

The lengthy and frustrating implementation cycles have more to do with the social and psychological hurdles that must be overcome. Also, some of the structural factors that are deeply embedded within organizations – such as the reward systems – work directly against knowledge management programs because they are disincentives to sharing. Organizations and their leaders have difficult decisions to make regarding how to deal with these obstacles to knowledge management. Massive changes in the reward systems, for example, may contribute to more fluid knowledge sharing but could have damaging effects on productivity.

Regardless of what happens to the term “knowledge management,” many of the practices and approaches under its umbrella that work well will survive and make strong contributions to organizations and their success. This term, though, drew needed attention to the fact that “knowledge,” elusive as it may be, is the most important asset in the netcentric workplace.

7 Virtual Teams and Computer-Supported Cooperative Work

Amit wakes up each morning and immediately checks his email from his home in India. Overnight, his inbox filled up with messages, attachments, and sample software code from his coworkers in Boston, Massachusetts. They had reviewed the India team's work on a new Web site and sent comments and additional software code during their workday. The Bostonians went home, but Amit starts working with his colleagues in India on the project, reacting to the materials the Boston group sent. They have many questions, but they can't reach the Boston team until early evening. At 6 p.m., which is 8:30 a.m. Boston time, both groups get on the Web to look over the latest prototypes and start an audioconference with a speaker phone in each room. They run into a problem that someone in the UK office might be able to resolve, so they dial her office. Fortunately, it is mid-afternoon in the United Kingdom and they are in luck. She is at her desk and they patch her into the audioconference. Together, all the team members open up a Web site with a virtual whiteboard so they can make drawings and hold an audio discussion at the same time. By 8 p.m. India time, Amit and his colleagues are eager for dinner. The group closes down their whiteboard sessions, saving the images for reference on their local computers, and then each person says “good night” or “good morning,” or “g'day,” laughing about the oddities of working within a global virtual team.

Teamwork has become an increasingly important feature of the workplace, especially as new, flatter organizational forms have emerged. People with specialized expertise are needed to fluidly move from project to project, and managers need considerable flexibility to put together the best minds for each unique project. A single worker with knowledge of a particular area might be called on to participate in many different committees, project teams, task forces, or working groups. Some appointments become

reasonably permanent, and others are short-lived, lasting only as long as the project continues.

Research on group behavior and teamwork has been going on for decades, and we know a great deal about what happens when people are asked to collectively perform a task, come up with a solution, or make a decision. The questions – and often the answers – have been quite intriguing and useful for understanding workplace dynamics. Consider what happens when a task force is appointed to improve some process in the workplace. Do they come up with a better solution than an individual would come up with? Do groups, in the form of search committees, make better hiring decisions than do individuals? How does the composition of the group affect its performance and cohesiveness? When people of different levels of the organization are placed on the same team, are they able to contribute equally? Or do higher ranking members dominate the decision making? How do the positive and negative relationships within the group affect its performance? Do team members need to like each other to do a good job as a team?

Technology Support for Teamwork

The majority of research on group work deals with how they operate when the members are collocated – working in the same room or within walking distance. They meet face-to-face to conduct their work, and all the elements of physical presence are part of the group's working environment. Most of the research also involved little technology other than blackboards, pencils, paper, and flip charts. Even though information technology was spreading rapidly throughout the organization and being deployed in several contexts, research on how groups might benefit from all of these new capabilities was sparse. Instead, researchers focused on the inner circle of Figure 7.1,

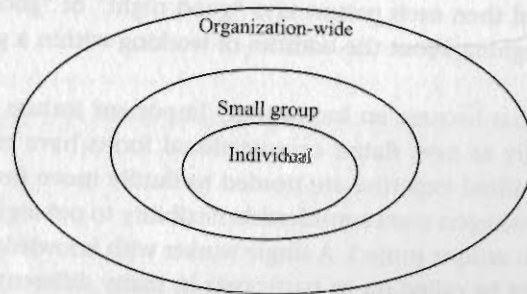


Figure 7.1. Applying new technology to different levels of an organization.

and found many ways to improve an individual's work, by improving the human-computer interface, for example. They also emphasized the organizational level, the outer circle, to understand how an entire organization adapts to new technologies.

The middle part of the circle, however, was receiving much less attention, even though so much work in an organization involves groups. Were there innovative ways to deploy emerging technologies to help people become more productive when they were working in small groups? Teamwork has always been a mixed blessing in organizations, sometimes resulting in better performance, sometimes worse. Social and psychological factors are critical, and it wasn't entirely obvious how technology could help, but there was great optimism and promise.

Efforts to understand how technology might best support group work got underway in disciplines such as business, psychology, communications, information sciences, and computer science. The field of *computer-supported cooperative work* (CSCW) emerged, and many interdisciplinary research projects were launched. Researchers began to analyze the impact of various technologies on cooperative groupwork, usually comparing the activities of computer-supported teams to the traditional face-to-face team, working in the same room without the advanced equipment. Researchers also started to actively design and test new technological tools for groups that attempted to take account of the way humans actually work together. The field drew people not only from the academic world but also from corporate research labs, software development companies, and government facilities.

Corporate networks and then the Internet added important new dimensions to studies of computer-supported cooperative work groups, because working "virtual teams" could now be quickly formed with members anywhere on the planet as long as they all had Internet access. Initially they used email primarily, but then began using far more sophisticated tools, such as Web-based whiteboards and desktop videoconferencing via the net. These new technologies promise to make geographic distance irrelevant for global teams. As you will see, it did not quite work out that way.

Expanding the Radius of Collaboration for Teamwork

In most organizations, small group work generally had been done by people who worked in proximity to one another. When appointing a task force, for example, a manager would preferentially choose people who worked in the same department, or invite people from other departments in the same geographic location, preferably the same building. Even a person who

worked at a branch office on the other side of the same town might be passed over for the task force, simply because it would be rather inconvenient to come to meetings, and impromptu team get-togethers would be very hard to accomplish.

Studies of voluntary collaboration in the workplace also highlight a critical role for physical distance, one that put constraints on people's natural inclination to collaborate. The great majority of collaborative work within organizations occurs among people who work within fifty feet of one another. This *radius of collaboration* supports the kind of informal knowledge sharing and brainstorming at the proverbial water cooler that can be so instrumental in a group's effectiveness. People who run into one another at the office, or who have plenty of opportunities to sit at the same lunch room table, are far more likely to talk about their work and collaborate with one another.¹²¹

Office-space designers offer some strategies that can increase the radius, such as open-plan seating, easily accessible team rooms for impromptu meetings, or large common areas that link different buildings on a corporate campus. Some strategies can also intensify the collaboration within the radius, even if the radius itself isn't increased. "War rooms," in which workers are closely collocated for long periods to work intensely on a collaborative project, are one example. These are larger spaces equipped with "caves" for individualized work, and "commons" for group work, along with large computer screens, electronic white boards, videoconferencing capabilities, and many more technological aids. When individuals are part of a group and their work is tightly coupled and interdependent, this extreme collocation can be very effective. Control towers, for example, must support highly cooperative work that is also dependent on technology, so air traffic controllers work together in the same room, within easy visual and auditory contact. Many software development projects also use the war room approach for housing the team members, especially if the project involves highly sensitive or classified information.

Depending on the usual radius of collaboration for effective teamwork, however, has serious drawbacks from the standpoint of organizational flexibility and adaptability. Even midsized and smaller firms are under pressure from globalization to deal with customers and suppliers anywhere in the world. Their own staff are spread around the globe to be closer to the people

¹²¹ Allen, T. J. (1977). *Managing the flow of technology: Technology transfer and the dissemination of technological information within the R&D organization*. Cambridge, MA: MIT Press.

they need to work with. If effective teamwork can occur in a virtual context, letting people participate as needed without congregating at a single location, a significant constraint on the company could be lifted.

Consider Dana, a software developer in Boston working for a Web development company with offices in Boston, San Francisco, Vancouver, Sydney, and Singapore. She has specialized knowledge of e-commerce payment gateways and shopping carts used to conduct online transactions. With computer and Internet-based cooperative technologies, she can contribute her expertise to several different teams trying to build Web sites for customers. She needn't travel, so the corporation saves large sums on the travel budget. She can participate for short or long periods, on more than one team at a time. She can also become a specialized resource, one that is not a full-fledged member of a team but who can be called upon when they start adding the "buy now" button to a customer's Web site.

