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CHAPTER 9

Collaboration and Social Media Participation

> Three helping one another will do as much as six working singly.

Spanish Proverb

Written in collaboration with Maxine S. Cohen

CHAPTER OUTLINE

9.1 Introduction

The introversion and isolation of early computer users has given way to extremely lively online communities of busily interacting teams and bustling crowds of chatty diverse users that span the gamut in terms of age, computer expertise, and geographic locations. The pursuit of human connections has prompted millions of users to join listservers, visit chat rooms, and fill online communities with useful information and supportive responses, peppered with outrageous humor. But, as in most human communities, there is also controversy, anger, slander, and pornography. The World Wide Web has dramatically enriched textual communications with colorful graphics and sometimes too-dazzling Java or Flash animations. The Web is sometimes derided as a playground, but serious work and creative endeavors are enormously facilitated by the easy flow of information it provides. Cell phones and mobile devices have also expanded the possibilities for communication by voice, text messages, digital photos, videos, and other forms of user-generated content.

The expanding options for collaboration and social media participation have benefits for everyone. Goal-directed individuals quickly recognize the benefits of electronic collaboration and the potentials for business in the networked global village. Playful and social personalities enjoy laughing with siblings and surprising their friends halfway around the world. The distance to colleagues is no longer measured in miles or kilometers, but rather in intellectual compatibility and responsiveness; a close friend is someone who responds from across an ocean within three minutes at 3:00 A.M. with the rare music file that you long to hear.

The good news is that computing, once seen as alienating and antihuman, is becoming a socially respectable and interpersonally positive force. Enthusiasts

hail collaborative interfaces, such as *groupware* for team processes, health support groups, scientific collaboratories, and shared documents as productivity and creativity support tools. They also cheer for the successes of virtual environments like *Second Life*, communal creations such as Wikipedia, and social networking sites such as Facebook. Even lightweight participation in social media, such as tagging a photo in Flickr, rating a movie in Netflix, or marking a new story in Digg™, can have a transformative effect through the cumulative efforts of millions of people.

However, these interfaces for collaboration and social media participation have limitations, and there may be a dark side to the force. Will the speedup in work rates reduce quality, increase burnout, or undermine loyalty? Can collaborative interfaces be turned into oppressive tools or confrontive environments? Does intimacy survive when participants are remote in time and physical space? Can laughter, hugs, and tears mean the same thing for electronic-dialog partners as for face-to-face partners? For participants immersed in this online connected world, the cell-phone number, e-mail address, or other electronic "handle" is part of the infrastructure for social relationships. Giving out your electronic contact information or accepting an invitation from someone else (e.g., in Facebook or LinkedIn) is a step in the direction of personal intimacy and business trust.

The first steps in understanding the social dimension of collaboration and social media participation are coming to grips with its terminology and scope. Although the conferences on *computer-supported cooperative work* have established *CSCW* as an acronym, the organizers still debate whether that acronym covers *cooperative*, *collaborative*, and *competitive* work and whether it includes play, family activities, and educational experiences. CSCW researchers focus on designing and evaluating new technologies to support work processes, but some researchers also study social exchanges, learning, games, and entertainment. In 2006, the CSCW conference celebrated its 20th birthday. The structure of the conference core and clusters were analyzed automatically using a citation graph methodology (Jacovi et al., 2006). Several new clusters emerged in 2002 and continued to grow in 2004 (the last year of the analysis). These clusters included social media participation activities such as meetings, media spaces, and conferencing; instant messaging (IM), social spaces, and presence; and video-mediated communication, shared visual space, and workspace awareness, which itself emerged in 2004. This burgeoning of new clusters shows the impact of social media participation in CSCW.

It is important to distinguish between collaboration and social media participation (Table 9.1). Collaborations can be seen as activities carried out by small teams of 2 to 20 people—or perhaps more, as in collaboratories (Bos et al., 2007). Collaborations emphasize work-related projects and they are well represented at CSCW and SIGGROUP conferences. The work is typically goal-directed and has a time frame for completion. Collaboration is purposeful and often business-related (as opposed to social media participation, which is more discretionary

Collaboration	Crossover	Social Media Participation
E-mail, phone calls, audio- and videoconferences, shared documents, collaboratories	Wikis, blogs, chat rooms, instant messages, short messages, listservers, Yahoo!/Google groups	Chat rooms, blogs, user-generated content sites, tagging, rating, reviewing
GoToMeeting®, LiveMeeting®, WebEx®, Skype®, Google Docs™, GeneBank™	Wikipedia, Wikia™, LinkedIn, *Second Life*, Blogger®	YouTube, Flickr, Picasa, Netflix, Technorati™, MySpace, Facebook, Digg, del.icio.us™

Want recognition for contributions May Aspire to Leadership	
Typically 2 to 2000 people	Typically 20 to 200,000,000 people
Work-related, goal-directed	Playful, process-oriented
Time-limited, milestones	Open-ended
Selected identified partners	Open unknown partners
Assign tasks and review each other's work	Act independently

TABLE 9.1
Characteristics and examples of collaboration and social media participation, including crossover characteristics

and oriented towards enjoyment). Participants know whom they are collaborating with, and the purposeful relationship may endure for days or years. E-mail, listservers, Skype (and other Voice over IP systems), teleconferencing, and videoconferencing are the tools used primarily for collaboration.

Social media participation can involve 10 people in a chat room or hundreds of millions of discretionary users in an environment such as Facebook or MySpace. The participation may support existing relationships or help users establish new ones, but often these relationships persist only in the online world. Sometimes there are no personal relationships, but only lightweight intersections, as when someone tags someone else's photo in Flickr or rates someone else's YouTube video. Amazon.com reviews, Netflix ratings/recommendations, restaurant reviews, Craigslist, Angie's List, and eBay are all social media, even though there may be little direct contact between participants. Many users remain in lightweight contact as occasional or even frequent lurkers. However, some users develop stronger relationships as they repeatedly make minor contributions, then become more active and substantial contributors, and eventually participate in governance, increasingly taking leadership positions (Li and Bernoff, 2008).

Some tools, such as blogs and wikis, can be used for team collaboration and social media participation. For example, Wikipedia, which is managed by a well-organized team who are familiar with each other, also has tens of thousands of minor contributors who have little contact with others, as well as millions of

users who benefit but don't contribute. Online communities such as healthcare discussion groups are social media with many unidentified participants and lurkers, but these tools may be part of a larger effort to collaborate purposefully.

Leading designers already support users' needs to learn from colleagues, consult with partners, annotate documents received from associates, and present results to managers. These designers also have started to design software that accommodates interruptions from coworkers, deals with privacy, establishes responsibility, and can be used by large numbers of users, if appropriate. It may be useful to think of collaboration and social media participation as the motivating force for using computers. This expansion of scope for interaction designers is why Part II of this book includes collaboration and social media participation—they are design requirements for most interfaces.

This chapter begins with an analysis of why people collaborate, then presents the traditional 2×2 matrix of collaborative interfaces to support the needs people have. The next three sections cover asynchronous distributed, synchronous distributed, and face-to-face interfaces. Section 9.3 focuses on e-mail; collaborative interfaces such as listservers, Yahoo! Groups, and Google Groups; and the more ambitious online and networked communities. Section 9.4 covers synchronous distributed tools such as chat, instant messaging, texting, and videoconferencing. Section 9.5 addresses the growing array of face-to-face software for electronic meetings and shared displays.

9.2 Goals of Collaboration and Participation

People collaborate because doing so is satisfying or productive. Collaboration can have purely emotionally rewarding purposes or specific task-related goals. It can be sought personally or imposed managerially. It can be a one-time encounter or an enduring partnership. Understanding the processes and strategies of the participants facilitates analysis of these varied situations for collaborative interfaces:

- *Focused partnerships* are collaborations between two or three people who need each other to complete a task, such as joint authors of a technical report, two pathologists consulting about a cancer patient's biopsy, programmers debugging a program together, or an astronaut and a ground controller repairing a faulty satellite. The growing set of partnerships also involves consumers who may negotiate with a travel agent, stockbroker, or customer-support staffer. Often, there are electronic documents or images to "conference over." Partners can use e-mail, chat, instant messaging, telephone, voice mail, videoconferencing, or a combination of these technologies. Newer strategies enable partnering through mobile devices, such as text messaging

(texting) or photo exchanging via cell phones or discussions over a shared electronic tabletop.

- *Lecture or demo* formats involve one person sharing information with many users at remote sites. The start time and duration are the same for all, and the recipients may ask questions. No history keeping is required, but a replay capability is helpful for later review and for those who could not attend.
- *Conferences* allow groups whose participants are distributed to communicate at the same time (synchronous) or spread out over time (asynchronous). Many-to-many messaging may be used, and there is typically a record of conversations. Examples include a program committee making plans for an upcoming event or a group of students discussing a set of homework problems. In more directed conferences, a leader or moderator supervises the online discussion to achieve goals within deadlines. Blogs (postings that invite outside commenting) and wikis (group editing spaces) are often used for conferences.
- *Structured work processes* let people with distinct organizational roles collaborate on some task: a scientific-journal editor arranges online submission, reviewing, revisions, and publication; a health-insurance agency receives, reviews, and reimburses or rejects medical bills; or a university admissions committee registers, reviews, chooses, and informs applicants.
- *Meeting and decision support* can be done in a face-to-face meeting, with each user working at a computer and making simultaneous contributions. Shared and private windows plus large-screen projectors enable simultaneous shared comments that may be anonymous. Anonymity not only encourages shy participants to speak up, but also allows forceful leaders to accept novel suggestions without ego conflicts. Voting and polling can also play a significant role.
- *Electronic commerce* includes customers browsing and comparing prices online, possibly followed by short-term collaborations to inquire about a product before ordering it. Several e-commerce sites offer a live help link to allow synchronous communication. Electronic commerce also includes business-to-business negotiations to formulate major sales or contracts. Electronic negotiations can be distributed in time and space, while producing an accurate record and rapid dissemination of results.
- *Teledemocracy* allows small organizations, professional groups, and city, state, or national governments to conduct online town-hall meetings, to expose officials to comments from constituents, or to produce consensus through online conferences, debates, and votes.
- *Online communities* are groups of people who may be widely distributed geographically and across time zones. These people come online to discuss, share information or support, socialize, or play games. Communities that focus on

shared interests, such as health concerns or a hobby, are often referred to as *communities of interest* (CoIs). Communities whose focus is professional are known as *communities of practice* (CoPs). Communities whose members are located in the same geographical region are known as *networked communities*; these people usually meet face-to-face as well as virtually.

