlib.computer.org/conferen/hicss/0493/pdf/04933034.pdf>
- Salus, P. (1995). *Casting the net: From ARPANET to Internet and beyond*. Reading, MA: Addison-Wesley.
- Savicki, V., Lingenfelter, D., & Kelley, M. (1997). Gender language style and group composition in Internet discussion groups. *Journal of Computer-Mediated Communication*, 2 (3). Retrieved June 15, 2001, from the World Wide Web: <http://www.ascusc.org/jcmc/vol2/issue3>
- Scannell, B. (1999). Life on the border: Cyberspace and the frontier in historical perspective. Retrieved June 15, 2001, from the World Wide Web: <http://www.kether.com/thesis/context.html>
- Seevak, N. (2001, April 27). Is wireless instant messaging the future of communication? *InternetNews*. Retrieved June 15, 2001, from the World Wide Web: [http://www.internetnews.com/intl-news/article/0,,6\\_753901,00.html](http://www.internetnews.com/intl-news/article/0,,6_753901,00.html)
- Schlager, M. S., Fusco, J., & Schank, P. (in press). Evolution of an on-line education community of practice. In K. A. Renninger & W. Shumar (Eds.), *Building virtual communities: Learning and change in cyberspace*. New York: Cambridge University Press.
- Schmid-Isler, S. (2000). The language of digital genres: A semiotic investigation of style and iconology on the World Wide Web. *Proceedings of the 33rd Hawaii International Conference on System Sciences*. Retrieved June 15, 2001 from the World Wide Web: <http://dlib.computer.org/conferen/hicss/0493/pdf>
- Selke, C. L., & Meyer, P. R. (1991). Testing claims for on-line conferences. *Written Communication*, 8(2), 163-192.
- Severinson-Eklundh, K. (forthcoming). To quote or not to quote: Setting the context for computer-mediated dialogues. In S. Herring (Ed.), *Computer-mediated conversation*.
- Severinson-Eklundh, K., & Macdonald, C. (1994). The use of quoting to preserve context in electronic mail dialogues. *IEEE Transactions on Professional Communication*, 37(4), 197-202.
- Sharf, B. F. (1999). Beyond netiquette: the ethics of doing naturalistic discourse research on the Internet. In S. Jones (Ed.), *Doing Internet research: Critical*