From the company's perspective, the capability to create teams without regard to geography is liberating. Those expert databases that I discussed in the last chapter on knowledge management would be pointless if the experts had to shuttle around the world to participate in projects that needed them. When corporations can create virtual teams, they do not need to develop specialized expertise in every location as the firm grows and expands to different parts of the world.

From Dana's perspective, the value of virtual teamwork is equally high. She doesn't have to travel away from her home in Boston, or find live-in help to care for her children while she is away. When her children are sick, she can confidently stay home with them and continue her teamwork from her connected home office. She can even choose to become a telecommuter, staying home two or three days a week and avoiding the traffic.

From society's viewpoint, virtual teamwork also has many advantages. It may help to reduce traffic congestion, along with the costs of building roads, public transportation, and other services needed to support population density. If some percentage of the population did not have to drive to a population center to reach work each day, the parking lots would have spaces and pollution would go down.

On the surface, virtual teamwork has many advantages and some analysts predict that distributed work arrangements involving virtual teams will be the number one trend of this millenium's first decade.¹²² Software vendors have been able to sell quite expensive "groupware" products to

¹²² Kemske, F. (1998). HR 2008. *Workforce*, January, 47-60.

company executives, even when the products are buggy and unproven as means to support cooperative work. But do virtual teams work as well as collocated teams? Are they more effective in some kinds of projects, but much worse in others? To answer these questions, let's first look at the characteristics of the team situation for each type of team, especially in the areas of communications and information access.

The Context of Teamwork

Although the process and the results of teamwork, such as the kinds of discussions conducted or the decisions reached, have always received attention, the context of the work has not. The context, however, is one of the most important differences between face-to-face and virtual teams.

FACE-TO-FACE CONTEXT

When people are in the same room trying to accomplish a task, make a decision, find a solution, or perform some activity, they are surrounded by a rich and complex assortment of sensory cues. They can see each person in the room, if not all at once, then simply by glancing around. Their facial expressions, postures, physical appearance, tone of voice, and speech tempo are all apparent to everyone in the room. Other sensory cues about the team members are also available, from body odor to a slap on the back. As I discussed in an earlier chapter, the face-to-face setting is high in media richness because information from every sensory channel can be exchanged from moment to moment. The face-to-face medium is conducive to quick clarifications in response to expressions of puzzlement. When anyone says something that the others don't comprehend, the feedback in the form of widened eyes or furrowed brows can instantly be used to initiate further clarification.

The social presence of each individual is also high. All those nonverbal cues that people use to form impressions of one another are quite salient in a face-to-face setting. Status cues can easily be seen, and behavioral patterns are perceived immediately. The high social presence also means that people are more publicly self-aware, in the sense that they know that others can perceive and judge all the cues they are emitting, whether verbal or nonverbal. Even the mere physical presence of other people is an important aspect of the environment. It increases attention to the task, or at least the drive to appear as though one is paying attention. The exposure increases familiarity with the idiosyncracies of each team member, and classic research in psychology demonstrates that familiarity usually leads to liking.

In the same room, people also have shared access to artifacts, such as a drawing on a whiteboard, documents lying on the table, a large computer screen, or a prototype of a new toaster they are designing. They can point to an artifact while they are speaking about it, hold it up, or move parts of it about to show how it works. When they speak, their words do not have to be completely descriptive, because they can use gestures to point or follow up with a clarification if the others show they didn't understand. Consider a meeting of a team composed of graphic designers, computer programmers, and a mathematician, who are working together to create math software based on an adventure game. They have sample graphics of the screen shots lying around on their circular table, and they also have a large computer screen on which the program is running.

- Jose:* Why did you put that here? (tapping the image of a "Submit" button on the paper printout on the table)
- Mary:* You mean this? (pointing to the screen, and touching the button with the mouse)
- Daryn:* Here, it works like this. (clicks the mouse button and the working prototype returns feedback)
- Jose:* OK but... (spreads hands to suggest button should be larger)

Not many words were exchanged in this portion of the meeting, but a large amount of information was exchanged because of collocation, not just of team members, but their artifacts. They could use gestures and words like "this" and "that" to achieve understanding rather quickly, moving fluidly from one kind of communication to another.

VIRTUAL TEAM CONTEXT

The virtual team's context is quite varied, but certainly very different from that of the face-to-face team. Virtual teams might use synchronous collaborative technologies, such as online chat systems, video- and/or audioconferencing, interactive whiteboards, or a combination of them. They might have team-based "awareness" capabilities that will let each of them know when a team member is or is not available for contact. Synchronous tools might also include group decision support systems (GDSS) that allow team members to brainstorm ideas, rearrange their ideas into coherent patterns and groupings on the screen, vote on various issues and tabulate the results immediately, or collectively rank order priorities. Asynchronous tools would also be employed, including collaboratively constructed Web sites

containing project artifacts, asynchronous discussion boards, and that popular favorite – email. The team members are not collocated, but they have many other tools to help them work together.

Nevertheless, the main context for a virtual team member is not the conference room, but the separate office or cubicle, and the desktop. Instead of glancing around at other team members or artifacts, he or she spends most of the time facing the computer monitor with hands on the keyboard. Monitors have certainly grown in size, but they are still quite small in comparison to a room filled with coworkers, whiteboards, and projected computer images. For the virtual team member, much of the interactive teamwork occurs through this narrow porthole.

CONTEXT IN THE BACKGROUND

The immediate surroundings form part of the context for team members, but context is also established through some background effects, such as whether the members have worked together before or whether they anticipate long-term working relationships. These background variables affect the kinds of relationships that develop among team members and how cohesive the team becomes. They also affect the motivation level for team members to do their part.

These background factors give collocated teams another edge, at least in terms of trust and the development of relational ties. Because they come from the same area, and perhaps even the same building, they are more likely to have worked together in the past, and they also are more likely to anticipate working together in the future. They can communicate more easily in and out of formal meetings simply because they are nearby. It is much easier to poke one's head into a neighbor's cubicle to ask a quick question and get instant clarification to coordinate work. On the other end of the continuum is the brand new global virtual team, with members from different countries who have never met, never worked together before, and never expect to do so again. Meetings are mostly formally arranged, perhaps using a combination of videoconferencing, audioconferencing, or Web-based interactions. Between meetings, most communication is electronic, and often asynchronous.

Despite the potential handicaps in terms of context, the advantages of virtual teams are great and their numbers are growing. How are they faring compared to the collocated teams? Small groups who work together in the same room have their share of problems – especially having to do with group dynamics – that sometimes interfere with performance and prevent

groups from doing as well on projects as they might. Virtual teamwork may actually offer certain kinds of improvements, at least under some circumstances. It is not necessarily the case that the face-to-face working group is always the “gold standard” for teamwork. Nevertheless, the reduction in media richness and social presence that accompanies virtual teamwork is not trivial. Let's next consider the group dynamics of face-to-face and virtual teams, particularly as it applies to the development of trust.

Group Dynamics in Virtual Teams

Groups, in principle, are expected to perform certain kinds of tasks better than individuals for a variety of reasons. Perhaps most important, a group consists of individuals, each of whom has special knowledge and experience he or she can bring to the table. All members should be able to look at a problem in their own ways, and offer creative insights and perspectives that a single individual, working alone, would not be able to do. A group can collectively divide up the responsibilities for a complex task, coordinate their activities, and move quickly toward the common goal. At least, that is the theory.

In practice, the social and psychological dynamics of working groups can dramatically affect the quality of their decision making and how productive they are. Sometimes, groups break down entirely, and members drift away or leave in a huff. Other times, groups turn out work that is flawed, and an individual might have done the job better at much lower cost. The factors that cause groups to do well or poorly are often related to the same contextual factors that distinguish face-to-face from virtual teams. The development of trust is one example.

DEVELOPING RELATIONSHIPS AND ESTABLISHING TRUST

A key ingredient for successful teamwork is trust. When work is divided and the project's success depends on each member making the right contribution at the right time, trust is essential. Members of a collocated team have many opportunities to develop trust in one another, both on the job and off. Sam's battery dies, and Monica, in a nearby office, gives him a jumpstart. The school calls Monica at work – her son shows signs of chicken pox and should be picked up. Sam volunteers to finish Monica's statistical analysis of this month's sales transactions for the report, due in the morning. When Sam and Monica are assigned to the same team, they already trust one another.