- *Collaboratories* are novel organizational forms for groups of scientists or other professionals to work together across time and space, possibly sharing expensive equipment such as telescopes or orbiting sensor platforms. These groups share interests, but may compete for resources. There is sufficient variety in the types of collaboration that a seven-category taxonomy (distributed research centers, shared instruments, community data systems, open community contribution systems, virtual communities of practice, virtual learning communities, and community infrastructure projects) of collaboratories has been developed (Bos et al., 2007).
- *Telepresence* enables remote participants to have experiences that are almost as good as being physically co-present. Telepresence is supported by immersive 3D virtual environments, which often involve users donning electronic devices (DataGloves, goggles), wearing special clothing, or entering an environment containing electronic sensors so that they can manipulate objects and communicate with each other in 3D space (Section 5.6). These virtual environments also include games and virtual worlds like *Second Life*.

This list is just a starting point—there are undoubtedly other collaborative processes and strategies, such as for entertainment, multiperson games, challenging contests, theatrical experiences, or playful social encounters. The potential market for innovative software tools is large; however, designing for collaboration is a challenge because of the numerous and subtle questions of etiquette, trust, and responsibility. The challenge is increased by the need to account for anxiety, deceit, desire for dominance, and abusive behavior.

Collaboration is critical in today's global industries and markets. People often work in distributed development teams, where collaborators may be located across the hall or across the country (or even at home, telecommuting) while working on the same product. They are forced to efficiently use various social interaction tools (such as teleconferencing, calendaring, e-mail, chat, blogs, wikis, and IM) to collaborate on designs. In addition, they are forced to use development environments and tools that enforce the application of version control and other essential development processes/standards. Typically, multiple identically configured and networked development and test environments are set up and tests are run to be sure that everything works the same wherever it is installed. Then the social interaction tools are used once again to be sure everyone understands what they are supposed to do. Collaboration is what makes industry run.

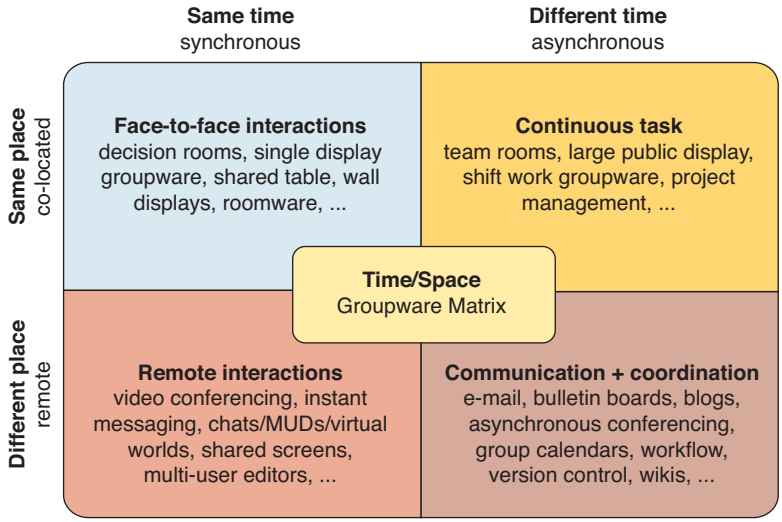

FIGURE 9.1
Time/space four-quadrant matrix model of group-supported work.

This variety of collaborative processes and strategies begs the question, how can we make sense of such a mix? The traditional way to decompose collaborative interfaces is by a time/space matrix generating four quadrants: same time, same place; same time, different place; different time, same place; and different time, different place. The common activities performed in each cell are listed in Fig. 9.1. This descriptive model focuses on two critical dimensions and guides designers and users. However, as collaboration and participation strategies become more sophisticated, many designers combine interfaces from two or more cells in this matrix. For example, many social networking environments offer combinations of personal profiles, public postings, personal e-mail, and chat for flexibility in discussions; some also have voting and group-decision-support tools for structured decision making. Choosing which software to include depends on the users' needs and budgets.

Research in collaborative interfaces is often more complicated than in single-user interfaces. The multiplicity of users makes it difficult to conduct controlled experiments, and the flood of data from multiple users defies orderly analysis. Studies of small-group psychology, industrial and organizational behavior, sociology, and anthropology provide useful research paradigms, but many researchers must invent their own methodologies. Designers need to understand online communities. One step in that direction is the development of a theoretically-based online community framework (de Souza and Preece, 2004). Participant reports and ethnographic observations are appealing because they emphasize the colorful raw data from human discourse. Reflective case stud-

ies of groupware tools provide well-reasoned analyses to guide improvement and adoption, but the most compelling indicator of success for many organizations is the willingness of users to continue using a software tool. Social networking analysis has become a growth industry with increasingly effective visualization tools to show the evolution of communities or their decay as well as to better understand the social roles of users communicating (Balakrishnan et al., 2008; Welser et al., 2007).

Collaborative interfaces and social media web sites are maturing, but the determinants of success are still not clear. Advocates of rich media aspire to match face-to-face encounters, but proponents of lean media see benefits in lightweight text-only tools. Researchers and entrepreneurs are trying to find answers to numerous questions. Why is e-mail so widely used, while videoconferencing is limited mostly to corporate meetings? Why are cellphones intensely popular worldwide, while immersive environments remain a research topic? Understanding the causes of failures in work-oriented groupware, such as disparities between who does the work and who gets the benefit, could lead to refinements. How is the informal communication captured when groups are located remotely (Gutwin et al., 2008)? Other potential problems that must be overcome are threats to existing political power structures and insufficient critical mass of users who have convenient access. More subtle problems involve violation of social taboos and resistance to change. Successful designers will be those who find ways to accommodate strongly held community values and create acceptable social norms.

Arguments over measures of success complicate any evaluation. Whereas some people cite the high utilization of e-mail, others question whether e-mail aids or hinders job-related productivity (Jackson et al., 2003). The number of participants registered in a discussion board, the number of messages posted, and the regularity of return visits are automatable metrics that can be viewed as indicators of success. Subjective measures obtained by surveys and ethnographic observation include how satisfied participants are with the discussions and whether they feel a sense of belonging to the community. These individual measures need to be supplemented by community measures of the ambience (empathic or hostile), thread depth, and goal achievement (Smith, 2002). For business managers, cost/benefit analyses are also important (Millen et al., 2002). Videoconferencing may initially reduce travel expenses, but it can encourage collaboration and familiarity with more distant partners. However, eventually these relationships may lead to increasing costs and possibly more travel as a desire for face-to-face meetings grows. In educational environments, improved outcomes can be measured by comparison of scores on final exams, but when students work collaboratively in networked environments, they are often learning new skills that cannot be measured quantitatively. Too many educators ignore these collaboration skills, which are needed in the workplace, where teamwork and effective communication are essential.

For all the talk about how communication technologies are once again bringing about the "death of distance," distance really does matter for many activities and relationships (Olson and Olson, 2000). Physically close partnerships have the advantage of serendipitous encounters for informal exchanges, plus the facile capacity to confer easily over documents, maps, diagrams, or objects. Co-location also facilitates awareness of a partner's gaze and body language and enhances trust-building eye contact; for more personal encounters, electronic hugs are still no match for the real thing. Wide-angle, high-resolution, and low-latency video technologies can't yet match the richness of being there. Another often-overlooked factor is that there is something profound about the shared risk accepted by those who participate in face-to-face encounters. The willingness to separate oneself from familiar surroundings and possibly even expose oneself to physical harm, especially if arduous travel is required, raises the status of a meeting among all partners and can increase the commitment to making a constructive outcome.

Collaboration and social media participation take time, effort, and motivation. Researchers are starting to understand the reasons people participate in these activities and how to motivate higher levels of participation. One approach is to divide motivation into four categories: egoism (you will personally benefit from the activity), altruism (you genuinely want to help others), collectivism (you believe in supporting the community), and principlism (you've been taught principles such as "do unto others, as you would have them do unto you") (Batson et al., 2002). Another similar four-way division deals with value: value to self, value to a small group the user is involved with, value to a small group where there is no real involvement, and value to the entire user community (Rashid et al., 2006). Assigning points and status levels is yet another way to keep users involved and participating (Farzan et al., 2008). Designers are coming to understand that they must make contributions visible, enable participants to gain recognition or build their reputation, and reward exceptional contributions (Preece and Shneiderman, 2009).

9.3 Asynchronous Distributed Interfaces: Different Place, Different Time

Close collaboration across time and space is one of the gifts of technology. Durable messages transmitted electronically enable collaboration. For many users, electronic communication in various forms has become as much a way of life as the telephone. This communication can range from distributed loosely structured online communities to more formal e-mail. E-mail is widely

appreciated because of its simple, personal, and prompt service, enabling communication between business partners or family members and friends across the street as well as across the world. It is excellent for clearly conveying facts (since there is a record of the communication) and convenient because cutting and pasting from/to other documents is easy. On the other hand, for complex negotiations or extended discussions, it can be too loosely structured (endless chatting with no leader, chaotic processes that don't lead to a decision), overwhelming (hundreds of messages per day can be difficult to absorb), and frustrating when it comes to locating relevant messages. In addition, late joiners to an e-mail discussion will find it hard to catch up on earlier comments. To remedy these problems, structured methods for electronic conferencing and various discussion-group methods have emerged (Olson and Olson, 2007).

9.3.1 E-mail

The atomic unit of collaboration for e-mail users is the *message*; the FROM party sends a message to the TO party. E-mail systems (Fig. 9.2) share the notion that one person can send a message to another person or a list of people. Messages usually are delivered in seconds or minutes; replying is easy and rapid, but recipients retain control of the pace of interaction by deciding how long to wait before replying.

E-mail messages typically contain text, but carefully formatted document, photo, music, or video files can be attached. Downloading long messages and large attachments can be a problem on mobile devices, but some images contain essential information such as diagrams or maps, so users may be willing to wait for and pay for these.

Most e-mail systems provide fields for FROM (sender), TO (list of recipients), CC (list of copy recipients), DATE, and SUBJECT. Users can specify that copies be sent to colleagues or assistants, and filters allow users to specify that they do not want to receive notices from a given sender or about a certain subject. Additional tools for filtering, searching, and archiving in commercial e-mail packages (for example, Microsoft Outlook®, Lotus Notes®, and Eudora®) enable users to manage incoming and previously received e-mail. However, better tools are still needed for high-volume users who receive hundreds of messages each day. Spam—unwanted, unsolicited advertisements, personal solicitations, and pornographic invitations—seriously annoys and frustrates many users. Most Internet services provide steadily improving filtering tools, but for many users spam dramatically undermines their satisfaction in using e-mail and impacts productivity.

Many web services offer their own e-mail programs, sometimes for free; examples include Microsoft's Hotmail® (now Windows Live Hotmail®), Yahoo!

