

# Journal of Management

<http://jom.sagepub.com>

---

## Virtual Teams: What Do We Know and Where Do We Go From Here?

Luis L. Martins, Lucy L. Gilson and M. Travis Maynard

*Journal of Management* 2004; 30; 805

DOI: 10.1016/j.jm.2004.05.002

The online version of this article can be found at:

<http://jom.sagepub.com/cgi/content/abstract/30/6/805>

---

Published by:

 SAGE Publications

<http://www.sagepublications.com>

On behalf of:



Southern Management Association

Additional services and information for *Journal of Management* can be found at:

**Email Alerts:** <http://jom.sagepub.com/cgi/alerts>

**Subscriptions:** <http://jom.sagepub.com/subscriptions>

**Reprints:** <http://www.sagepub.com/journalsReprints.nav>

**Permissions:** <http://www.sagepub.com/journalsPermissions.nav>

**Citations** (this article cites 123 articles hosted on the SAGE Journals Online and HighWire Press platforms):

<http://jom.sagepub.com/cgi/content/refs/30/6/805>



Pergamon

Journal of Management 2004 30(6) 805–835

---

---

**JOURNAL OF  
MANAGEMENT**

---

---

## Virtual Teams: What Do We Know and Where Do We Go From Here?

Luis L. Martins\*

*Georgia Institute of Technology, College of Management, 800 West Peachtree Street NW,  
Atlanta, GA 30332-0520, USA*

Lucy L. Gilson

*Department of Management, School of Business, University of Connecticut, 2100 Hillside Road,  
Unit 1041, Storrs, CT 06269-1041, USA*

M. Travis Maynard

*Department of Management, School of Business, University of Connecticut, 2100 Hillside Road,  
Unit 1041, Storrs, CT 06269-1041, USA*

Received 25 February 2004; received in revised form 13 May 2004; accepted 24 May 2004  
Available online 14 July 2004

---

*In this paper, we review the research on virtual teams in an effort to assess the state of the literature. We start with an examination of the definitions of virtual teams used and propose an integrative definition that suggests that all teams may be defined in terms of their extent of virtualness. Next, we review findings related to team inputs, processes, and outcomes, and identify areas of agreement and inconsistency in the literature on virtual teams. Based on this review, we suggest avenues for future research, including methodological and theoretical considerations that are important to advancing our understanding of virtual teams.*

© 2004 Elsevier Inc. All rights reserved.

---

Virtual teams, in which members use technology to interact with one another across geographic, organizational, and other boundaries, are becoming commonplace in organizations (Gibson & Cohen, 2003). The *Wall Street Journal* reports that more than half of companies with more than 5000 employees use virtual teams (de Lissler, 1999). Also, a recent survey by the Gartner group found that more than 60% of professional employees work in virtual teams (Kanawattanachai & Yoo, 2002). The growing prevalence of virtual teams is being

---

\* Corresponding author. Tel.: +1 404 894 4366; fax: +1 404 894 6030.

*E-mail addresses:* luis.martins@mgt.gatech.edu (L.L. Martins), lucy.gilson@business.uconn.edu (L.L. Gilson), travis.maynard@business.uconn.edu (M.T. Maynard).

attributed to a confluence of technological and organizational developments along with a range of business benefits associated with using these types of teams (Solomon, 2001). Virtual teams (VTs) can be composed of the best individuals for the task regardless of their physical or organizational location, thus enhancing the quality of decisions (e.g., Lipnack & Stamps, 1999; Townsend, DeMarie & Hendrickson, 1998). Further, to attract and retain employees, knowledge workers in particular, organizations are increasingly offering remote working options to their employees (e.g., Cascio, 2000). Overall, VTs provide an effective structural mechanism for handling the increased travel, time, coordination, and costs associated with bringing together geographically, temporally, and functionally dispersed employees to work on a common task.

Over the last decade, researchers have sought to understand the benefits and costs associated with VTs. Given this, there is now a burgeoning literature on VTs that spans multiple disciplines. However, several researchers have commented that despite the prevalence of interest in the topic, there is a lack of clarity on what we know and the direction that future research should take (Bell & Kozlowski, 2002; Griffith & Neale, 2001). Thus, in this review we seek to integrate the literature on VTs and identify directions for future research. We begin by examining the various definitions of VTs used in the literature and then review the research findings. We organize and integrate the literature using the inputs-processes-outcomes (I-P-O) framework (Hackman & Morris, 1975), as this has become the dominant theoretical lens used in the study of teams. Based on this review, we identify areas of agreement and disagreement, as well as gaps in the literature. In the final section, we propose directions for future research.