Charles Handy, formerly of the London School of Business, argues that successful organizations in the information age require trust among their employees, and "trust needs touch."¹²³ Paradoxically, the more "virtual" an organization becomes, the more it will need to bring the people together for meetings, picnics, conferences, or other collocated events so they develop relationships with each other and establish the kind of trust that Sam and Monica have.

Research on trust within virtual teams tends to support Handy's point of view, though there may be ways to facilitate the development of trust in such contexts. Sirkka Jarvenpaa of The University of Texas at Austin and her colleague Dorothy E. Leidner of INSEAD explored the development of trust in global virtual teams consisting of students from around the world.¹²⁴ Three hundred and fifty graduate students from twenty-eight universities participated in the project, and each student was assigned to a small team, all of whose members resided in a different country. Motivation to participate and do well on the team project came from the course grade, but the researchers also promised a \$600 reward for the highest performing team along with industry publicity.

The teams were each given voluntary and mandatory assignments, including the course project that involved developing a Web site to offer a new service to information systems practitioners. Team members communicated by email and also had access to a project Web site containing a central repository of information accessible to all teams. The researchers collected all email exchanges and also asked participants to complete a survey early in the project and again at the end. The survey was designed to measure the participants' trust levels and contained items such as, "If I had my way, I wouldn't let the other team members have any influence over issues that are important to the project" and "I can rely on those with whom I work in this group."

The teams varied dramatically on their levels of trust and the nature of their communications. For teams that ended the project with a low level of trust, communications were often unpredictable and uncertain, and few people took any individual initiative to get the team moving in some common direction. One team member writes, "What is happening to the rest of the team apart from James?" after a long period of silence from other team

¹²³ Handy, C. (1995). Trust and the virtual organization. *Harvard Business Review*, 73(3), 40-48. Retrieved March 3, 2003, from Business Source Premier Database.
¹²⁴ Jarvenpaa, S. L., & Leidner, D. E. (1999). Communications and trust in global virtual teams. *Organization Science*, 10(6), 791-815.

members. Another sends the message, "I am kind of confused... not sure I can be helpful." Participants in low-trust teams were not often forthcoming about their own reliability. One said, "I think (not a promise) that I'll be able to have the page (at least the skeleton of it) done early next week." That kind of remark does little to convince your team members that you are reliable and will carry your part of the workload.

Some groups did report a much higher level of trust, and their messages were often quite different. They were more likely to jump into the communications medium with enthusiasm, welcoming the other team members, telling something about themselves, and eagerly assigning roles or volunteering for responsibilities. They were also more likely to respond to one another more quickly, and with more substance. Although the high-trust groups were promptly reacting to one another's contributions and work products, the groups that failed to develop or maintain trust were not. One team member whose group started out with higher trust but lost it as the project went on lamented that he received little feedback about his own contributions from the others. He said he would "just use my own creativity as I haven't had any real comments."

Jarvenpaa and Leidner suggest that trust can be formed in these global virtual teams, but it is not equivalent to the strong relational ties that bind collocated groups. Instead, it is a kind of "swift trust" that is more task oriented and action based. This trust was fragile and temporal, and it was easily lost if technology problems arose, communication breakdowns occurred, or some members fell silent.

TRUST, COOPERATION, AND CONFLICT IN SOCIAL DILEMMAS

Studies of social dilemmas also demonstrate how difficult it is to establish trust in a virtual team. Social dilemmas are situations in which the interests of individual members of a group are at odds with the collective interests of that group. Some of them can be "beaten" if the individuals within the group choose to trust one another and cooperate, but a single defector can undermine the cooperation and push the group toward competitive behavior. Many dilemma scenarios, such as the "Prisoner's Dilemma," have been devised for experimental research, with varying payoff matrices that create different balances between individual and group rewards. They have been especially popular as a research device to study patterns of cooperation and conflict within small groups because they make it easier to quantify the elusive psychological variable of trust.

Elena Rocco of the Collaboratory for Research on Electronic Work at University of Michigan used a social dilemma to assess the level of cooperation

and trust that groups could achieve when they were working face-to-face, compared to when they were working virtually, using electronic communication.¹²⁵ The dilemma involved investment in the market, and members of her six-person groups were each given thirteen tokens at the start of each of the twenty-eight rounds of the experiment. They could invest as much as they wanted and their payoff at the end of each round was a share of the group payoff, proportional to the investment they made. Individually, the more they invested the more they earned, but the payoff matrix held a trap. After a certain level, the bigger the total group investment the lower the group's payoff. This meant that groups who cooperated with one another, and voluntarily kept their investment levels in check, would earn the most. However, a single defector would run off with sizeable rewards if all the other members were cooperating, and then the trusting cooperators would lose out. After each round, participants received a report showing their past record of investments and payoffs, and also the total investment for the last round. The report did not show what each person had invested, so the identity of a defector – if there were one – would not be revealed. The group members got together to discuss the dilemma after the tenth, fifteenth, and twentieth rounds. Some groups met face-to-face during these communication periods, whereas others communicated electronically, but not anonymously.

The results showed striking differences in cooperation between the groups. After the first communication session (tenth round), the face-to-face groups figured out at once that they needed to cooperate, and they quickly developed stable investment patterns with no defectors. Initially, their cooperative strategy did not necessarily maximize the group's rewards, but some of the groups were able to achieve the maximum reward by the end of the study – all through cooperation.

The groups who communicated electronically, however, showed much more individualistic behavior and far less cooperation. During the communication period, most groups attempted to come to an agreement about how to cooperate with a collective strategy. After each agreement, there was a short period in which the participants attempted cooperation, but the agreements were quickly disregarded. Some people in each group chose opportunism; they defected by making a large investment, to the great

¹²⁵ Rocco, E. (1998). Trust breaks down in electronic contexts but can be repaired by some initial face-to-face contact. Conference proceedings on human factors in computing systems, 1998, 496–502. Retrieved May 7, 2003, from ACM Digital Library.

disadvantage of the members who were trying to stick to the agreement. After the initial defections, all members swung back to an individualistic choice. During the communication periods, their messages were dominated by aggressive expressions of blame, disappointment, and mistrust. The glaring failure of the electronically communicating groups to reach a cooperative strategy shows how difficult it is to develop trust without touch.

Most teams are neither completely virtual, as the experimental groups in this study were, nor completely face to face. Perhaps some advance face-to-face relationship building might make it easier for groups who later are limited to electronic communication to cooperate in the dilemma. Rocco added another condition using the same social dilemma, but this time, the groups who were to communicate electronically were allowed to meet face-to-face the day before the experiment. Their task during this preexperiment gathering was designed to elicit socialization and collaboration, so they might have some personal basis for trust the next day. Each group spent forty-five minutes building a tower out of paper, and they competed against the other groups who would also be in the dilemma experiment to make the best tower.

The groups who met face-to-face before the social dilemma experiment did considerably better than the ones who were communicating electronically and had never met before, though they still had some trouble establishing and sticking to an agreement. Cooperation increased initially after the communication period in the tenth round but then dropped off. Apparently, based on the analysis of the messages, the members of the groups intended to cooperate but were not clear about which system they had agreed upon. The virtual environment inhibited understanding, but some trust had already been established from their preexperiment gathering so they worked out the problems in the next communication period. By the end of the twenty-eight rounds, their cooperative performance was as high as the face-to-face groups.

CAN VIDEOCONFERENCING REPLACE TOUCH?

What is it about trust that is so quick to emerge with face-to-face encounters but so fragile and difficult to build when virtual teammates are using electronic communications? If trust really requires touch, and teams require trust to perform effectively together, then corporations must rethink their deployment of widespread virtual teaming. They may need to increase their travel budgets, to make sure group members at least get a chance to meet one another before the project kicks off.