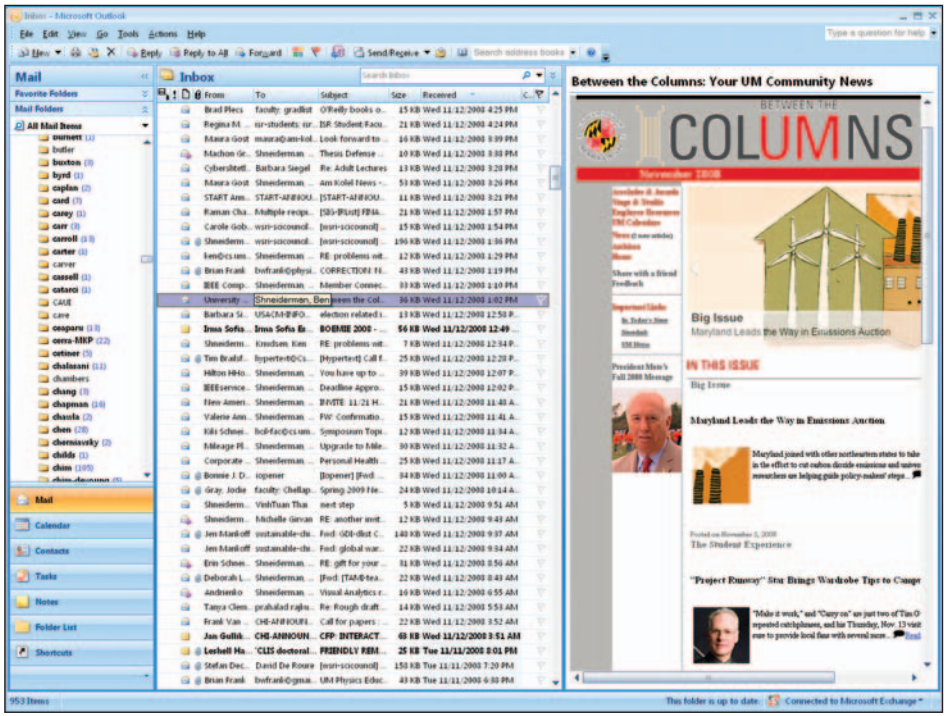

FIGURE 9.2

Interface for Microsoft Outlook 2007, showing the content of a folder selected in a hierarchy of folders and the content of an e-mail message. This is also a good example of coordinated windows and effective use of display space.

Mail®, and Google's Gmail™ (Fig. 9.3). Web-based e-mail services have become increasingly popular because they provide easy access from anywhere in the world via any computer equipped with a web browser. E-mail is also available on mobile devices, such as the RIM Blackberry or iPhone (Fig. 9.4), and is offered by most cell-phone service providers. These services have exploded in scope and range, and many people are now staying connected via e-mail through mobile devices as well as conventional computers.

In the U.S., more than three-fourths of the population use e-mail at work, at home, or via public-access terminals. Internet cafes are springing up all over the world, sometimes in the most unlikely places. A traveler from Tibet recently reported that getting access to e-mail was easier and cheaper than getting a shower. She paid $0.50 for one hour of fast e-mail access, while a shower cost $1.00 for a few minutes. Free e-mail is often available in airline terminals, Wi-Fi hot spots, and communal places like Starbucks and hotel lobbies.

Online directories and the ease with which e-mail addresses can be found on the Web are good facilitators, since it is necessary to know a person's e-mail

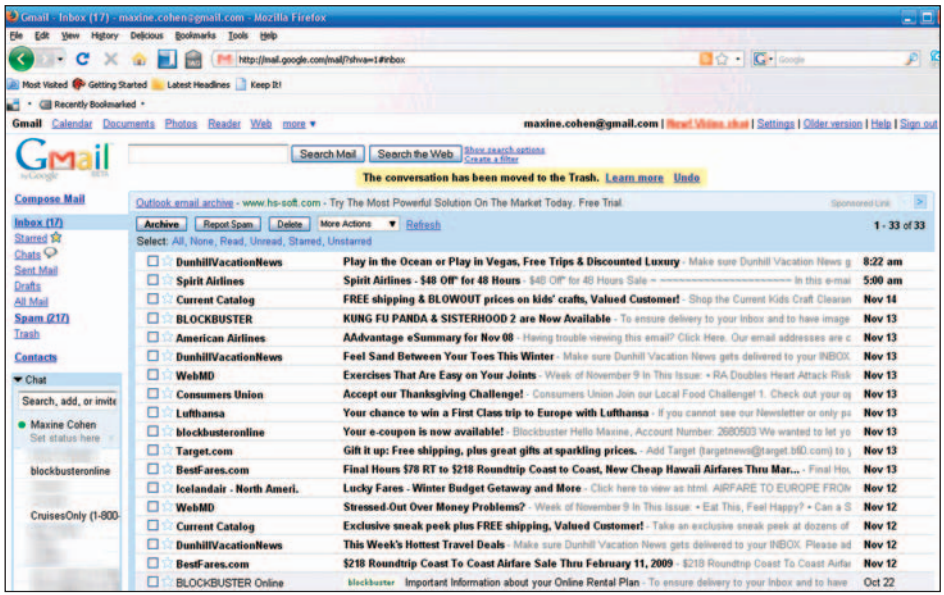

FIGURE 9.3
Web-based e-mail through Gmail showing the user's Inbox (http://www.gmail.com).

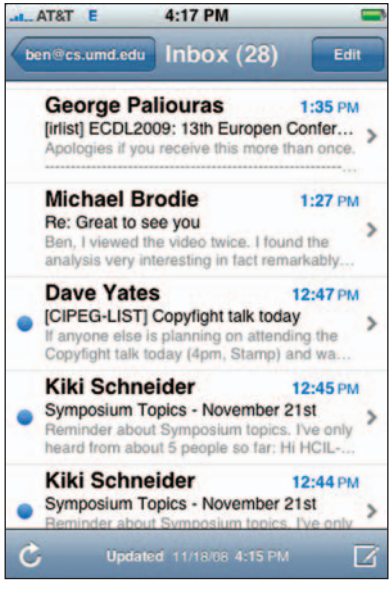

FIGURE 9.4
E-mail message on an iPhone.

address before sending a message. Such online directories often include the capacity to create new group lists, so that large groups can be reached easily. The dangers and frustrations of spam remain, though, and even noble ideas of collaboration can be undermined by users who fail to be polite, nuisances who persistently disrupt, electronic snoopers who do not respect privacy, or calculating opportunists who abuse their privileges. E-mail easily can become overwhelming (Bellotti et al., 2005).

9.3.2 Listservers and Yahoo!/ Google groups

E-mail is a great way to get started in electronic communication, but its basic features need extension to serve the needs of groups. When groups want more structured

discussions, they need tools to organize, archive, and search the discussion history. A popular community structure is the *listserver*, to which individuals must subscribe to receive e-mail notices of new messages. LISTSERV® is a popular example of listserver software that uses *push technology*: Users subscribe to a list, and new messages are pushed into their e-mail inboxes. Listservers can be moderated by a leader who keeps out irrelevant messages, or they can be unmoderated, simply acting as mail reflectors that send out copies of received e-mail messages to all subscribers. Users can opt to receive these messages as they trickle through one by one, or choose to have them collected into long messages known as *digests*. Receiving messages individually makes replying to a single user straightforward, whereas it is cumbersome to extract a message from a digest of dozens of messages. Either way, keeping track of how messages relate to each other can be a problem, particularly when they get mixed in with regular e-mail. Many high-volume users try to get around the problem by setting filters to catch messages from different sources. Getting flooded with listserver-related e-mail can be a burden, so the decision to subscribe is sometimes a serious commitment. Listservers keep lists of subscribers and searchable archives of notes. L-Soft™, a major supplier of free and professional versions of listserver software, claims to support more than 30 million messages a day and 130 million list subscribers.

A second popular form of community structure is the web-based *Yahoo!* or *Google groups*, which evolved from the older *bulletin boards*. Each message has a short one-line heading and an arbitrarily long body. Messages may contain a question or an answer, an offer to buy or sell, an offer of support, interesting news, a joke, or a "flame" (abusive criticism). Topic *threads* starting with the initial question and then listing all the responses make it easier to follow the progress of a discussion (See Fig. 12.14). Two basic types of messages can be sent: those that launch a new discussion topic, and those that reply to an existing message. To send a reply, users simply click a reply button on the existing message and complete the template that is presented. To initiate a new topic, users specify a subject heading that clearly describes the contents of the message. The date of posting is usually shown with the user's username.

Many web-based discussion groups now support graphical attachments, links to web sites, private discussion areas, improved message archiving and searching, and e-mail notification about new messages. Aesthetic features that may enhance the experience include colorful backgrounds that complement the graphic design of the site, graphics, emoticons to signal mood, topic icons to indicate the type of topic, and personal pictures. Robust software on powerful servers supports service to large numbers of participants, provides archival backup, and ensures security, privacy, and protection against viruses and hackers.

Enabling users to search message archives by subject, date, and sender and to view archives in various ways (threaded by date, reverse threaded, by sender) extends the usability of the discussion groups. Allowing users to represent themselves with pictures or icons or to link to their home pages increases a sense

of presence (the impression that one is actually talking to another human being) and helps users to identify each other. *Emoticons*, also known as *smilies* (for example, ☺ and ☹), can ease tension by signaling the sender's emotional state in an otherwise textual environment devoid of smiles, laughing, and other body language.

Access to discussion groups may be open or restricted to members who must register and be approved. Restricting membership helps to deter people who are not interested in the topic and troublemakers. It also helps to ensure that discussions stay on topic. For example, to join an online discussion group for anesthesiologists, a prospective member had to present certification paperwork. This is to prevent unqualified people taking part in the discussions. Membership-only discussion groups may have only tens or hundreds of participants, whereas open boards may be visited by thousands of people each day.

In large discussion groups, most users read and do not post; they are silent members who are known as *lurkers*. Some researchers estimate that lurkers outnumber posters by as much as 100 to 1, but in some discussion boards—particularly in patient-support communities—the ratios are much lower (Nonnecke and Preece, 2000). Whether lurking is a problem depends on the goals of the discussion and the number of people who participate. In a small discussion board where most of the members lurk, the feeling of lively discussion dissipates. In a large discussion board, large numbers of lurkers may be attractive to those who wish to stand out and influence the group. Some participants and moderators like to spark discussion by asking provocative questions or making bold statements. At other times, they may ask active posters to take their discussions offline or to start a separate group, so as to keep the volume of messages low and of interest to the entire group.

Thousands of Yahoo!/Google and listserver groups have emerged around the world, administered by devoted moderators. These Gertrude Steins of electronic salons keep the discussion moving and on-topic, while filtering out malicious or unsavory messages. Indeed, groups without such dedicated moderators usually do not survive; nurturing the group through all stages of its growth is usually a requirement for success. Social roles of these participants (Welser et al., 2007) are evolving. Visualization methods can clearly demonstrate the communication patterns. The pattern for an "answer person" is quite different from the pattern for a "discussion person" (Fig. 9.5).