- issues and methods for examining the net (pp. 243-256). Thousand Oaks, CA: Sage.
- Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunications*. London: Wiley.
- Sierpe, E. (2000). Gender and technological practices in electronic discussion lists: An examination of JESSE, the library/information science education forum. *Library & Information Science Research*, 22, 273-289.
- Silberman, S. (2000). Talking to strangers. *Wired* 8.05. Retrieved June 15, 2001, from the World Wide Web: <http://www.wired.com/wired/archive/8.05/translation.html?11=1&topic>
- Sloan, B. (1997, February). Using CUSeeMe to keep in touch: A glimpse into the future for remote communication in the built environment. *Habitat*, 3. Retrieved June 15, 2001, from the World Wide Web: <http://ctiweb.cf.ac.uk/HABITAT/HABITAT3/cuseeme.html>
- Smit, C. R. (2000). Fascination: The modern allure of the Internet. In D. Gauntlett (Ed.), *Web.studies: Rewiring media studies for the digital age* (pp. 130-136). London: Arnold.
- Smith, M. A. (1999). Invisible crowds in cyberspace: Mapping the social structure of Usenet. In M. Smith & P. Kollock (Eds.), *Communities in cyberspace*. London: Routledge.
- Soukup, C. (1999). The gendered interactional patterns of computer-mediated chatrooms: A critical ethnographic study. *The Information Society*, 15, 169-176.
- Soukup, C. (2000). Building a theory of multi-media CMC. *New Media & Society*, 2, 407-425.
- Spears, R., & Lea, M. (1992). Social influence and the influence of the "social" in computer-mediated communication. In M. Lea (Ed.), *Contexts of computer-mediated communication* (pp. 30-65). London: Harvester Wheatsheaf.
- Spertus, E. (1996). Social and technical means for fighting online harassment. Retrieved June 15, 2001, from the World Wide Web: <http://www.ai.mit.edu/people/ellens/Gender/gk>
- Spertus, E. (1997). Smokey: Automatic recognition of hostile messages. *Proceedings of the Ninth Innovative Applications of Artificial Intelligence Conference*. Retrieved June 15, 2001, from the World Wide Web: <http://www.ai.mit.edu/people/ellens/smokey.ps>
- Sproull, L., & Kiesler, S. (1986). Reducing social context cues: Electronic mail in organizational communication. *Management Science*, 32, 1492-1512.
- Sproull, L., & Kiesler, S. (1991). *Connections: New ways of working in the networked organization*. Cambridge, MA: MIT Press.
- Steinfeld, C. W. (1986). Computer-mediated communication systems. *Annual Review of Information Science and Technology*, 21, 167-202.
- Steinhardt, S. (n.d.). An interview with Dave Gobel, chairman and founder of Worlds Inc. *Online Magazine*. Retrieved June 15, 2001, from the World Wide Web: <http://www.online-magazine.com/gobel1.htm>
- Stoll, C. (1995). *Silicon snake oil: Second thoughts on the information highway*. New York: Doubleday.
- Stubbs, P. (1998). Conflict and cooperation in the virtual community: E-mail and the wars of the Yugoslav succession. *Sociological Research Online*, 3(3). Retrieved June 15, 2001, from the World Wide Web: <http://www.socresonline.org.uk/socresonline/3/3/7.html>
- Sudweeks, F., & Rafaei, S. (1996). How do you get a hundred strangers to agree? Computer mediated communication and collaboration. In T. Harrison & T. Stephens (Eds.), *Computer networking and scholarly communication in the twenty-first-century university* (pp. 115-136). Albany, NY: SUNY Press.
- Suler, J. (1996). *The Psychology of Cyberspace*. Retrieved June 15, 2001, from the World Wide Web: <http://www.rider.edu/users/suler/psyber/psyber.html>
- Sutton, L. (1994). Using Usenet: Gender, power, and silence in electronic discourse. In S. Gahl, A. Dolbey, & C. Johnson (Eds.), *Proceedings of the 20th Annual Meeting of the Berkeley Linguistics Society* (pp. 506-520). Berkeley, CA: Berkeley Linguistics Society.
- Turkle, S. (1988). Computational reticence: Why women fear the intimate machine. In C. Kramarae (Ed.), *Technology and women's voices: Keeping in touch* (pp. 41-61). London: Routledge & Kegan Paul.
- Turkle, S. (1995). *Life on the screen: Identity in the age of the Internet*. New York: Simon & Schuster.
- van Gelder, L. (1990). The strange case of the electronic lover. In G. Gumpert & S. L. Fish (Eds.), *Talking to strangers: Mediated therapeutic communication* (pp. 128-142). Norwood, NJ: Ablex.
- Vilhjalmsson, H. H. (1997). *Autonomous communicative behaviors in avatars*. Unpublished master's thesis, Massachusetts Institute of Technology, Cambridge. Retrieved June 15, 2001, from the World Wide Web: [http://hannes.www.media.edu/people/hannes/msthesis/a\\_interface.html](http://hannes.www.media.edu/people/hannes/msthesis/a_interface.html)
- Virnoche, M., & Marx, G. (1997). "Only connect"—E.M. Forster in an age of electronic communication: Computer-mediated association and community networks. *Sociological Inquiry*, 67, 85-100.
- Wakeford, N. (2000). New media, new methodologies: Studying the Web. In D. Gauntlett (Ed.), *Web.studies: Rewiring media studies for the digital age* (pp. 31-41). London: Arnold.
- Walther, J. (1996). Computer-mediated communication: Impersonal, interpersonal and hyperpersonal interaction. *Communication Research*, 23(1), 3-43.
- Walther, J. (1999). Visual cues and computer-mediated communication: Don't look before you leap. Retrieved June 15, 2001, from the World Wide Web: <http://www.rensse-laer.edu/~walthj/ica99.html>
- Weber, H. L. (forthcoming). Missed cues: How disputes can socialize virtual newcomers. In S. Herring (Ed.), *Computer-mediated conversation*.
- Wellman, B. (1997). An electronic group is virtually a social network. In S. Kiesler (Ed.), *Culture of the Internet* (pp. 179-204). Mahwah, NJ: Lawrence Erlbaum.



- Wellman, B., & Gulia, M. (1999). Net surfers don't ride alone: Virtual communities as communities. In M. Smith & P. Kollock (Eds.), *Communities in cyberspace* (pp. 167-194). London: Routledge.
- Wellman, B., Salaff, J., Dimitrova, D., Garton, L., Gulia, M., & Haythornwaite, C. (1996). Computer networks as social networks: Collaborative work, telework and virtual community. *Annual Review of Sociology*, 22, 212-238.
- Werry, C. C. (1996). Linguistic and interactional features of Internet Relay Chat. In S. Herring (Ed.), *Computer-mediated communication: Linguistic, social and cross-cultural perspectives* (pp. 47-63). Amsterdam: John Benjamins.
- Wilkins, H. (1991). Computer talk: Long-distance conversations by computer. *Written Communication*, 8(1), 56-78.
- Woodburn, R., Proctor, R., Arnott, J. L., & Newell, A. F. (1991). A study of conversational turn-taking in a communication aid for the disabled. *Proceedings of HCI 91: People and Computers*, 4, 359-371.
- Yates, S. J. (1996). English in cyberspace. In S. Goodman & D. Graddol (Eds.), *Redesigning English: New texts, new identities* (pp. 106-140). London: Routledge.
- Yates, S. J., & Graddol, D. (1996, July). "I read this chat is heavy." The discursive construction of identity in CMC. Paper presented at the 5th International Pragmatics Conference, Mexico City.
- Zastrow, J. (1999). ICQ for info pros. *Database*, 22(3), 36-38.
- Zickmund, S. (1997). Approaching the radical other: The discursive culture of cyberhate. In S. Jones (Ed.), *Virtual culture: Identity and communication in cybersociety* (pp. 185-205). Thousand Oaks, CA: Sage.

## Knowledge Discovery