Current technologies, however, support channels with higher media richness and more social presence than just the text-based communications those noncooperating and defecting groups were using. Perhaps some of the benefits of face-to-face meetings can be achieved through higher bandwidth. In a follow-up study to Ellen Rocco's, Nathan Bos and colleagues, also at the Collaboratory for Research on Electronic Work at University of Michigan, attempted to determine whether videoconferencing or audioconferencing could better support the development of trust for virtual teams.¹²⁶ They organized forty-five teams of three people each and assigned each team to one of four communication media: face-to-face, videoconferencing, audioconferencing, and text-based chat. Each team worked on the "Daytrader" game, another social dilemma in which players get thirty tokens at the beginning of each round of the game and must decide whether to invest individually or with the group. Individual investments received a guaranteed reward of double the investment – not bad, given economic volatility. Funds targeted for group investment are lumped together for the team, and the amount is *tripled*. The proceeds are then divided equally among the three team members. The dilemma involves the same risk of defection that plagues all social dilemmas. Acting collectively, the group can maximize its rewards. Defectors, though, can reap even more rewards if they deceive the other members of the group and act individually, at the expense of the other team members. The total payoff for the group at the end of each round and also at the end of the thirty-round game is the quantitative measure of cooperation. Groups engaged in the discussions and strategic planning after every five rounds using whichever communication medium they were assigned.

Not surprisingly, the face-to-face groups achieved a high level of cooperation early in the game, and the teams using text-based chat achieved very little throughout all thirty rounds. The groups using videoconferencing achieved a high level of cooperation but were slower to reach it compared to the face-to-face groups. Nevertheless, this finding bodes well for this higher bandwidth medium as an alternative to face-to-face meetings for virtual teams. It appears that one important ingredient of touch is "face time," which can occur over the net.

The audioconferencing groups were also able to achieve higher levels of cooperation compared to text-based chat groups, but their patterns of cooperation were very unstable. After each audioconference, their cooperation

¹²⁶ Bos, N., Gergle, D., Olson, J. S., & Olson, G. M. (2001). Being there versus seeing there: Trust via video. Proceedings of CHI 2001: Short Papers. New York: ACM Press. Retrieved September 1, 2002, from ACM Digital Library.

levels would go way up initially and the parties would at first stick to whatever agreements had been reached. Then, however, defections would begin. The cycle repeated itself after each communication period. Audio alone may simply not offer enough media richness to transmit whatever cues are needed to establish trust.

The researchers had also offered a ninety-token bonus every fifth round to the player in the team that made the most money in the previous five rounds, and most of the players showed an end-of-game dropoff in cooperation. This looked like the "defector's sprint" at the end. Players wanted to win the individual bonus, so they were willing to abandon cooperation and good will – particularly because no one could retaliate after the last round. This phenomenon was more pronounced in all the groups who were not meeting face-to-face, suggesting that whatever trust had developed was more like the task-oriented and fragile "swift" trust that appeared in the global virtual teams of students I discussed earlier. The relational ties that developed during face-to-face discussions were stronger and more able to withstand the temptation to defect at the end of the game. Thus, it seems some face time through videoconferencing is the best way for virtual teams to establish trust and facilitate cooperation, but it still falls short of touch.

Group Dynamics for Problem Solving and Decision Making

An important function of groups is to examine a problem, come up with ideas and alternatives for solving it, analyze and weigh the alternatives, and make a decision about the best course of action to take. Many people believe that groups will do a better, fairer, and more comprehensive job at this sequence compared to individuals. We rely on the twelve-person jury of peers to evaluate the evidence in a trial and decide the defendant's fate. We prefer to appoint a committee to deal with complex problems in the workplace and come up with a range of options. Committees with decision-making responsibilities abound in practically every organization because most people believe their solutions will be higher in quality. They certainly create more buy-in by employees.

Groups, however, have certain flaws for problem solving and decision making, and they may not always reach the best decision because of the effects of group dynamics. As everyone has observed, the person with the highest status often has the most influence, even if that person is not the most knowledgeable. Group discussion also can lead to *polarization* of attitudes and opinion. When an individual who leans toward a particular point of view on a topic begins discussing that topic with others who also lean in

that direction, the group discussion tends to strengthen those preexisting attitudes. During the discussion, the members avoid bringing up points that would be more balanced. They tend to stop weighing the pros and cons of different points of view and instead keep reinforcing each other by making points to support their initial leanings.

Early studies on the *risky shift* phenomenon demonstrated how polarization operates in groups. Most people expected groups to be more conservative than individuals because, presumably, they would contain members with different viewpoints and the resulting decision would be more of a middle-road compromise. However, research demonstrated that in many circumstances, groups are willing to take more risks than individuals and go further out on a limb than the average viewpoint of the members. The process was first demonstrated in a study of the recommendations groups and individuals gave to the fictitious "Helen." Helen is a writer who was weighing the risks of dropping her lucrative career as an author of formula Westerns in favor of writing the great literary novel. When teams weighed the risks, their recommendations were less conservative than were those of individuals. They were, as groups, more willing to say, "Go for it!"¹²⁷

The phenomenon of *groupthink* can also plague group problem solving and decision making, and it represents an extreme case of polarization. When a highly cohesive team becomes eager to seek concurrence and agreement, individuals are very reluctant to bring up counterarguments. The group is no longer able to scan the horizon for a wide variety of alternatives, nor can its members dispassionately appraise the pros and cons of any decision or alternate courses of action.

Are virtual teams susceptible to the same kinds of influences when they are trying to come up with alternatives and make decisions about them? In some cases, virtual teamwork actually improves group problem solving and decision making. In others, the reduced media richness and low social presence introduce elements that hamper groups even more. Let's first look at brainstorming.

GROUP BRAINSTORMING

In the 1950s, Alex Osborn published a book about stimulating creativity with the intriguing title *Applied Imagination*. One of his suggestions was

¹²⁷ Stoner, J. A. F. (1962). A comparison of individual and group decisions involving risk. Unpublished master's thesis, Massachusetts Institute of Technology, 1961. Cited by D. G. Marquis in Individual responsibility and group decisions involving risk. *Industrial Management Review*, 3, 8-23.

intended to increase the effectiveness of brainstorming through groups, by using a set of systematic rules. Individuals were brought together in a room and asked to think up as many ideas on a particular topic as they could, but never criticize or evaluate another person's contributions. They could improve on them or combine them, but not tear them down. The goal was to create a supportive group where even the most outlandish suggestions would be free to emerge, and thereby reduce the evaluation apprehension that people feel when they are offering innovative notions in a group setting.

Though the technique generated much enthusiasm, later research demonstrated it didn't work very well. Although a brainstorming group generated more ideas than a single individual working alone, it was not as effective as a "nominal" group working on the same topic. That is, six people working alone would come up with far more ideas than six people working together in the same room. The face-to-face context actually hindered the effective generation of original ideas for several reasons, one of which is called *production blocking*. First, only one person could speak at a time, and the others needed to listen. This meant that everyone in the room had less time for private thought on his or her own ideas. The waiting time created by the act of listening when others are speaking caused other kinds of problems, as well, including forgetfulness. A listener who had an idea in mind may forget about it while listening to someone else talk. Another reason face-to-face brainstorming may be less than effective is because of the *social loafing* phenomenon. When several people are working on the same task, each individual does not feel particularly accountable for doing his or her best. Some will loaf and let John do it, because they would get no individual credit for their work anyway.

The problems that hindered face-to-face brainstorming would be much reduced if the team used some technology - groupware in particular. This kind of software allows members to work independently and simultaneously, typing ideas on a keyboard, but they could also see what everyone else was typing as the entries scrolled by. The approach should decrease the amount of production blocking common in face-to-face brainstorming. Izak Benbasat of the University of British Columbia and John Lim of the National University of Singapore found this to be true in a study comparing the output from electronic and face-to-face brainstorming teams.¹²⁸

¹²⁸ Benbasat, I., & Lim, J. (2000). Information technology support for debiasing group judgments: An empirical evaluation. *Organizational Behavior and Human Decision Processes*, 83(1), 167-183.

Overall, the groups working with the software generated more ideas about the task compared to the groups working in a face-to-face setting.