A typical business use of discussion groups is for an online conference that might support a product-planning group in which members propose possible products to develop in time for an annual industry exposition and then vote to stipulate their choices. Thoughtful discussions within a conference are facilitated because asynchronous communications systems allow time for participants to consider their positions judiciously, consult other materials such as market surveys, discuss issues with colleagues, and review competitors' offerings. Then participants can phrase their contributions carefully, without the pressure to make an immediate comment that is inherent in a telephone call, in a face-to-face meeting, or when using synchronous communications software (see

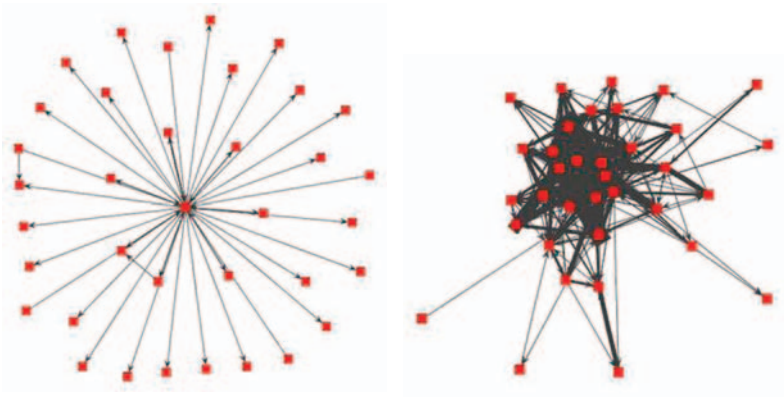

FIGURE 9.5
Visualization of the communication pattern of an "answer person" on the left, and a "discussion person" on the right (Welser et al., 2007).

Section 9.4). There is a powerful advantage of 24-hour availability, so users can participate when it is convenient for them. Skeptics who argue for immediacy and high-bandwidth videoconferencing should consider the advantages of a slower pace for many personalities and for those for whom writing a well-formed sentence is a challenge. This approach also provides advantages for teams that are distributed across the world, for whom finding a convenient synchronous time is nearly impossible.

9.3.3 Blogs and wikis

Web-logs or *blogs* and *wikis* are new forms of social software that started to become popular around 2001. Both types of software support the democratic philosophy that underpins the Web—namely, that all people should be able to make their opinions widely available to others without having to cross the hurdles of editorial boards and censorship that govern traditional media such as print, TV, and radio. Blogs are open electronic documents or diaries that are "owned" by their creators, but readers can contribute comments. Blogs can focus on any topic; popular themes include politics, music, popular literature, travels, film critiques, and personal diaries. Blog software, provided by Blogger.com and others, makes it easy for the blog owners to tell their stories and allows readers to add comments (Fig. 9.6). The software provides templates for readers to add pictures and provide links. The success of one's blog is judged according to how many people visit it, link to it, and discuss it—in other words, by the attention that it gets from other bloggers. Some companies pay people to blog and profess their expert opinions and viewpoints. Some of the reasons for blogging

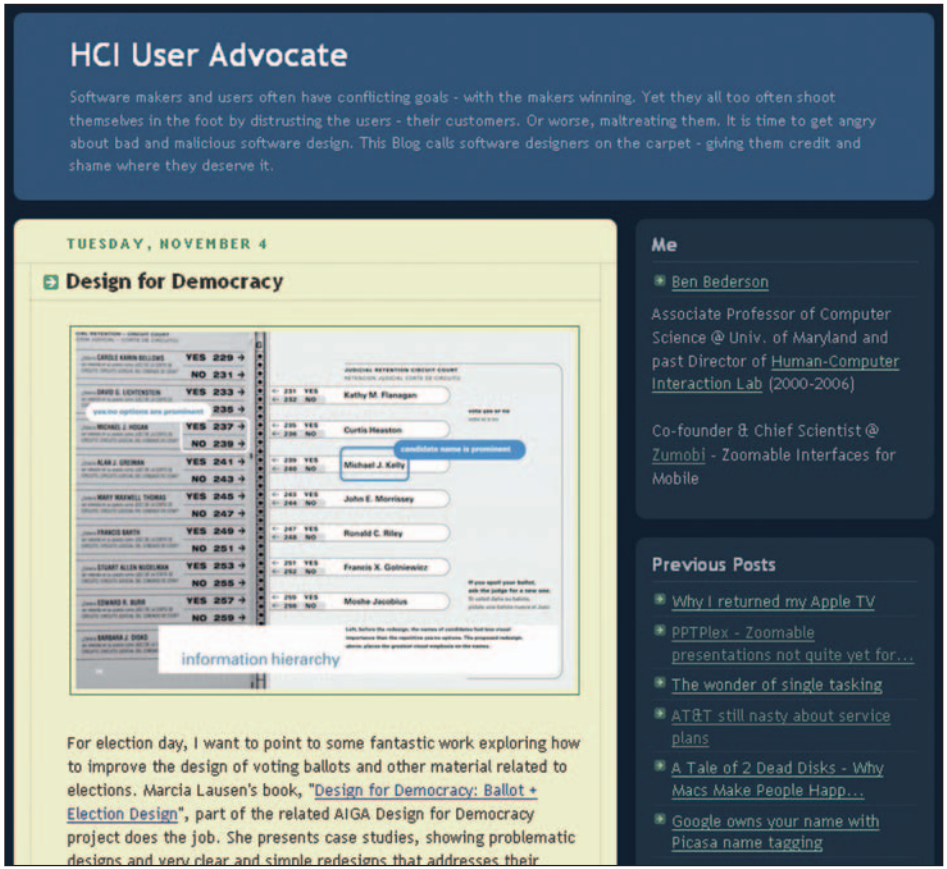

FIGURE 9.6

Blogger home page (http://www.blogger.com/). Graphics as well as text appear on the blog page, and the entries are listed with the newest at the top.

include documenting one's life, providing comments and opinions, expressing emotions, articulating ideas through writing, and forming and maintaining community forums (Nardi et al., 2004).

Wikis are collaborative web pages that are open for anyone to add or revise content, unless they are limited to members who must supply a password. "Wiki" is a Hawaiian word meaning fast. Wikis are used for discussing a variety of topics, but they are particularly popular with project teams, who like to discuss and record innovative ideas, plan meetings, and develop agendas on the team wiki. *Wikipedia* is a collaborative encyclopedia developed by people from over 40 countries and in over 250 different languages (Fig. 9.7). This amazing venture demonstrates the power of collaboration. Anyone can add to

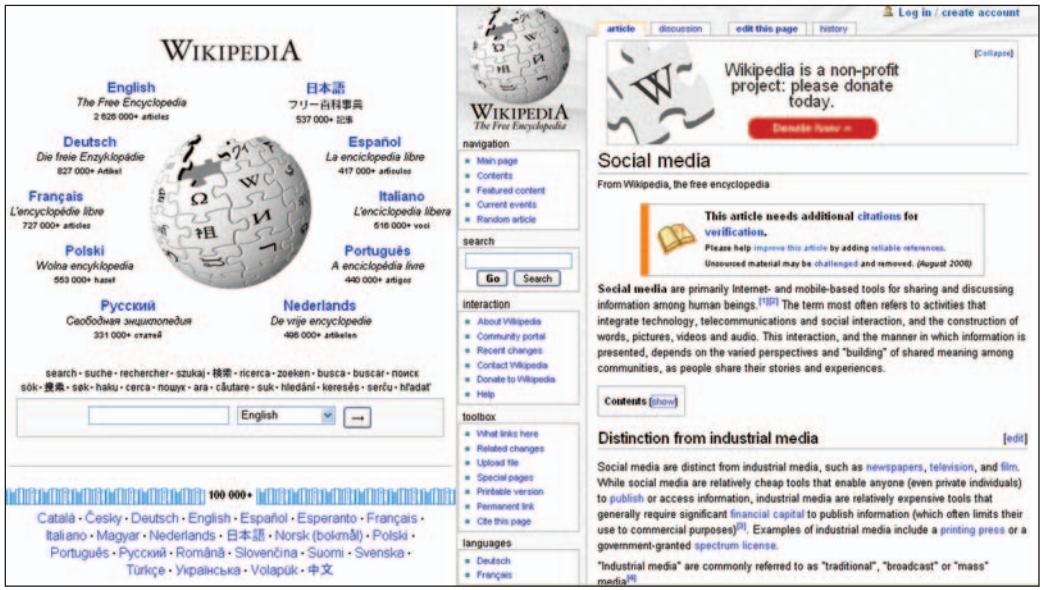

FIGURE 9.7
The home page of Wikipedia and a sample page on social media.

an existing topic or start a new one. Contributors are asked to be respectful to others when editing or adding to their work. An archive of previous pages also helps to ensure that valuable work can be recovered. In spite of the high levels of controversy and vandalism, Wikipedia devotees are quick to resolve differences and repair attacks. Wikipedia (and other forms of social media participation) are often perceived as the "wild west" with few rules and running rampant, but there are 44 wiki pages in the Wikipedia Official Policy that guide behavior (Butler et al., 2008). There is also a well-organized infrastructure of admins, bureaucrats, and stewards, plus an active Board of Directors to resolve differences and set policy. Interestingly enough, Wikipedia provides an example of supporting a wide range of activities, contributors, and structures and still producing an excellent collaborative product. It is a primary example of how the "wisdom of the crowds" phenomenon works (Kittur et al., 2007; Surowiecki, 2004).

Initially, Wikipedia was scorned by academics as an unreliable source of information. That opinion is now changing, and studies have shown Wikipedia to be appropriately researched and well written. Incorrect information seems to be monitored and removed. It is updated by millions of people daily and is very current. When a major news reporter (Tim Russert) died, his Wikipedia site was updated within minutes of the reporting of his death. One of the interesting points of Wikipedia is how naturally it supports a wide range of users, from

the novice to the expert. Novices find Wikipedia easy to use and see it as an information-gathering tool. They may even feel they have some limited expertise and participate in the editing part of Wikipedia. Experts look at Wikipedia from more of a community perspective and become more like peer reviewers as they transition to "Wikipedians" (Bryant et al., 2005).

The phenomenon of Wikipedia was rather unexpected: It was a grass-roots effort that has changed the way we find and use information. This form of social media participation has created a new field called *Wikinomics* (Tapscott and Williams, 2006). Three conditions feed this development. First, the cost for contribution is low; editing a wiki is rather straightforward. Second, tasks are easily broken down into manageable pieces, and minor editing can easily be done on small contributions to the wiki. Finally, the cost of integration and quality control is low, as wikis are based on volunteer contributions. The number of users of Wikipedia is huge and growing constantly; the contributors constitute only a small percentage of the users (Rafaeli and Ariel, 2008).

Microblogging or *mini-blogging* is yet another new collaborative type of social media participation. People use this to talk about their life as it happens, in short bursts (usually less than 200 characters). These entries can be shared via text messages, instant messages, e-mail, or the Web. The current services include Twitter™, Jaiku™, Tumblr, and Pownce™. Since people seem to be so rushed and time is of the essence, these communications have become more common. Twitter, launched in 2006, seems to be the most popular microblogging service (Fig. 9.8). Communications, which are limited to 140 characters, are called *tweets*. Users can "follow" other users, who are added as "friends." Users who are not friends can still monitor the communication and be "followers"; that is, friendships can be one way (followers) or two way (friends). This model maps nicely into directed graphs (Java et al., 2007). One software developer has created a web site that superimposes a public timeline onto a Google map (http://twittervision.com/) and tracks twitters all over the world.