## Virtual Teams: A Review of the Literature

For this review, we identified studies to be included through three means: (1) a manual scan of leading journals in management, international business, information systems, psychology, and business communications; (2) a search of several electronic databases using an extensive list of relevant terms (e.g., virtual teams, computer-mediated communication [CMC]); and (3) a scan of the reference lists from the articles identified through the first two methods. Of the articles identified, we selected only empirical articles in peer-reviewed journals for inclusion in the review of findings. In our review of definitions, we also included 16 theoretical articles, of which 10 were practitioner-focused. A total of 93 empirical articles were included in the review. Of these, 66 were lab studies, 13 used “real teams”; and 14 were case studies. Finally, 47 appeared in management journals and only 23 were published prior to 1995.

### *Defining Virtual Teams*

As the literature on VTs has grown, there has been a proliferation of definitions. An examination of the definitions used indicates that there is considerable overlap in the core definition, with some small variation in the specifics. Further, it appears that researchers are shifting away from defining VTs as a type of team that contrasts with a “traditional” or “conventional” face-to-face team (e.g., Guzzo & Dickson, 1996) but are focusing instead on

“virtualness” as a potential characteristic of all teams (e.g., Griffith & Neale, 2001; Griffith, Sawyer & Neale, 2003).

To date, the foundation for the majority of definitions is the notion that VTs are functioning teams that rely on technology-mediated communication while crossing several different boundaries (e.g., Bell & Kozlowski, 2002; Lipnack & Stamps, 1999; Lurey & Raisinighani, 2001). The most commonly noted boundaries are those of geography, time, and organization, with the first two being mentioned in almost all definitions. Contrasted against face-to-face teams, members of VTs are not constrained to one physical location and can be located throughout the world (e.g., Montoya-Weiss, Massey & Song, 2001). In fact, such geographic reach has led several researchers to focus exclusively on “global virtual teams” (e.g., Maznevski & Chudoba, 2000; Odenwald, 1996). The distribution of VT members across temporal boundaries can occur due to members’ locations in different time zones (Kayworth & Leidner, 2000), and due to the use of asynchronous communication media (such as e-mail) that limit the ability of team members to interact in “real-time” (Bell & Kozlowski, 2002). Finally, members of VTs are often drawn from different organizations via outsourcing or through joint ventures among service providers who work across organizational boundaries (Maznevski & Chudoba, 2000; Townsend et al., 1998; Zigers, 2003).

In contrast to the consistency with which the characteristics discussed above have been factored into definitions, several additional traits have been noted but have not been universally adopted. For example, VTs are often conceptualized as having a more fluid membership such that a specific expertise can be added or removed as tasks change (Alge, Wiethoff & Klein, 2003; Kirkman, Rosen, Tesluk & Gibson, 2004). Additionally, researchers have noted the tendency of VTs to possess a shorter lifecycle as compared to face-to-face teams (Jarvenpaa & Leidner, 1999).

Early definitions of VTs sought to contrast virtual and face-to-face teams and therefore focused on physical dispersion and technology-based interaction. Such definitions were appropriate for the context in which they were used, namely, laboratory settings using student participants. However, as the focus of inquiry shifts toward organizational teams working on “real-world” tasks, the definition of VTs has begun to undergo a transformation and some refinement. One aspect of VTs that had not been addressed in traditional definitions was the degree of technology-mediation, as opposed to face-to-face interaction, that is necessary for a team to be considered virtual. For example, some researchers specifically state that VTs are teams that interact exclusively through electronic media and, therefore, exclude teams that meet face-to-face (e.g., Bouas & Arrow, 1996). On the other hand, several researchers have relaxed this restriction to allow for some face-to-face communication as long as the majority of interaction occurs electronically (e.g., Jarvenpaa & Leidner, 1999; Maznevski & Chudoba, 2000). It remains unclear, though, what proportion of electronic communication is sufficient for a team to be classified as virtual.