Although this finding seems like good news for virtual teams and the electronic brainstorming software to support them, more recent research suggests that nominal groups do just as well, and perhaps even better, than groups using the software, at least in terms of the quality of ideas generated, if not the quantity. Henri Barki of École des Hautes Études Commerciales in Montreal and Alain Pinsonneault of McGill University conducted a complex study of brainstorming in groups under several different conditions.¹²⁹ Some groups brainstormed verbally (face-to-face), while others were formed into nominal groups in which members never met or communicated with one another. Two sets of groups used electronic brainstorming software: one anonymously and one nonanonymously. Groups were asked to come up with as many original ideas as they could for a variety of topics that ranged in sensitivity, from "How can the spread of AIDS be reduced?" to "How can tourism be improved in Montreal?"

If the effectiveness of brainstorming sessions is measured in terms of idea quality rather than quantity, the nominal group did better than both electronic brainstorming groups, and also much better than the group who met face to face. Groups that used the electronic brainstorming software anonymously did somewhat better than the ones who participated nonanonymously. Though the researchers attempted to introduce variables that might improve the brainstorming sessions for the groups using the software, such as the sensitivity of the topic, none of them had any influence. Clearly, electronic brainstorming is superior to the face-to-face version, but it is not always superior to a nominal group in which independent minds focus on the same task without any interference, interruptions, or distractions from other people's chatter.

Why nominal groups might produce higher quality ideas than electronic group brainstormers is not clear. Perhaps nominal team members have more time to think and expand on their own notions, filling in details and weighing pros and cons. They don't have to look up at a collective screen to see what everyone else is contributing and try to alter their thinking to piggyback on someone else's creative idea. Also, people in nominal groups may be less likely to succumb to social loafing, because they have to turn in a product for which they are individually accountable.

¹²⁹ Barki, H., & Pinsonneault, A. (2001). Small group brainstorming and idea quality. *Small Group Research*, 32(2), 158-206.

Organizations continue to use group brainstorming – the face-to-face kind – long after the research demonstrated it was not as effective as nominal groups working on the same creative tasks. Adrian Furnham, of University College London, suggests a key reason may be that group brainstorming helps create buy-in and acceptance of the solutions to complex organizational problems.¹³⁰ Although the electronic brainstorming software certainly reduced some of the obstacles to success, the software itself may not be needed if the only goal is to create many high-quality ideas. Buy-in and acceptance are important components in group problem solving and decision making, so many organizations may continue to use group brainstorming for reasons other than a desire for innovative ideas. Buy-in and acceptance may be even more important for virtual teams, especially to encourage trust, so organizations may emphasize electronic group brainstorming for those teams in particular. In any case, it is clear that applying technological solutions to group work is a complicated affair, and we have much to learn about the intricacies of computer-supported cooperative work.

INEQUALITIES IN GROUP PARTICIPATION AND INFLUENCE

One of the more negative aspects that results from the social dynamics of groups involves inequalities of participation. When a team of people attempts to solve a problem and make a decision, certain people have more influence than others. In a face-to-face setting, their unequal influence might be due to physical appearance, gender, weight, ethnicity, age, or other characteristics that weigh heavily in the impression they make. From the standpoint of social cognition, people form impressions very rapidly when they first meet, usually relying on cues involving physical appearance. Tall, good-looking people are judged favorably even before they open their mouths to speak. The impressions then affect how people receive each individual's suggestions and how much influence each person has.

From the standpoint of trust, physical presence appears to be quite a plus, but it has mixed results with respect to other aspects of group work. Early research on computer-mediated communication, for example, demonstrated that groups who communicated only electronically were more likely to exhibit *status equalization*. People who were lower in status were more likely to speak up (electronically) and contribute more to the discussion than they were in face-to-face settings. Sara Kiesler and her colleagues performed some

¹³⁰ Furnham, A. (2000). The brainstorming myth [Electronic version]. *Business Strategy Review*, 11(4), 21-28.

of the first research on this topic.¹³¹ They found that in three-person groups attempting to come to some decision, one person tended to dominate the discussion. However, when they communicated online, participation rates were more equal.

Virtual teams should benefit from this status equalization phenomenon, though they won't be completely immune. If they use the videoconferencing that helps build trust, for example, the effects of physical appearance on group dynamics will reenter the equation, although it will unfold rather differently. Picture the physical appearance that remote team members present on the TV screen in a small conference room. You can see your virtual teammates, but because there is just one camera, you see all of them at once, sitting around their own conference table. Each person – especially the ones farthest from the camera – appears quite tiny. You can't easily see who is talking because the images are so small, and the impression they make on you is quite different from what it would be if they were in the same room. The video contact may help improve the development of trust, but the impressions you form of those remote colleagues will not be the same.

Desktop videoconferencing, in which you can see a much larger headshot of your communication partners, also introduces some intriguing nuances for impression formation. The camera angle, for example, affects the impression people make and the biases that plague group discussions. Wei Huang, Judith S. Olson, and Gary M. Olson at the Collaboratory for Research on Electronic Work at University of Michigan experimented with camera angles that would make people on camera appear rather short or rather tall to the person on the receiving end of the transmission.¹³² They randomly assigned one person in a pair to the "tall" camera angle, in which the camera was well below the person's eye level. The other person's camera made him appear "short" onscreen, because the camera was looking down from above. Before the videoconference began, each subject completed the Arctic Survival task, in which they ranked the importance of holding onto various items after they had crash-landed in an extremely cold and isolated landscape. Then each pair discussed the problem over the desktop videoconferencing link and arrived at a joint conclusion. The measure of

¹³¹ Kiesler, S., Siegel, J., & McGuire, T. W. (1984). Social psychological aspects of computer-mediated communication. *American Psychologist*, 39, 1123–1134.

¹³² Huang, W., Olson, J. S., & Olson, G. M. (2002). Camera angle affects dominated in video-mediated communication. In *Proceedings of CHI 2002, Short Papers*. New York: ACM Press. Retrieved February 1, 2003, from ACM Digital Library.

influence in this experiment was simply how close the joint conclusion was to each individual's initial ranking. Subjects were also asked whether they thought they were more or less influential on the task. Not only did the "tall" partners *think* they were more influential than their "short" partners, they *were*. The joint conclusions were closer to the "tall" person's original ranking than to the "short" person's. Apparently, the camera angle affected the behavior of both the "tall" and the "short" person. The "tall" person became more confident and influential, whereas the "short" one was more easily persuaded and perhaps intimidated. (Even in face-to-face groups, it might be wise for shorter people to choose chairs with a higher seat.)

BIASED DISCUSSIONS

Another common finding in group dynamics that impedes performance involves bias – the tendency for members to selectively choose which information they have that they will share with the group. Each person, of course, has tons of information that may be at least peripherally relevant to a problem-solving/decision-making event, so they must make many choices along the line. However, most groups try to seek consensus, so when the group starts leaning in a particular direction, individuals become less likely to bring up the "cons" of that direction – even when they would be especially relevant. Groupthink is an extreme example, but it happens in many group settings.

Ross Hightower and Lufus Sayeed found that biased discussions become even more biased when they are conducted online with groupware.¹³³ They formed three-person groups to review the qualifications of a set of candidates and collectively decide who was the best fit for the position. Each team member received a packet that had some information about each candidate drawn from the resumes, but the subsets they received were not the same. This meant that the team would need to share what they knew rather efficiently to come up with the best candidate. Some groups met face to face, whereas others communicated via online chat and also used the groupware's voting capabilities.

Regardless of how they were communicating, none of the groups were able to choose the best candidate because of bias effects. As the discussions proceeded, people were less likely to bring up negative information about the candidate who appeared to be "winning" in terms of the group

¹³³ Hightower, R., & Sayeed, L. (1995). The impact of computer-mediated communication systems on biased group discussion. *Computers in Human Behavior*, 11, 33–44.

discussion. They were also not likely to bring up positive information about the "losers," even though it would unbiased the discussion and ensure the group had all the information they needed – both pro and con – about each candidate. As the group moved closer to consensus, each member made nonrandom choices about what piece of information to contribute, so the consensus was reached with very biased information in the end. For the online groups, however, the bias was especially strong, more than twice as large compared to that of the face-to-face groups. One reason for this may have been that the online groups had to do more work, in the form of typing, to make a contribution to the discussion, so they were even more selective about what they chose to share.