FIGURE 9.8
An example of Twitter on an iPhone (from http://daringfireball.net/2008/04/twitter_web_clients_for_the_iphone).

The creation of all this user-generated content has spawned a need to be able to

search this material as well. Sites like Technorati provide real-time search engines that look at blogs and other user-generated content. Other sites, such as del.icio.us and Digg, provide facilities to share bookmarks and other shared content. Digg functions by users voting and commenting on stories; these activities can either raise a story to the top or bury it. Users are creating their own taxonomies to better manage the social tagging activity. For example, a bottom-up classification system called a *folksonomy* has emerged.

9.3.4 Online and networked communities

Online and *networked communities* have become talk-show topics, with social commentators celebrating or warning about their transformational power. Online communities are topically focused and geographically dispersed; they exist for AIDS patients, archaeologists, and agronomists (Maloney-Krichmar and Preece, 2005; Kim, 2000). Some networked communities are geographically bounded, such as the ones in Seattle, WA; Blacksburg, VA; Milan, Italy; and Singapore (Cohill and Kavanaugh, 2000; Schuler, 1996). The frequency of contact may vary from often to on certain occasions. Some may even display a hybrid capability and have a physical face-to-face component; for example getting together for an annual car show. Online and networked community members may use all the software discussed earlier and then add other features, such as information resources, community histories, bibliographies, and photo archives.

Howard Rheingold's (1993) popular book tells charming and touching stories of collaboration and support in the San Francisco–based WELL online community. The positive side is the facilitation of communication among like-minded people who have shared interests. Patient-support communities have been particularly successful for bringing together those with similar medical problems; patients with rare diseases and those who are house-bound or who live in isolated rural areas are pleased to be able to share their stories and problems and get support. Similarly, online communities are bringing together people from across the world whose access to high-bandwidth communication is limited. As low-cost mobile devices become more pervasive, this trend will continue. The negative side is that online community participants may have lower levels of commitment than people who attend face-to-face meetings of hobby clubs, neighborhood groups, and parent/teacher associations. Furthermore, there are problems with false identities, malicious users, and deceptive invitations (Donath, 2007). Some early studies suggested that active participants on the Internet withdrew from other social contacts and felt more alienated, but later studies have shown more positive outcomes (Kraut et al., 2002; Robinson and Nie, 2002).

Community members typically have a shared goal, identity, or common interest and participate electronically on a continuing basis. Some communities have strict rules on membership, and some members have an intense devotion to their online communities. This generates a sometimes remarkable willingness

to trust and assist other community members, leading to what sociologists call "generalized reciprocity"—helping others in the belief that someday someone will help you. In health-support communities, the help is often in the form of information about treatments or physicians, but a striking aspect to any reader of these discussions is the high level of empathic support conveyed among participants (Preece, 1999). Postings can reveal personal fears about surgery and generate supportive comments such as "Don't worry, I've been through it and you'll do fine" or "Just hang in there—you are not alone" and requests to "Let the group know how your surgery turns out—we're cheering for you."

Developing successful online and networked communities is not easy, as revealed by the thousands of electronic ghost towns without any participants. Good interfaces are just one factor in determining success. Attention to and support for social interaction as the community grows are equally important. The skill, energy, and nurturing attention of community leaders and moderators are often the determining factors in a thriving community. These leaders may take on various roles in the life of these communities, including social roles such as community-seeker, community-builder, evangelist, publisher, or small team leader (Thom-Santelli et al., 2008). Successful communities tend to have clearly stated purposes, well-defined memberships, and explicit policies to guide behavior (Maloney-Krichmar and Preece, 2005). For example, Bob's ACL Kneeboard (Fig. 9.9) is for people who have suffered tears of the anterior cruciate ligaments (ACL) in their knees and are facing decisions about surgical methods. Bob started this online community in 1996, and his medical history, with explicit pictures of surgery on both his knees, tells his story. Members return year after year to help recent sufferers with their decisions, provide information about new surgical practices, and offer emotional support for their pain and difficult choices.

Community policies must deal with rude behavior, off-topic comments, and commercial notices. Some communities have written policy documents enforced by moderators, while others establish norms of behavior that are upheld by members. Principles of freedom of speech should be extended into the online world, but there are novel dangers of disruptive behaviors, illegal activities, and invasion of privacy. Some online communities have been criticized for spreading racist or otherwise harmful material, so the challenge is to preserve valued freedoms and rights while minimizing harm. Each online community has to decide how to interpret such policies, just as each town and state must decide on local rules.

The user interfaces for online communities tend to be simple in order to accommodate the large number of users, some still with low-speed dial-in access. The intrigue lies in the complexity of the conversations, especially in spirited replies and debates. As usage increases, the moderator must decide whether to split the community into more focused groups to avoid overwhelming participants with thousands of new messages. Ensuring that the communities remain interesting and consistent is a challenge; if a group of physics researchers who are discussing current theories is visited by students asking beginner-level questions,

FIGURE 9.9

Bob's ACL Kneeboard, a threaded discussion board for people who have suffered tears of the anterior cruciate ligaments in their knees (http://factotem.org/cgi-bin/kneebbs.pl).

the experts will want the moderator to steer the students to other discussion boards or communities. An alternative is for the researchers to move their discussion to a new online community web site.

Within corporations, universities, or government agencies, communities may be established for topics such as corporate direction, new technologies, or product development. These specialist groups are often referred to as communities of practice, to acknowledge their professional orientation (Wenger, 1998). Understanding how to make CoPs thriving places for discussion can be a challenge. How can management motivate employees to spend time on helping colleagues, when they may be in competition for a promotion? One school of thought is that

automated tools can be used to mine the content of old discussions for nuggets of knowledge that are relevant to a current problem—a hot topic among knowledge-management professionals. However, skeptics suggest that it may be more effective to designate individuals and develop processes for compiling, summarizing, and classifying organizational knowledge so as to facilitate future retrieval. Communities of inquiry are promoted in educational circles as web-based conferences to promote discussions using these stages of action: (1) ask, (2) investigate, (3) create, (4) discuss, and (5) reflect (Bruce and Easley, 2000).

Online communities have become common for distance education courses and as supplements to face-to-face classes, because they can stimulate lively educational experiences. Widespread adoption of educational course-management systems such as Blackboard®, Moodle™, Sakai™, Angel™, and FirstClass® demonstrate the efficacy of an online format for college courses, complete with homework assignments, projects, tests, and final examinations. Instructors find the constant flow of messages to be a rewarding challenge, and students are generally satisfied with the experience. The essence of the virtual classroom is an environment to facilitate collaborative learning, often with team projects (Fig. 9.10). For distance-seperated education students, the increased ability to be in constant communication with other learners is an obvious benefit. But even for campus-based courses, the technology provides a means for a rich, collaborative learning environment that exceeds the traditional classroom in its ability to connect students and make course materials available on an around-the-clock basis (Hiltz and Goldman, 2005; Hazemi and Hailes, 2001). The University of Phoenix and the British Open University are impressive examples of how interactive technologies are being employed to serve educational needs.

Some online communities support thousands of contributors to important projects such as the Linux operating system. The phenomenal growth of this open-source movement and its remarkable impact demonstrate how effective geographically dispersed online communities can be. Hundreds of thousands of programmers also feel devotion to the Slashdot community, whose lively discussions of technical topics often receive hundreds of comments per hour. Millions of people participate in eBay to buy or sell products, generating feelings of shared experiences that are the hallmark of a community. Sellers strongly identify with their colleagues and collaborate to pressure eBay management for new policies. The reputation manager (Feedback Forum) enables purchasers to record comments on sellers, such as these typically complimentary notes: "Everything works," "Quick shipment," "thank you," "Peace," "A+ seller," "Item exactly as described, fast shipping, smooth transaction," "A+++++++++++," "I'm very satisfied A++++." And these are just the first steps. Creative entrepreneurs and visionary political organizers are still exploring novel networked approaches for business development and consensus seeking.

For scientists who need to collaborate at a distance, discussing ideas, viewing objects, and sharing data and other resources, *collaboratories*—laboratories

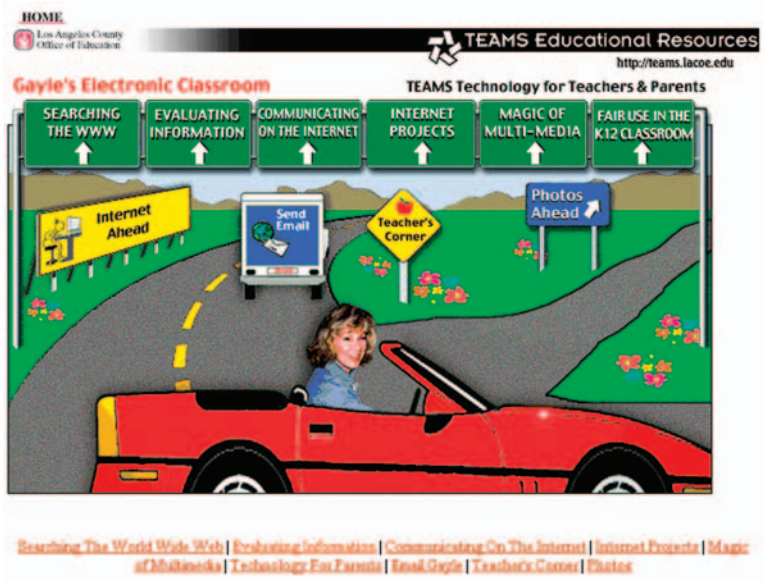

FIGURE 9.10

Starting screen for a virtual classroom example from the Los Angles County Office of Education. There are many clickable links that open various windows and applications, including a link to send e-mail directly to the teacher. There is a picture of Gayle (the teacher) to personalize the site (http://teams.lacoe.edu/documentation/classrooms/gayle/gayle.html).

without walls—provide new opportunities (Bos et al., 2007). Geographically dispersed teams, for example, can benefit from sharing costs for and being able to access remote instruments for space or environmental research. Collaboratories can employ all forms of collaborative interfaces, but the asynchronous technologies seem to be most valuable. Collaboratories are also social structures that promote collaboration among groups with complementary skills, accelerate dissemination of novel results, and facilitate learning by students or new researchers. Standard data formats facilitate sharing that leads to multiple analyses, and well-maintained archives reduce redundant experimentation.

Social media web-site designers are also trying to create communities around their users. For example, Flickr users can invite friends to view, tag, and comment on their photos and can sign up for notifications when new photos are posted. Whole families can sign up to see marriage ceremony photos or keep up with traveling cousins, thereby strengthening family bonds. Similarly, book-, restaurant-, or movie-reviewing web sites encourage discussions among reviewers. Political, sports, religious, or financial blogs can easily trigger hundreds of postings to discuss controversial positions. Here again, the lively

discussions are highly visible, but most invitations to participate fail to generate any comments, so more research is needed to understand the determinants of success (Preece and Shneiderman, 2009).