In an attempt to move beyond the potentially unsolvable theoretical problem of what is or is not a VT, recent definitions have instead focused on a team’s *extent of virtualness* (e.g., Bell & Kozlowski, 2002; Griffith & Neale, 2001; Kirkman et al., 2004; Zigers, 2003). Consequently, recent definitions have stressed the ubiquity of virtual interactions, pointing out that a purely face-to-face team that does not use any communication technology is rare

in organizations today (e.g., Griffith & Neale, 2001). Thus, a team's extent of virtualness may vary depending on the nature of the task, technological resources, and members' skills and capabilities. For example, Bell and Kozlowski (2002: 29) note: "where a particular virtual team falls along the continuum depends on the complexity of the task it performs." Similarly, Griffith and Neale (2001: 386) state that "the form a team takes [on the continuum between purely face-to-face and purely virtual teams] is an interplay between the structures and capabilities provided by the technology, the demands of the task, and the structures that emerge . . ."

Thus, recent definitions incorporate the traditional dimensions of VTs, but also highlight the fact that VTs are teams first, with virtualness being treated as a team characteristic. Integrating the traditional and newer definitions, we define VTs as *teams whose members use technology to varying degrees in working across locational, temporal, and relational boundaries to accomplish an interdependent task.*

### *Attributes of Virtual Teams*

Teams can choose from a broad array of *technologies* to supplement or replace face-to-face interaction. The technologies differ in their extent of media richness as communication channels (Daft & Lengel, 1984) and in the extent to which they enable synchronous collaboration (e.g., Riopelle et al., 2003). Thus, whereas desktop videoconferencing is relatively high in media richness and in synchronicity, e-mail is lower on both dimensions. Other technologies commonly used to support the functioning of VTs include telephones, web sites, instant messaging, file- and application-sharing, electronic bulletin boards, group decision support systems, and real-time calendar/scheduling systems. The extent to which a team uses these technologies affects its extent of virtualness (Bell & Kozlowski, 2002; Griffith et al., 2003).

The *locational* boundary refers to any physical dispersion of team members, such as different geographic locations or different workplaces at the same geographic location. The *temporal* boundary encompasses lifecycle and synchronicity. Lifecycle captures the extent to which a team is temporary or ongoing, while synchronicity refers to the timing of member interaction on the group's task. The *relational* boundary refers to the differences in relational networks of VT members, that is, their affiliations with other teams, departments, organizations, and cultural sub-groups. In general, individuals are more likely to look within their relational networks rather than across networks for team members (Griffith et al., 2003). However, VTs can overlap multiple relational networks, enabling teams to be composed of members based on "what they know" rather than "who they know." In such teams, members have to work across differences in assumptions, motivations, knowledge bases, and working styles that characterize each of the relational networks that is spanned by the team (Shapiro, Furst, Spreitzer & Von Glinow, 2002).

The definition presented above focuses on "team-ness" in concert with "virtual-ness" and moves away from simply describing input factors. Such a reconceptualization is important to paradigmatic progress in the study of VTs, as it encourages a focus on understanding the functioning of VTs rather than on simply comparing them to face-to-face teams.

## Research Findings

The inputs-processes-outcomes (I-P-O) model (e.g., Hackman & Morris, 1975) is the dominant framework used in the study of teams and provides a sound basis for organizing and integrating the literature on VTs. *Inputs* represent starting conditions of a group, such as its material or human resources. *Processes* represent dynamic interactions among group members as they work on a group's task. *Outcomes* represent task and non-task consequences of a group's functioning. Figure 1 depicts the I-P-O model, while research findings on each of these aspects of VTs are summarized below.