The Performance of Actual Virtual Teams

Virtual teams are on the rise, though based on research findings the difficulties of making them work well are not trivial. Nevertheless, people are adaptable and may be able to bypass the problems that arise when team members are not collocated and capitalize on the features that actually improve group dynamics and productivity for virtual teams compared to their face-to-face counterparts. The acid test for virtual teams is whether they are working in the workplace, not what happens in the laboratory. People have much higher motivation to do well in the workplace and they may find many ways to compensate for the lack of media richness and social presence. The findings from field studies of real, working virtual teams, however, confirm how the obstacles I've described can lead to performance problems. Results are mixed, but it is clear that virtual teams are more difficult to launch successfully than many expected.

VIRTUAL SOFTWARE DEVELOPMENT TEAMS

One collaborative research project that involved researchers at Bell Labs, Lucent Technologies, and the School of Information at University of Michigan, for example, investigated actual software development teams, working from four locations.¹³⁴ Geographically distributed software development has become more and more common in technology companies, and these workers were located at sites in the United Kingdom, Germany, and India. The researchers took advantage of a critical feature of software development

¹³⁴ Herbsleb, J. D., Mockus, A., Finholt, T. A., & Grinter, R. E. (2000). Distance, dependencies, and delay in global collaboration. In *Computer Supported Cooperative Work, 2000*. Philadelphia, PA: ACM Press. Retrieved February 3, 2003, from ACM Digital Library.

to help analyze the results of projects accomplished by team members who were all collocated and compare them to results achieved by teams with dispersed members. This was the "change management system," which is used to track the events that take place when modifications to complex software systems are requested. The change management system automatically tracks the initial request, along with all the logins of the people who submitted modified software code as the work progressed. From this system, it was possible to calculate the amount of time each modification request took, how complex the coding was, and how many people from each site were involved in each project.

The most striking finding was that projects requiring work from people who were not collocated took quite a bit longer than projects handled totally by people at the same site. The average modification request for single-site projects took about five days from the time the work started to the time it was completed. For projects involving people at more than one site, the work interval shot up to 12.7 days. The developers working with colleagues in another location reported various reasons for the delays. They had trouble finding the right person who could answer a question, they didn't receive answers quickly enough from people at distant sites, and of course, time zone differences made it more difficult to contact one another.

The software developers also ran into problems establishing trust across sites. For example, they were asked in a survey how much they agreed with these statements, both for their collocated team members and for those at the remote sites:

"I assist my coworkers with heavy workloads, beyond what I am required to do."

"My coworkers assist me with heavy workloads, beyond what they are required to do."

All workers generally agreed with the first statement, and they believed they assisted coworkers equally well regardless of where their coworkers were located. Everyone believed they helped out all their coworkers with heavy workloads, beyond what they were required to do. However, based on their responses to the second statement, the developers had differing opinions about the willingness of their coworkers to help them. They thought coworkers at remote sites were much *less* likely to assist *them*, compared to their collocated coworkers. Clearly, there is a disconnect in perceptions here, one that reflects the difficulty virtual teams have in developing trust.

THE FUNDAMENTAL ATTRIBUTION ERROR AND VIRTUAL TEAMWORK

Catherine Durnell Cramton, of the School of Management at George Mason University, finds that the *fundamental attribution error* is exacerbated for

virtual teammates, and this may explain why the developers thought they were being very helpful to their remote colleagues, but they didn't think their remote colleagues were being helpful to them.¹³⁵ Attribution involves the processes people use to infer what caused behavior, and whether they emphasize the person's basic nature and disposition or the specific context of the situation. Suppose, for example, you receive an email from the CEO saying the New Year's party was being canceled. What would you attribute that behavior to, and what factors would influence your choice? You could emphasize the CEO's disposition and conclude the CEO is a lousy leader who doesn't care at all about workplace morale, or you might attribute the CEO's behavior to a stingy nature. However, with more information about the context of the CEO's behavior, such as the knowledge that the CEO's spouse just passed away, you would be more likely to attribute the CEO's cancellation to situational factors rather than to dispositional ones.

One typical error people make in their attribution process is to overestimate dispositional factors when making attributions about other people's behavior and underestimate situational factors. A key reason for this is that they don't have broad-based information about the context of the other person's behavior, so they often don't know that an unusual situation might even exist. When Jack hangs up the phone on you, you assume Jack – whom you know little else about – is a jerk. That is his disposition. If you hang up the phone on someone else, you attribute your own behavior to the situation; the other party said something outrageous, and that caused you to behave rudely. You know much more about the context of your own behavior, of course, so it is far easier to see how the situation played a role.

Cramton and her colleagues found that people who work in distributed teams are more likely to attribute their remote colleagues' behavior to dispositional factors rather than to situational ones. After working together on a team whose members were either collocated or dispersed, each person was asked: "On this project, when team members did not meet my expectations, it could generally be attributed to 1) something within the team member, or 2) circumstances outside the member's control." The dispersed team members were more likely to choose number 1.

Remote colleagues are less likely to have knowledge of the context of their coworkers' behavior, so the fundamental attribution error is exacerbated. A team in India might be having a major monsoon that brings down the networks, but the team in the United Kingdom wouldn't know that.

¹³⁵ Cramton, C. D. (2002). Attribution in distributed work groups. In P. Hinds & S. Kiesler (Eds.), *Distributed work*. Cambridge, MA: MIT Press.

Instead, they would assume the India team was simply ignoring their email requests for information. Switching from asynchronous text-based communication to synchronous videoconferencing does not always alleviate the problem. One such conference involved a remote team in Oregon and a team at the corporate headquarters in California. The virtual meeting was to begin with the presentation of a videotape that was shown in California and transmitted over the videoconferencing link to Oregon. However, the transmission wasn't reaching the remote team in Oregon because of a technical glitch, so they saw only a blank screen. Unfortunately, the California team didn't know the Oregon team couldn't see the tape. The team members in Oregon didn't really want to interrupt to report the blank screen, especially because they suspected they were being intentionally excluded. The Oregon team thought they were not supposed to be invited, so they got up and left. When the videotape ended, the California team's monitor picked up the Oregon site again, but all they saw from California was the empty couch in Oregon, because everyone was gone. The empty couch remained on the California monitor throughout the meeting, reminding everyone in California how rude the Oregon teammates were.

Certainly many virtual teams work reasonably well, some exceptionally so. Also, many collocated teams fail miserably. The collocated team may not be an entirely fair comparison to judge the performance of virtual teams anyway, because the corporation may not be able to create the team at all if it must be created in the same geographical location. Virtual teaming allows corporations to bring together expertise in ways that were not possible in the past, so many teams can now benefit from expertise that is especially hard to find. Nevertheless, virtual teams face many challenges that can undermine their performance.

What Will Make Virtual Teams More Effective?

Based on what has been learned about the factors that derail virtual teams, we can propose some approaches that will help make their work smoother, both now and in the future. It is critically important to analyze these factors carefully, especially to guide technology innovations that will better support virtual teamwork and avoid foisting useless and expensive products on corporations. In fact, many of the factors have little to do with the capabilities of groupware or netcentric technologies. Instead, they have more to do with making wise decisions about the kind of work virtual teams should tackle and with providing effective leadership. Let's first look at the kind of work virtual teams can and can't do well.

COUPLED AND UNCOUPLED WORK

Gary M. Olson and Judith S. Olson use the concept of *coupling* to refer to how close the level of coordination must be among the workers on a team, and how frequently they need to communicate to achieve the right level of coordination.¹³⁶ Tightly coupled work requires team members to communicate often, to constantly be aware of one another's progress at a high level of detail, and to share information and work products quickly and nimbly. Highly complex tasks are tightly coupled when the problem is not well defined and alternative approaches and solutions must be evaluated collectively by people with different kinds of expertise. In software design and development work, for example, the team would include a range of people who understand functional requirements, people who have deep content knowledge in the subject, and techies who have specialized knowledge in areas such as database design, systems analysis, or application development.

People who are doing tightly coupled work benefit enormously from collocation as they continually communicate with one another using whiteboards, flip charts, and live prototypes displayed on a large computer screen. In the same room, they have a great deal of "real estate," in the form of walls, screens, and tables, to collectively analyze the artifacts of their work. They also have awareness of when other team members are available for the quick question or clarification, so even when they are not in the conference room they can quickly get the answers they need to continue with their part of the project. Some of the most successful projects involving tightly coupled work use the war room approach I described earlier.