9.4 Synchronous Distributed Interfaces: Different Place, Same Time

Collaborative interfaces are increasingly flexible, allowing distributed groups to work together at the same time by using chat, instant messaging, or text messaging via cell phones. Shared screens allow teachers and trainers to present web seminars (*webinars* or *webcasts*) from their homes with audio accompaniment and video windows, while thousands watch their slides and demonstrations from anywhere that they can find an Internet connection. Physicians in hospitals hundreds of miles apart can share X-rays, MRIs, and body scans so that they can discuss treatments for rare cancers and other ailments. Voice over Internet (VoIP) services, such as Skype, offer free or low-cost phone calls and audio- or videoconferences.

Social media participation also enables discretionary and playful collaborations for connecting with friends, meeting new people, or playing games. Active voting by text messaging and phone for *American Idol* performers has become a cultural phenomenon. Lightweight awareness technologies like Twitter allow friends to keep up with one another all day long, while richer, immersive 3D experiences engage thousands of participants in *Second Life*. Some of the most innovative commercial developments are interactive games that permit two or more people to participate simultaneously in poker, chess, or complex fantasy games such as *EverQuest* or *World of Warcraft*. These games offer 3D graphics and animations that engage players as they try to outwit each other; enthusiastic users eagerly acquire high-speed Internet connections, powerful game-playing machines, and special input devices such as paddles with numerous buttons.

9.4.1 Chat, instant messaging, and texting

Even simple synchronous exchanges of text messages among groups of 2 to 20 participants can be exciting. Internet Relay Chat (IRC) programs and software such as *Second Life* and Microsoft's LiveMeeting® have *chat* windows as well as graphical interfaces. Brief greetings and short comments are typical of fast-moving chat environments, where participants must type quickly and hope that their comments appear on the screen near to the ones that they answer. There is little time to reflect.

In *Second Life*, users can explore 3D worlds by teleporting their avatars (graphic characters that represent users instead of mere login names) around the

screen using a touchpad, cursor keys, or a joystick. They can move close to other characters and interact with them, or simply tour the environment. The menu of viewing options also allows users to look up or down, turn around, and jump or wave to express their emotions. Participation in *Second Life* varies from game-playing teenagers to the more staid corporate presences: Some corporations and educational institutions have established their own islands in *Second Life*.

Users can tire of navigating through the graphical worlds, however, so they often spend more time on the textual chat. This begs the question, what is the added value that avatars and 3D graphics bring to such environments? If avatars are moving around, social proximity can facilitate discussion, since users will know who else is participating. Avatars are an essential feature for many games, but they may be less important for other topics or groups with a stable set of participants. Once past the initial rapid exchange during greetings, text users can conduct useful business meetings, support lively social clubhouses, and offer sincere care for those in need.

Another aspect of chat environments is that they allow participants to take on new personalities, underscored by engaging and imaginative names such as Gypsy, Larry Lightning, or Really Rosie. The social chatter can be light, provocative, or intimidating. Unfortunately, some chat participants turn into wisecracking *flamers* more intent on a putdown than a conversation, and with a tendency to violent or obscene language. Even worse, chat rooms, like the real world, can be environments for deception, illicit invitations, and various forms of entrapment. Children and parents, as well as unsuspecting business people, need to take precautions.

Instant messaging is a popular alternative to open chat rooms, in part because membership can be tightly controlled. IM is ideal for quick exchanges between close friends, family members, or small groups who are readily available at their desktop or laptop computers. Facebook, Microsoft, and Yahoo! have created IM systems that have hundreds of millions of subscribers.

On some systems, users launch IM programs by clicking on a small icon on the desktop, in a toolbar, or in an applications list. Other systems automatically show users which of their friends are also logged on when they log on. Either way, there is a window that shows the buddy or friends lists that the users have created. Each list contains the names of the participants in that community. A chat window similar to that found in chat systems contains the conversation, and new messages can be typed in the lower pane. Conversations can involve two or more people. Typically, IM communities contain fewer than 20 people, but they may be larger. Membership is usually restricted to groups whose members know each other and want to be in regular contact. For example, students from Thailand studying in the United States may share one IM community, as well as another with Thai friends across the United States and friends back home. Much of the motivation is to enable users to track each other's movements and to chat. It's comforting to know when friends come online, how their work is progressing,

whether they are sick or well, and so on. IM is used in a similar way to text messaging. It's all about knowing which friends are where and when; it can also be an inexpensive way to have long-distance conversations.

Most IM systems include features such as emoticons, the ability to send photographs and other files, and a wide variety of sounds and backgrounds. Research into novel ways for users to identify each other indicates that sound may have a role (Isaacs et al., 2002); an office manager might be represented by a high-pitched "ping," peers by the "doh, rei, me" musical scale, and a partner or spouse by the first three bars of his or her favorite tune. Comments, like those typical of chats, are short and concise. Groups in which members know each other delight in developing standard phrases (see Table 7.1; for example, LOL for "laughing out loud" or IMHO for "in my humble opinion") and cryptic shorthand ways to communicate using symbols and characters (for example, "me4u", "cu@1", or "☺2cu"). Teenagers are particularly adept and creative users of such shorthand, especially when texting on their cellphones. Researchers report that teenagers (Grinter and Palen, 2002) and office workers (George, 2002; Herbsleb et al., 2002) are the largest user groups of IM. This finding has generated concern for parents who want to monitor their children's online activities (Fig. 9.11).

Security and privacy are essential for all IM users, although needs may differ. For example, office workers may not want their colleagues and bosses to read their communications. However, the popular assumption that workplace instant messaging is only for idle chatter has been shown to be wrong. According to one study (Isaacs et al., 2002), productive work was carried out by the frequent IM users, who used it to discuss a broad range of topics with colleagues via many fast-paced interactions per day, each with many short turns and much threading and multitasking. Users rarely switched from IM to another medium when the conversations got complex. Only 28% of conversations were simple interactions, and only 31% were about scheduling or coordination. Still, evidence that serious work can be accomplished via this means of interaction does not take away from the capacity for IM's informal, flexible style to also support the lightweight exchanges that contribute to awareness of what colleagues, family, or friends are doing and where they are (Nardi et al., 2000).

Texting via cell phones (using the *Short Message Service*, or SMS) has also become an extremely popular means of communication. The mobile nature of cellphone texting allows for lively but private exchanges, but texting is also used to send messages to be read later or simple alerts. Worldwide acceptance is high, in part because texting costs are low. Some organizations use text-messaging capabilities to inform their constituents of activities, such as traffic alerts or weather-related emergencies, or to provide disaster-response instructions. Fishermen in India use their cellphones to check out the best prices before deciding where to come ashore (Rheingold, 2002).

People can now easily check in with each other to report where they are, what they are doing, and what they intend to do next. A typical text on the D.C. Metro

FIGURE 9.11

Parental control system to oversee children's online activities (http://www.sentryparentalcontrols.com/). This is a sample activity log: It shows the history of online activities, violations, and time spent on various activities.

goes like this: "I'm at VanNess, eta 10 min" (meaning estimated time of arrival in 10 minutes). Political groups at rallies or partying teenagers can organize and coordinate smoothly because of the ease and speed of communication. Similarly, text messages relaying emergency information can reach people wherever they are.

Teenagers are large users of these forms of communication. Both texting and IM are used for different types of activities. IM is better when trying to set up a plan to get together, as several teenagers can converse all at once. The convenience of being at home also provides accessibility to parents to arrange transportation and inform them of the planned activity. Being online additionally provides the opportunity to check out web sites (Grinter et al., 2006). Text messages, on the other hand, are better for a shorter confirmatory communication. Needless to say, however, this distinction is blurring as web sites and conferencing capabilities become more widely available on phones.

9.4.2 Audio- and videoconferencing

Audio- and videoconferencing are steadily growing commercial successes for when synchronous communication is needed to organize a special event, deal with tense negotiations, or build trust among new contacts. Standard telephones or cell phones anywhere in the world can be used to dial into an audioconferencing system, and the convenience of *desktop videoconferencing* from offices or homes enables architects to show their models or grandparents to keep in contact with grandchildren. At the other end of the spectrum, specialized videoconferencing rooms with high-resolution multi-camera setups that must be reserved by appointment give these events greater significance. The hardware, network, and software architectures that support synchronous videoconferencing have dramatically improved. However, users must still deal with the problems of delays, sharing, synchronization of actions, narrow field of view, and poorly transmitted social cues such as gaze and changes in body language, which are essential for effective turn taking and reading the moods of remote participants (Olson and Olson, 2007).

Today, Microsoft's meeting software has improved the video-conferencing capabilities. There can be multiple conferencing windows, so more can be captured and the conference can be more realistic. For example, one window can display a device being discussed, another window can show a video and another window can capture the faces of the participants. As the resolution becomes more robust, expressions and images become clearer, adding fidelity to the experience. Similar services are also available from Yahoo!, Cisco®, Citrix®, and WebEx.

The Polycom®, Sony, TANDBERG®, and HP Halo videoconferencing platforms provide increasingly high-quality images and sound (Fig. 9.12). Some meetings are simple discussions that replace face-to-face visits; the improvement over the telephone is the capacity to assess facial expressions and body-language cues for enthusiasm, disinterest, or anger. Many professional meetings include conferencing over some object of interest, such as a document, map, or photo. Developers emphasize the need for convenient turn taking and document sharing by using terms such as *smooth*, *lightweight*, or *seamless integration*. These same requirements are needed for the growing family market. Grandparents love interacting with grandchildren via videoconferencing—they speak about their experiences in glowing terms and schedule regular meetings. Likewise, some parents who must travel make a ritual of after-dinner or bedtime videoconferences with their kids to keep in touch. Videoconferencing capabilities in hospital settings allow patients and families to visit, diminishing some of the stress caused by a hospital confinement for both parties.

Controlled experimentation on performance with different media reinforces the importance of having a clear voice channel for coordination while users are looking at the objects of interest, while adding video of the person speaking can distract participants from focusing on the objects of interest.

FIGURE 9.12
An example of high-quality videoconferencing from HP Halo. Some of the participants are local; others are remote (http://h71028.www7.hp.com/enterprise/cache/572525-0-0-224-121.html).

Instead of a scheduled videoconference, some researchers believe that continuously available video windows, tunnels, or spaces would enable an enriched form of communication that supports opportunistic collaborations and informal awareness. These continuous video connections from public spaces such as kitchens or hallways could enable colleagues to see who is at work and ask the casual questions that might lead to closer ties. Some test subjects appreciated these opportunities, but others found them intrusive, distracting, or violating of their privacy (Jancke et al., 2001). Video connections from individual offices might enable participants to access the resources of their office environments while affording a chance for communication and emotional contact, but again, the intrusion of such systems is often seen as an annoyance (Olson and Olson, 2000).