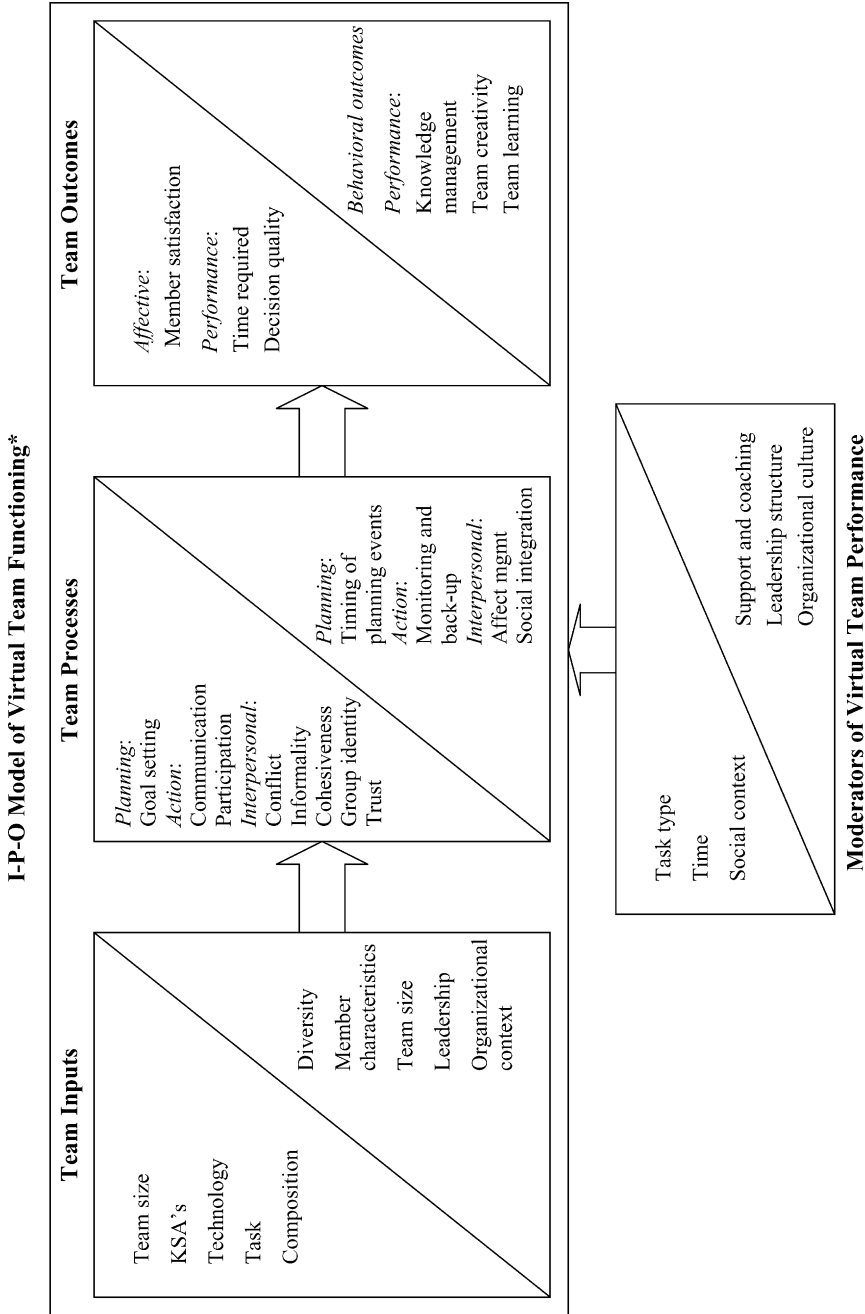
### *Team Inputs*

Input variables represent the design and compositional characteristics of a team such as member personalities, knowledge, skills, and abilities (KSAs), group size, technology, task, and history or experience that influence how teams operate and perform (Hackman & Morris, 1975). Appendix A presents a summary of VT studies that have examined team input variables.

*Group size.* As an input, group size has traditionally been described as critical to group performance (Steiner, 1972). Researchers have noted that team size may affect VTs differently than face-to-face teams. This argument is based on the idea that technology can mitigate the negative effects of size (such as process losses and production blocking) found in face-to-face decision-making or creative teams (Leenders, van Engelen & Kratzer, 2003; Valacich, Dennis & Connolly, 1994; Valacich, Dennis & Nunamaker, 1992). Specifically, the number of ideas generated in VTs has been found to increase with group size, which contrasts with results found in face-to-face groups (Gallupe, Dennis, Cooper, Valacich, Bastianutti & Nunamaker, 1992; Valacich, Dennis, et al., 1994). However, the effect of size on VT functioning may depend on the nature of the task and the technology used. For example, in a case study of six global VTs in a field setting, Riopelle et al. (2003) found that increased size made it difficult for participants to interact effectively using audio-conferencing.

*Knowledge, skills, and abilities (KSAs).* A proposed benefit of VTs is that they can bring together individuals with the needed KSAs regardless of their location (Blackburn, Furst & Rosen, 2003). Nonetheless, while theorists have described the benefits of a variety of member KSAs for outcomes such as quality, creativity, and customer satisfaction, empirical work has only examined technical expertise and experience with certain technologies (e.g., Lea & Spears, 1992). Here it has been found that technical expertise in a VT is positively related to a team's success (Kayworth & Leidner, 2000), the team's ability to deal with technical uncertainty, and group member trust (Jarvenpaa & Leidner, 1999).