Loosely coupled work has fewer immediate dependencies, and more structured and modular components to it. The successful work of one team member is not so heavily dependent on complex interactions with the rest of the team, and there are fewer ambiguities. Most projects have some portions that are tightly coupled and other parts that are loosely coupled, but they generally lean toward one or the other. Olson and Olson argue that virtual teams, at least with today's technology, are very ill-equipped to handle tightly coupled work. Assigning such projects to a distributed team could doom the team to failure because it would be almost impossible for the members to communicate as fluidly and spontaneously as they needed.

COMMON GROUND

Teams become more and more efficient as members learn more about one another and establish more *common ground*. This broad term covers cultural

¹³⁶ Oldson, G. M., & Olson, J. S. (2000). Distance matters. *Human-Computer Interaction*, 15, 130-178.

factors, local context, history of working together in the past, and many other features that help individuals communicate efficiently and smoothly. When a group of people are working together many communication efficiencies emerge when this common ground is in place. For example, one team member may say "deep-six that." With common ground established, the other team members know immediately what "that" is, and what "deep-six" means. Also, the speaker *knows* that they know it and also has some notion of whether he or she would offend someone on the team by making such an abrupt, colloquial dismissal of whatever "that" is (perhaps someone else's favorite suggestion). Common ground in the team saves much time and also helps reduce conflict due to misunderstandings and misperceptions.

Awareness of the state of one's coworkers is another component of common ground. Simply knowing they are around to ask questions and don't mind interruptions increases communication efficiency considerably. Being aware of their state of mind also helps. If you know your coworker's desk was just flooded by a pipe break in the ceiling, you will adjust your attributions about the cause of his or her behavior when the coworker seems a bit testy.

Olson and Olson also argue that virtual teams who have this common ground may work very well together despite the distances between them, because they have already established trust as well as communication efficiencies. However, the virtual team composed of people who have almost no common ground at all, because they come from different cultures, have never worked together in the past, and are geographically too distant to meet face to face will encounter very serious obstacles to success. Probably the fastest way to increase the common ground available to a team to maximize their effectiveness is to collocate them. For virtual teams, face-to-face meetings at the start of the project at least would certainly help.

EFFECTIVE LEADERSHIP FOR VIRTUAL TEAMS

What makes an effective leader for a virtual team? The leader must be aware of all the pitfalls of virtual teaming, from problems in trust development to communication ambiguities. The leader must do whatever possible to counteract them and help the team members become aware of them as well. Much of the research on virtual team leadership suggests that it requires a somewhat different approach compared to leadership in collocated teams. Generally, a structured and deliberate management style works better because the message will be clearer when transmitted over impoverished media. Virtual team members have trouble self-organizing, so clear instructions about the project goal, deadlines, and role assignments are usually

needed. But the leader must also be deliberate about the "consideration" component that we discussed in an earlier chapter. Leaders must find ways to build those relational ties, trust, and common ground to make the group maximally effective.

Suzanne Weisband at the University of Arizona conducted a study of virtual team leadership in which business students at two geographically distant universities worked together on a four-week project to write a consensus policy document.¹³⁷ The teams consisted of two to four people, and each team included one or more members from both locations. Team members used a Web-based computer conferencing system and email to do their project, and the researchers assigned one of the students as the team leader. The team's performance was judged based on the quality of the paper, graded by several instructors who came to a consensus. The messages that were exchanged were also analyzed in depth based on their content, and messages from the leader were analyzed separately. Students also filled out a questionnaire after the project was completed and the paper turned in.

The results of this study demonstrate several aspects of successful leadership in the virtual team environment. First, the leaders of the high-performing teams were more likely to initiate task structure through their messages compared to leaders of low-performing teams, especially early in the project. They sent out messages that clarified the task objectives and set up deadlines and roles. Second, the more successful teams also had leaders who tried to increase group awareness and relational ties in various ways. Their messages included many statements that attempted to find out what the members of the team were doing, if they were having problems, or if they needed help. They also systematically tried to include everyone. One email in that vein read:

"OK, I'll be looking for posts/principles from Rick and Matt on Saturday and from Josh on Sunday. If you are having any trouble at all or anticipate any future problems, let me know now rather than later. I can help in any way and take up any slack (if I know in advance). See ya!"

This is the same kind of tack that those who were able to develop "swift trust" used. The leaders showed consideration for the team members, their workloads, and also used a great deal of structure to reduce the ambiguities that plague virtual work teams. In a face-to-face setting, this might seem a

¹³⁷ Weisband, S. (2002). Maintaining awareness in distributed team collaboration: Implications for leadership and performance. In P. J. Hinds & S. Kiesler (Eds.), *Distributed work*. Cambridge, MA: MIT Press.

bit heavy-handed and overly authoritative. However, in virtual teams this seems to be the most promising approach to leadership.

A study by Timothy R. Kayworth of Baylor University and Dorothy E. Leidner of INSEAD in France on global virtual teams also pointed to the important role the leader plays in the team's performance.¹³⁸ They created virtual teams of five to seven students, each from locations in Europe, Mexico, and the United States. After the teams submitted their projects, all of the nonleaders completed surveys that assessed what they thought of the leader's effectiveness. The questions probed the participants' judgments of many aspects of the leader's behavior, including how clearly the leader communicated roles, how much influence the leader exerted on the team, how innovative the leader was, and how well the leader functioned as a mentor by showing empathy and concern for each team member. The measure of each team's success was the grade on the project.

The team members especially focused on the leader's mentoring capabilities and empathy when they were judging the leader's effectiveness. They also considered the leader's ability to clarify roles and communicate effectively as key ingredients of an effective leader. Leaders who scored low on these characteristics were judged less effective by their team, and teams whose members thought the leader was ineffective did not do well on the project.

Participants made telling comments about the leaders they judged to be particularly ineffective. Some of their comments show the importance of both consideration and structure in the virtual team environment:

"[The leader] never wanted to know anything about us."

"To him the topic was easy, but to us it was very complicated and difficult to understand."

"I didn't feel like I was being pushed to do well. I must admit I didn't do my best because I didn't feel encouraged and pushed along."

"Unfortunately, he did not follow up in a good, effective way in guiding the team... He should have given us more specific guidelines."

This research project also investigated the leader's perspective. Leaders found their virtual leadership role to be highly challenging, and their main problems focused on the motivation and behavior of the team members, the lack of control mechanisms, and technology hurdles. Leaders struggled with nonresponsiveness in some of the team members, and they were never

¹³⁸ Kayworth, T. R., & Leidner, D. E. (2002). Leadership effectiveness in global virtual teams. *Journal of Management Information Systems*, 18(3), 7-40.

sure if the problem was apathy, laziness, or technology. All but two were disappointed in the quality of their group's project, but as one might expect from attribution theory, they did not blame themselves. Instead, they blamed the situation. High on their list of factors that caused the less than sterling results from the leaders' perspective were the lack of motivation and responsiveness in the team members and the unpredictable technologies they were using. Hayworth and Leidner summarize the leaders' perspectives: "It is telling that the leaders saw themselves as helpless, powerless, and yet flawless."

Clearly, virtual teams will benefit from effective leadership tailored to their special needs. Leaders must recognize that consideration and structure are both still positive leadership behaviors, just as they contribute to effective leadership in face-to-face settings. However, they play out differently online and seem to require much more deliberate communications, focused attention, and clearer role assignments. Leaders underestimate the power of the nuances that can so easily be communicated with physical presence, and they are awkward at using the tools available in a virtual environment. It takes considerable skill with a keyboard to provide the kind of structured leadership and role clarity that virtual teams need without sounding too bossy and overbearing. It takes even more to convey a sense of empathy without sounding false or just goofy. Ending each message with a smiley face :), for example, will not carry the same message as ending a conversation with a smile.

TECHNOLOGY

The leaders did indeed have various problems with technology, and as we've seen throughout this chapter, many characteristics of the technology virtual teams are using introduce challenges for them. The Internet and all the netcentric innovations that have arisen along with it have a great deal of power to improve productivity, but the kinds of tools people use to participate in truly effective virtual teams are still rather limited. Mark S. Ackerman of the University of California at Irvine calls this the *social-technical gap*.¹³⁹ It divides what is needed to support virtual teams from what we can now support technically. The gap is due to limitations of the Internet and other components of the technological infrastructure and also to our limited knowledge of what is actually needed by the groups themselves. He writes,

¹³⁹ Ackerman, M. S. (2000). The intellectual challenge of CSCW: The gap between social requirements and technical feasibility. *Human-Computer Interaction*, 15, 179-203.