Researchers are still trying to understand the conditions under which the richer media of audio- or videoconferencing are more effective and appealing than the lean media of chat, IM, and texting. Similarly, there are times when these synchronous media are less effective and appealing than asynchronous textual discussions. First-time meetings may be improved by a videoconference if a face-to-face meeting is not possible, whereas reflective discussion may be better supported by a listservers, a wiki, or e-mail.

Electronic classrooms balance the inclusion of new technologies with the exploration of new teaching and learning styles. At the University of Toronto, the ePresence project gives distant learners increased opportunities for participation during the lectures and the capacity to review later. Webcasting allows remote viewers to see and hear the lecturer, and students can have private chats during and after the lectures (Baecker et al., 2007). The Georgia Tech eClass project emphasized capturing videos of lecturers and their presentations so students could review them or make up missed classes (Pimentel et al., 2001). Nova Southeastern University was an early pioneer in distance learning and electronic classrooms. Its early electronic classrooms, starting in the 1980s, ran on a Unix platform using dial-up connections. The communication was all text-based, but it did permit students and an instructor to hold online classes. Later versions included microphones and faster connections. Today this technology has been replaced by more modern course management systems (CMSs) like Blackboard (formerly WebCT®), Sakai, and Moodle that provide electronic classrooms in addition to discussion-posting features, electronic grading and gradebooks, electronic testing, and syllabus-creation features.

9.5 Face-to-Face Interfaces: Same Place, Same Time

Teams of people often work together in the same room and use complex shared technology. Pilot and copilot collaboration in airplanes has been designed carefully with shared instruments and displays, and coordination among air-traffic controllers has a long history that has been studied thoroughly (Wiener and Nagel, 1988). Stock-market traders and commodity-market brokers view complex displays, receive orders from customers, and engage in rapid face-to-face collaboration or negotiations to achieve deals. Brainstorming and design teams often work closely together and have special needs because of the rapid exchanges, frequent updates, and the necessity for accurate recordings of events and outcomes. Even the familiar classroom lecture has changed, as some professors give up chalk and present their notes as slide shows via projectors. Classroom lectures can also be made interactive, with electronic polling devices at each student station and the capability to project a student's desktop for the entire class to view.

9.5.1 Electronic meeting rooms, control rooms, and public spaces

Ordinary business meetings are rapidly integrating computer technology, because so many participants arrive with relevant information already on their laptops or networks. However, computer presentations in business meetings

can interfere with communication by reducing eye contact and turning a lively dialog into a boring monologue in a darkened room. The first challenge is to understand the role of technology in supporting information transfer, while preserving the trust-building and motivational aspects of face-to-face encounters. The second challenge is to recognize the appropriate role of shared control of computing and presentation tools so that participants can be more active, while preserving the leadership role of the meeting organizer.

In business meetings, structured social processes for brainstorming, voting, and ranking can produce highly productive outcomes. The University of Arizona was a pioneer in developing the social process, the physical environment, and the software tools that continue to be marketed by GroupSystems®. This environment promises to "reduce or eliminate the dysfunctions of the group interaction so that a group reaches or exceeds its task potential" (Valacich et al., 1991). By allowing anonymous submission of suggestions and ranking of proposals, the authors introduced a wider range of possibilities; the approach also ensured that ideas were valued on their merits, independently of their "originators." Because ego investments and conflicts were reduced, groups seemed to be more open to novel suggestions. With this approach, well-trained facilitators with backgrounds in social dynamics consult with the team leader to plan the decision session and to write the problem statement. In a typical task, 45 minutes of brainstorming by 15 to 20 people can produce hundreds of lines of suggestions for questions such as "How can we increase sales?" or "What are the key issues in technological support for group work?" Then, items can be filtered, clustered into similar groups, and presented to participants for refinement and ranking. Afterwards, a printout and electronic-file version of the entire session is immediately available.

Even informal processes can be facilitated by shared workspaces in which multiple participants can add their contributions by projecting their displays for the group to see or by cutting and pasting from their materials to the group display. For example, three architects' proposals or three business plans might be shown on a common display to facilitate comparison. Another approach is for managers to arrive at a meeting and offer copies of slides for all to annotate and take home.

Several shared-workspace designs have found a growing audience. Newer devices, such as the simple, cheap sensors tied to special pen holders available from mimio®, allow participants to get electronic copies of what is written on the large whiteboard in front of the group. SMART Technologies, Inc. produces a SMART Board that allows interaction with fingers or pens, locally or remotely (Fig. 9.13); it also offers the SMART Table™, which serves a similar purpose to Microsoft Surface. Another leader in interactive whiteboard technology is Numonics.

Expensive control rooms for electric utilities, chemical plants, and transportation networks often have large wall displays so all participants have a shared situation awareness. Similarly, military war rooms and NASA space-flight operations centers enable rapid collaboration among participants, often in stressful

FIGURE 9.13
Children using the SMART Board electronic whiteboard from Smart Technologies Inc. to annotate a diagram in the classroom (left) and compose a story across distributed locations (right) (www.smarttech.com).

conditions. Researchers are developing high-resolution interactive wall displays for smaller groups to conduct brainstorming or design sessions (Guimbretière et al., 2001; see also Section 8.5).

Interaction in *public spaces* with wall displays may be through personal computers, mobile devices, or special input devices (Vogel and Balakrishnan, 2004; Streitz et al., 2007). The advantage of a shared public space is that everyone sees the same display and can work communally to produce a joint product, but privacy concerns and distractions trouble some users. Some technologies support fewer goal-directed activities, such as keeping colleagues informed about your whereabouts or a project's status or just presenting public notices in stores or offices.

Sharing photos is a growing topic for collaborative interfaces. Personal collections made public on the Web or sent as e-mail attachments are the most common approaches, but some innovative methods of sharing are appearing. Projections on living-room walls emulate the traditional slide shows of family pictures, but

newer approaches include projections on tables with shared capabilities for manipulating the layout of the photos. Another idea is to mount a computer display in an elegant photo frame connected to the Internet. Then parents can upload a changing set of photos of children for grandparents to view on a rotating basis.

Other forms of notification or ambient awareness include reports and alerts about the weather, stock prices, production processes, or equipment status. This can be accomplished by small computer windows that display current information or by audio tones that draw attention to changes. Innovative products from Ambient Devices, Inc. include softly glowing colored lights to gently signal changes. Various forms of sculpture, mobiles, light shows, or even changing odors have been suggested to provide minimally intrusive awareness information to users of public spaces. Public spaces are also becoming the objects of creative explorations. Hallways of buildings, foyers of hotels, and museum galleries are beginning to glow with more than advertising signs and hanging pictures. Projected images, large displays, and spatial sound installations can reflect the work tempo or changes in the weather. The goal may be to calm users or make them aware of outside conditions. Lobbies may offer multimedia presentations about the organizations in the building, celebrate historic figures, or make artistic statements in sound and light. Designers may strive to create emotional responses that calm or excite, intrigue or offend—public art pieces are hard to categorize, but they can serve as innovative uses of technology or provocative commentaries on modern life (Halkia and Local, 2003; Fig. 9.14).

9.5.2 Electronic classrooms

The potential for a groupware-mediated paradigm shift in education evokes passion from devotees, but there is ample reason for skepticism and resistance. By giving each student a keyboard and simple software, it is possible to create an inviting environment for conversation, comparison, or brainstorming. For example, each student can respond to a professor's question by typing a line of text that is shown immediately, with the author's name, on every student's display. With 10 to 50 people typing, new comments may appear a few times per second, and lively (if sometimes confusing) conversations ensue. The academic developers note that

> It seems slightly ironic that the computer, which for twenty-five years has been perceived as anti-human, a tool of control and suppression of human instinct and intuition, has really humanized my job . . . . Freed of having to be the cardboard figure at the front of the classroom, I became a person again, with foibles, feelings and fantasies. As a group, we were more democratic and open with each other than any other writing class I'd had, (Bruce et al., 1992)

At the University of Maryland, teaching/learning theaters were built with 40 seats and 20 personal computers to explore face-to-face collaboration methods. Hundreds of faculty members who use the electronic classrooms for semester-long

FIGURE 9.14
Modulor II is a time-dependent architectural work of art in which participants create new patterns daily by collaboratively weaving colored strings through an interactive labyrinth of luminous poles (Halkia and Local, 2003).

courses explored novel teaching and learning styles to create more engaging experiences for students. While traditional lectures with or without discussion remain common, electronic-classroom technologies can enliven lectures while enabling active individual learning, small-group collaborative learning, and entire-class collaborative learning. Most faculty members acknowledged spending more preparation time to use the electronic classrooms, especially in their first semesters, but one wrote that it was "well worthwhile in terms of greater learning efficiency" (Shneiderman et al., 1998).

The assumption that improved lectures was the main goal changed as more faculty tried out the teaching/learning theaters. Faculty who had used paper-based collaborations appreciated the smoothness of showing student work—paragraphs from essays, poems, computer programs, statistical results, web pages, and so on—to the whole class. Faculty who had not used these methods still appreciated the ease and liveliness of an anonymous electronic brainstorming session. The transformational breakthrough was in opening the learning process by rapidly showing many students' work to the entire class. Doing so at first generates student and faculty anxiety, but quickly becomes normal. Seeing and critiquing exemplary and

ordinary work by fellow students provides feedback that inspires better work on subsequent tasks. As the technology is becoming more ubiquitous and easier to use, more adopters are becoming devotees. Still, there is room for improvement. Although classroom teaching has been around for over a century, full understanding of pedagogy has not yet been achieved. When an instructor is splitting cognitive resources between managing the class and running the technology, it is hard to pay attention to everything and still be effective. Better understanding of the "pulse of the classroom" would help (Chen, 2003; Fig. 9.15).