*Technology.* The type of technology used by VTs is an important input as media richness (Daft & Lengel, 1984) has been found to positively impact team effectiveness, efficiency,



\*Within each category of variables, those that have been examined in research on VTs are listed above, and those in need of future research are listed below, the diagonal.

Figure 1. I-P-O model of virtual team functioning.

amount of communication (Carlson & Zmud, 1999; Hinds & Kiesler, 1995; Jarvenpaa, Rao & Huber, 1988; May & Carter, 2001), the relationships among team members (Pauleen & Yoong, 2001), and team commitment (Workman, Kahnweiler & Bommer, 2003). For example, the addition of video resources results in significant improvements to the quality of a team's decisions (Baker, 2002). The use of richer media also results in increased levels of performance and trust (Burgoon, Bonito, Ramirez, Dunbar, Kam & Fischer, 2002). In contrast, technology does have its dark side as the novelty of the technology used has been found to negatively impact team performance (Hollingshead, McGrath & O'Connor, 1993). The diminished non-verbal and visual cues associated with increased technology usage have been cited as reasons why VTs take longer to make decisions, are less able to make inferences about members' knowledge, and are less able to anticipate other members' responses (e.g., Cramton, 2002; Hollingshead, 1998; Sproull & Kiesler, 1986).

*Task.* The notion that VTs work on interdependent tasks toward a common objective has been noted in several definitions. Researchers have also indicated that VTs are often used to address complex tasks of significant importance (Kirkman et al., 2004; Leenders et al., 2003). Additionally, task type has been argued to be critical to the success and speed with which VTs make decisions (Daly, 1993; El-Shinnawy & Vinze, 1998; Hiltz, Johnson & Turoff, 1986). For instance, when a team's task is ambiguous, the extent of virtualness may increase the length of time needed to reach a shared goal, but may actually assist in the development of a more focused or better goal (Straus & McGrath, 1994). Indeed, it has been argued that rather than viewing task type independently, it is better to examine the compatibility of the task with virtual teaming (Hollingshead et al., 1993).

*Composition.* The final input variable that has been considered within the VT literature is group composition. Theorists initially argued that group composition would be less salient within VTs and empirical research has indeed found that status effects are reduced in virtual interactions (Sproull & Kiesler, 1986). Dubrovsky, Kiesler and Sethna (1991) found that status inequalities were significantly reduced when groups used e-mail to communicate. Additionally, electronic communication allows greater access to individuals at higher seniority levels with whom scheduling face-to-face meetings may be difficult (Sproull & Kiesler, 1986). Finally, Nowak (2003) found that VT members were unable to identify other member's gender identities from the content of their e-mail messages and, where they did, the majority of the attributions were inaccurate.

However, not all studies have found support for status equalization in VTs or that group composition influences VT decisions (El-Shinnawy & Vinze, 1998; Hollingshead, 1996). For instance, McLeod, Baron, Marti and Yoon (1997) reported that minority members were more likely to express their opinions in anonymous conditions, but their opinions were given more consideration in the face-to-face condition. Other researchers have found that computer-mediated communication (CMC) groups tend to recreate hierarchies in an attempt to preserve status differences (Owens, Neale & Sutton, 2000). Cramton (2001) found that, even in virtual student groups, coalitions were formed with out-group members being perceived as not putting in sufficient effort and as being too aggressive in



their behavior. Also, research suggests that status hierarchies may be retained due to the behaviors of high-status members such as talking more, perceiving their contribution as greater, and rating themselves more highly (Weisband, Schneider & Connolly, 1995).

In examining gender, Lind (1999) found that, compared to men, women in VTs perceived their teams as more inclusive and supportive, and were more satisfied. Also, in a study of e-mail communication among knowledge workers from North America, Asia, and Europe, Gefen and Straub (1997) found that women viewed e-mail as having greater usefulness, but found no gender differences in levels of usage. Bhappu, Griffith and Northcraft (1997) examined the effects of communication dynamics and media in diverse groups, and found that individuals in face-to-face groups paid more attention to in-group/out-group differences in terms of gender than those in VTs.

National culture also appears to affect interaction in VTs, such that members from individualistic cultures tended to challenge majority positions more than members from collectivist cultures (Tan, Wei, Watson, Clapper & McLean, 1998). Cultural differences have also been found to negatively impact VT coordination (Maznevski & Chudoba, 2000) and communication (Kayworth & Leidner, 2000).