"Simply put, we do not know how to build systems that fully support the social world . . ." A face-to-face setting contains an almost infinite number of variables that can affect the productivity of a team. Identifying the critical ones that must be supported by technology so that virtual teams work well is a challenging process.

The technologies teams are now using, such as email, Web-based conferencing systems, interactive whiteboards, video- and audioconferencing, groupware, project Web sites, and instant messaging, can all make a contribution to the communication efficiencies of virtual teams; but they also introduce problems. Even videoconferencing, which is arguably the least impoverished in terms of media richness, has its share of problems and is unable to substitute fully for the physical presence of collocated teams. Some difficulties arise simply because the technologies themselves are not particularly robust and are sensitive to many configuration and transmission troubles that take time to solve. Setting up a desktop videoconferencing link, for example, is hardly as simple as popping your head into your coworker's cubicle to ask a question. The sensitivity and idiosyncracies of different workstations often mean that virtual team members spend a lot of time just debugging and tweaking their communication tools. They also must spend some time just to learn how to use them, even when they work perfectly.

No one is giving up, however. Much recent research is dedicated to aligning the innovations in technological tools to support group work with the social requirements, as these unfold and we learn more about what they actually are. For example, there has been much interest in developing technological means to support synchronous *awareness* of team members. In a collocated environment, knowledge of who's around at any moment in time appears to be one of those subtle characteristics of the communication environment that did not receive much attention, but that may be a significant feature that is missing in virtual teamwork. Knowing when your colleagues are within conversational range (even if the conversation is conducted by instant messages) is a security blanket and time saver. If you have a quick question you can just ask them, without having to arrange a formal meeting or send an email for which you might not receive a reply for days. Instant messenger software supports a low-bandwidth version of awareness, through its buddy lists. When a "buddy" signs on to the system, a sound file of a door opening plays and the buddy's name appears in the list of available buddies. When the buddy signs off, the door slamming sound file plays. Other strategies have also been used to support the awareness of presence. In game worlds, for example, players use avatars that they can

move about on the screen. Other players in the same portion of the game can see and interact with the avatars that are "present."

One prototype to support the virtual workplace was developed by researchers from both the corporate and the academic communities.¹⁴⁰ The software, called "Rear View Mirror," supports instant messaging and synchronous group chats with a text-based interface, but it also supports "presence awareness" in a richer way compared to instant messaging. Team members have a "presence viewer" displayed on their computer screens that shows the photos of their team members. The border of the photo indicates the person's present state and anticipated availability. Green, for example, means the person is present, and yellow means temporarily unavailable. Red means the person is likely to be away for more than an hour or two. Rolling the mouse over a photo pops up a brief message that the team member can tailor, such as "I'll be away for about an hour." One lighthearted team member set his rollover to automatically change to "Missing, presumed working," when he was inactive for an hour.

Innovative technology to support virtual teams is not easy to introduce, and most people stopped using Rear View Mirror after a few months. Concerns about privacy were one reason some users were reluctant to adopt this software, even in trial mode. The presence viewer appeared to be a tool that could be easily used for worker surveillance, and German team members thought it might be illegal in their country. In any case, it had to be approved by a worker's council.

Another barrier to a successful adoption is one that haunts any technology that needs a critical mass to be useful at all. Groupware falls into this category; if all your group members are not using the new technology fully, then it becomes less useful for the whole team. New technologies, however, especially prototypes like this one for Rear View Mirror, are usually quite buggy so only the most tolerant and forgiving employees were willing to keep trying it in a workplace setting. They needed to get their work done after all. Yet to design effective technology for groups, the designers must have feedback from the users. This becomes a catch-22, because it is difficult to get the critical mass needed for virtual team members to learn whether the new tools will be valuable for them when they tackle group projects.

Software vendors hype and promote innovative technologies to support virtual teams, but not many relate the examples of failed attempts to

¹⁴⁰ Hersleb, J. D., Atkins, D. L., Boyer, D. G., Handel, M., & Finholt, T. (2002). Introducing instant messaging and chat in the workplace. In *Proceedings of CHI 2002*. New York: ACM Press. Retrieved January 15, 2003, from ACM Digital Library.

implement them. Managers who champion the projects within their own organizations naturally prefer to talk about successes rather than failures as well, so stories of the projects that collapse or fall by the wayside are not widely circulated. However, such technologies can be very difficult to launch and knowledge about the false starts is valuable.

Tomorrow's Virtual Teams

With today's Internet and technological infrastructure, virtual teamwork is a challenge, indeed. In their book *Virtual Teams*, Jessica Lipnack and Jeffrey Stamps point out that, "Virtual teams must be smarter than a conventional collocated team – just to survive."¹⁴¹ The technologies available to support them are still in their infancy and are neither able to convey all the nuances of communication nor counteract the advantages of collocation. We cannot create life-size three-dimensional holograms of team members, for example, transmit the images over the Internet, and invite them all to interact within a virtual collaborative space. Also, we are still learning what aspects of the collocated team are most critical for the team's success and trying to embed at least those features into the technology.

The technologies will certainly improve, and what we are using today will seem very antiquated in the near future. However, some researchers believe that virtual teams will never be able to operate the same way that collocated teams do, regardless of how much futuristic technology we provide to support them. They will always be hindered by problems involving trust, the development of common ground, and the difficulties related to communications. Humans evolved and learned to work together in collocated spaces, and there may be just too many factors and interrelated characteristics of the face-to-face setting that simply can't be duplicated by people working with electronically mediated communication tools on different continents. Woody Allen may have been right when he quipped, 80 percent of success is just showing up.

Despite the obstacles, virtual teams are and will continue to be a significant trend in the workplace. In many circumstances, they add a critically valuable capability in the context of the work that people want to do. One of the finest and most productive implementations of virtual teamwork, for example, is the virtual collaboratory system used by space physicists. This community of scientists is located all over the world, and the measurements

¹⁴¹ Lipnack, J., & Stamps, J. (1997). *Virtual teams: Reaching across space, time, and organizations with technology*. New York: John Wiley & Sons.

and images each one collects from the sensors and telescopes at their own sites are extremely interesting to their coworkers. Their laboratory includes remote access to real-time data from the instruments, as well as maps, virtual "rooms" and "clubs" where the scientists can choose the displays they want to see and gather to jointly view and discuss the data.

The best approach is to continue to learn from the successes and failures of virtual teams, identify the problem areas, and explore what can be done to better support them. As the technologies improve, some obstacles will disappear – or at least shrink. Yet useful improvements can be made now by understanding the social and psychological issues that arise when teams are not collocated. Many of these issues can be addressed by changing what kinds of work virtual teams are assigned, how they are oriented, and how they are led.

8 E-Learning

With an Internet connection on the desktop at work and at home, you can join fellow students from around the world and take classes whenever you choose. The organization does not necessarily need to arrange classroom-based training for all its employees when new standards and procedures are required. When new people come on board, they do not have to wait until the next scheduled program they need to become effective in their new jobs. Just as the Internet offered opportunities to break through the boundaries of time and place for teamwork, it offers the same opportunities for classrooms.

Success for a knowledge-based workplace relies heavily on continual upgrading of skills, and organizations put considerable effort and funding into their training programs. Surprisingly, despite the promises and potential of Internet-based delivery of education and training, few organizations use it much for in-house corporate training. The instructor-led classroom-based program is still the norm in most places, though some analysts predict that the e-learning market is poised for explosive growth in the coming decade. Gartner Group, for example, predicts the market will grow to more than \$33 billion by 2005. Others, however, think the reports of the death of distance in educational settings, as Mark Twain put it, are greatly exaggerated; bits and bytes can never replace live teachers.

Although employees might not yet have many opportunities to engage in e-learning for their in-house corporate training, they have an astounding number of alternatives for university-level distance programs which are growing rapidly. Many organizations provide tuition assistance for students who wish to pursue degrees, especially if they are job related. In the past, employees would need to enroll in a local college or university to attend class, usually at night, as a part-time student. After work, the employee grabbed a sandwich and drove to the college for the evening lecture,