Small-group collaborative-learning experiences include having pairs of students work together at a machine on a time-limited task. Pairs often learn better than individuals, because they can discuss their problems, learn from each other, and split their roles into problem solver and computer operator. With paired teams, the variance of completion time for tasks is reduced compared to

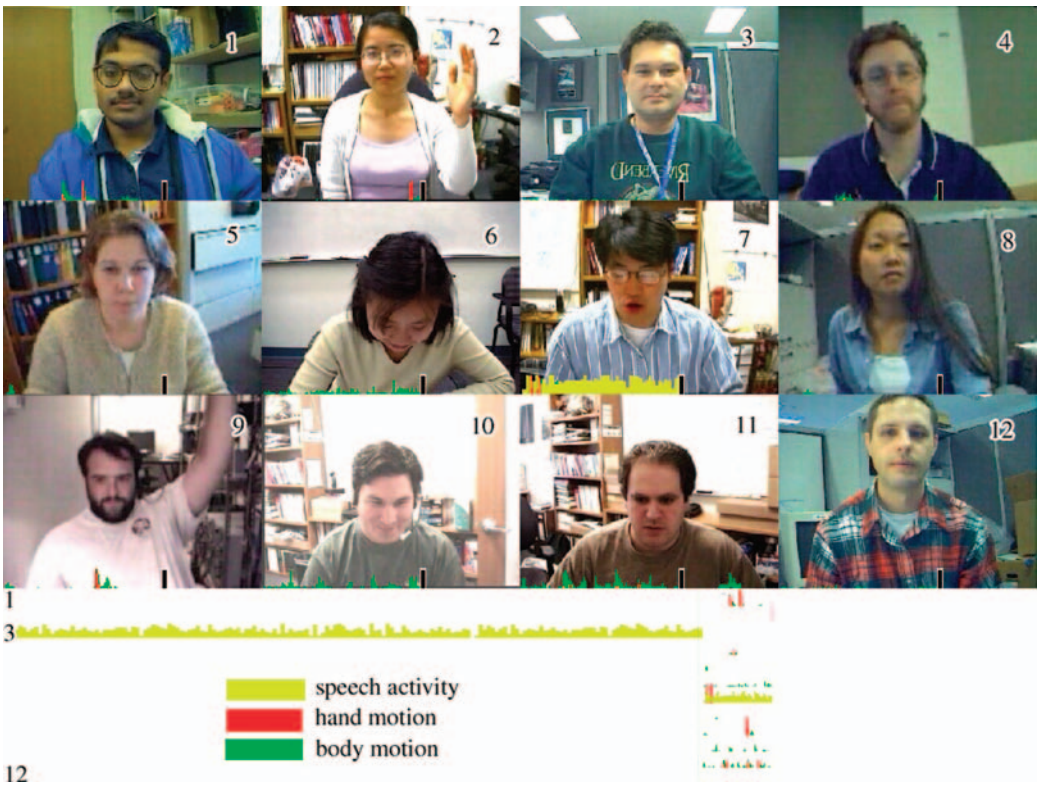

FIGURE 9.15

Students in an online classroom. Activity is monitored by color: speech in yellow, hand motion in red, body motion in green. Under each student is a timeline of their individual activity and at the bottom is an activity picture (using the colors) of the class (Chen, 2003).

individual use, and fewer students get stuck in completing a task. Furthermore, verbalization of problems has often been demonstrated to be advantageous during learning and is an important job skill to acquire for modern team-oriented organizations. Displaying and sharing a learning experience with technology can be accomplished with relatively young students (Fig. 9.16).

Innovative approaches with larger teams include simulated hostage negotiations with terrorist airplane hijackers in a course on conflict resolution, and business trade negotiations in a United Nations format for a course on commercial Spanish. Teams work to analyze situations, to develop position statements online, and to communicate their positions to their adversaries over the network. In an introductory programming course, 10 teams wrote components and sent them through the network to the lead team, who combined the pieces into a 173-line program, all in 25 minutes. The class performed a walkthrough of the code using the large-screen display and quickly identified bugs.

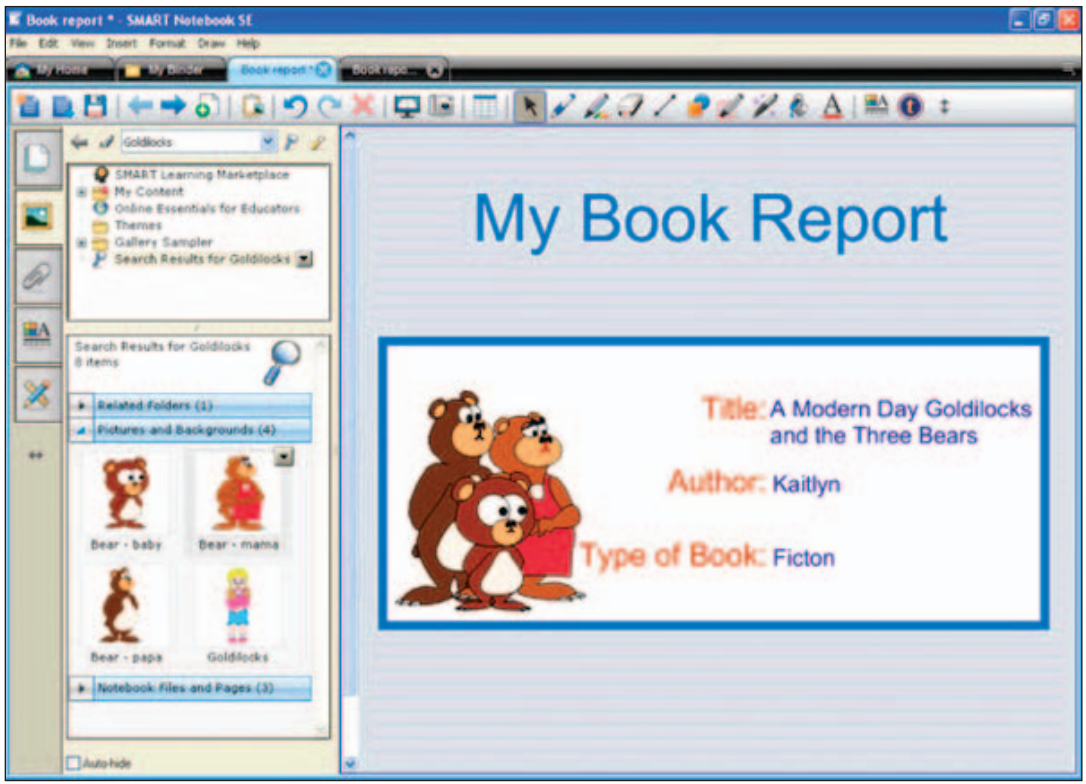

FIGURE 9.16

A sample application created with the SMART Board electronic whiteboard from SMART Technologies, Inc. (http://www.smarttech.com/).

Some faculty find that adapting to the electronic-classroom environment impacts their style so much that they teach differently even in traditional classrooms. Other faculty vow that they will never teach in a traditional classroom again. Most faculty users want to continue teaching in these electronic classrooms and discover that more than their teaching styles change—their attitudes about the goals of teaching and about the content of the courses often shift as well. Many faculty develop higher expectations for student projects. Some become evangelists within their disciplines for the importance of teamwork and its accompanying communication skills.

On the negative side, a math professor who used the computers only to do occasional demonstrations returned to teaching in a traditional classroom, where he had much more blackboard space. Some reluctant instructors express resistance to changing their teaching styles and anticipate having to make a large effort to use the electronic classrooms. Students, however, are generally positive and often enthusiastic: "Everyone should have a chance to be in here at least once . . . Great tech. Great education technique . . . Even though there were a few humps to get over at the beginning—it was well worth the effort (and money)."

The business case for technology-rich classrooms is more difficult to make than that for distance education (Baecker et al., 2007). However, as computer projectors in classrooms become as common as chalkboards, faculty notes migrate to slide presentations, and most students carry laptops and mobile devices, it seems likely that educational experiences will become more interactive and collaborative.

Practitioner's Summary

Collaboration tools have restructured work teams by allowing greater freedom in terms of when and where to work. E-mail has made it easy to reach out and touch someone, or thousands of someones. Listservers, online communities, instant messaging, and texting have enabled users to be in closer communication. Coordination within projects and between organizations is facilitated by easy exchanges of text, graphic, audio, and video files, and even face-to-face meetings are getting a facelift with new tools for electronic meetings and with the advents of teaching/learning theaters. The introspective and isolated style of past computer use has given way to a lively social environment where training has to include *netiquette* (network etiquette) and cautions about flame wars. Social media participation is the remarkable and still emerging new opportunity for users and entrepreneurs. Technology that enables users to tag photos, rate movies, review books, and view user-generated content is changing society; innovative services such as wikis and blogs give users new sources of information and forms of expression. As with all new technologies, there will be failures and surprising discoveries that will guide the next generation of designers (Box 9.1). Thorough testing of new applications is necessary before widespread dissemination.

BOX 9.1

Questions for consideration. The novelty and diversity of computer-supported cooperative work means that clear guidelines have not emerged, but these sobering questions might help designers and managers.

Computer-supported cooperative work questions

- How would facilitating communication improve or harm teamwork?
- Where does the community of users stand on centralization versus decentralization?
- What pressures exist for conformity versus individuality?
- How is privacy compromised or protected?
- What are the sources of friction among participants?
- Is there protection from hostile, aggressive, or malicious behavior?
- Will there be sufficient equipment to support convenient access for all participants?
- What network delays are expected and tolerable?
- What is the user's level of technological sophistication or resistance?
- Who is most likely to be threatened by computer-supported cooperative work?
- How will high-level management participate?
- Which jobs may have to be redefined?
- Whose status will rise or fall?
- What are the additional costs or projected savings?
- Is there an adequate phase-in plan with sufficient training?
- Will there be consultants and adequate assistance in the early phases?
- Is there enough flexibility to handle exceptional cases and special needs (users with disabilities)?
- What international, national, and organizational standards must be considered?
- How will success be evaluated?

Researcher's Agenda

Understanding the motivations for collaboration and social media participation remains a dominant task. For all the much-debated successes, predicting the trajectory for new designs is difficult. Even basic products, such as for e-mail clients, could be improved dramatically by inclusion of advanced features such as online directories, improved filtering, and sophisticated archiving tools that enable easy

finding of key documents. As users grow more numerous internationally, universal-usability features such as improved tutorials, translations, and assistance for users with special needs (including disabilities) will be needed.

There are multiple opportunities for research on user-interface designs for collaborative and social media interfaces, but the larger and more difficult research problems lie in studying their organizational and societal impacts. Research evidence shows that collaborative and social media interfaces increase the breadth of participation, allowing marginalized individuals greater influence. However, critics complain that time devoted to forming and maintaining relationships could reduce productivity or undermine organizational loyalty. How will home life and work be changed? Can Internet technologies restore community social capital, or will time online increase distance from neighbors and colleagues? Will trust and responsibility increase because of electronic archives or decrease because of the disembodied nature of electronic communications? Will patients, consumers, and students be more informed, more misinformed, or more argumentative? What are the taxonomies of social roles and author types in online discussions and Yahoo!/Google groups? How can visualization techniques be used to better understand the social roles? The existing tools are primarily for information sharing, cooperation, and coordination. Additional work is needed to better understand collaboration and to create tools to support it (Denning and Yaholkovsky, 2008). Some of the attraction for researchers in computer-supported collaborative work stems from the vast uncharted territory: theories lack validation, controlled studies are difficult to arrange, data analysis is daunting, and predictive models are rare. In short, this is a grand opportunity for researchers to influence a potent, yet still emerging, technology.

WORLD WIDE WEB RESOURCES

http://www.aw.com/DTUI/

Computer-supported cooperative work is naturally a part of the World Wide Web, and novel tools are springing up on many web sites. You can try various chat services, download special-purpose software, or shop for conferencing tools (video-, audio-, or text-based).

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