Finally, members' personalities have been found to affect their participation in VTs. Specifically, Straus (1996) reported that extraversion was positively related to participation in CMC groups. Variance in extraversion in VTs, though, has been found to have only a marginally negative impact on interactions among team members (Potter & Balthazard, 2002).

### *Team Processes*

Team processes have been defined as “how” teams achieve their outcomes (Weingart, 1997). They may be classified into planning processes, action processes, and interpersonal processes (e.g., Marks, Mathieu & Zaccaro, 2001). *Planning processes* encompass mission analysis, goal setting, strategy formulation, and other processes related to focusing the group's efforts. *Action processes* are those dynamics which occur during the performance of a group's task, such as communication, participation, coordination, and monitoring of the group's progress. *Interpersonal processes* refer to relationships among group members; they include conflict, tone of interaction, trust, cohesion, affect, and social integration, among others. Appendix B provides a summary of studies that have examined team processes within a virtual environment.

*Planning processes.* Researchers have found that goal setting in VTs is positively associated with cohesion, commitment, collaboration, decision quality, and numbers of alternatives generated (Huang, Wei, Watson & Tan, 2002). It has been argued that developing a shared vision or mission may be more difficult for VTs, as it is often harder for members to establish a unified sense of purpose due to diminished member interactions (Blackburn et al., 2003). Nonetheless, formalizing work processes and strategies has been found to be critical for VT performance (Lurey & Raisinighani, 2001).

In examining the differing effects of various communication media on team processes, Kayworth and Leidner (2000: 186) found that rich computer-mediated communication

systems “greatly facilitated teams’ abilities to plan, to exchange ideas, and to reach consensus on a variety of issues . . .” Further, they noted that difficulties in planning and coordination across time zones and cultural differences were barriers to successful VT performance. In one of the few studies focused on training in a virtual setting, Warkentin and Beranek (1999) found that planning improved interaction processes, trust, and commitment. Finally, a study assessing variability in the project management of 103 global, virtual, and collocated new product development (NPD) teams found that collocated teams reported a significantly lower number of difficulties with various aspects of project management (such as keeping on schedule and staying on budget) than did virtual or global teams (McDonough, Kahn & Barczak, 2001).

*Action processes.* Thus far, most studies focusing on action processes in VTs have centered on team communication and participation. Communication is essential for the functioning of VTs, which are thought to face a more difficult challenge in attaining effective communication due to reduced social context cues (Sproull & Kiesler, 1986) and the utilization of “weaker” communication media (Daft & Lengel, 1984). Together, these factors have been used to explain the finding that the overall amount of communication relayed among VT members is less than that among face-to-face team members (Bhappu et al., 1997; Hiltz et al., 1986; Hollingshead, 1996; Straus, 1996). For example, in an experiment utilizing undergraduate students who were given the task of reaching consensus on a choice-dilemma problem, CMC groups exchanged fewer remarks than did face-to-face groups (Siegel, Dubrovsky, Kiesler & McGuire, 1986).

Whereas many studies that have assessed the overall amount of communication have found that communication declines as teams move higher on the virtualness continuum, differing results have also been reported. For instance, it has been found that participation equality and the total number of remarks exchanged in CMC groups were the same as in face-to-face groups (Jarvenpaa et al., 1988; Weisband, 1992) and in some cases were even higher (Jessup & Tansik, 1991). Interestingly, in a study that examined group history, no differences were found in communication effectiveness or information sharing for groups that had a prior history of working together (Alge et al., 2003). Finally, for creativity, both very low and very high levels of interaction among CMC group members were found to be detrimental (Leenders et al., 2003).

A reason proposed by those who have found that VTs experience increased participation is that computer-mediated communication allows for asynchronous communication that encourages members to contribute based upon their own schedules (Bikson & Eveland, 1990; Siegel et al., 1986; Straus, 1996). However, this can also bring about a range of issues that are not relevant in face-to-face contexts, such as how to react to no participation and the multiple meanings attributed to silence (Cramton, 2001, 2002). Likewise, human-computer interface mistakes and technology failures may also hamper communication. Somewhat surprisingly, these errors are frequently attributed to dispositional factors such as poor work ethic rather than to situational or technological conditions (Cramton & Orvis, 2003).

In a study conducted in an ongoing organization, Sproull and Kiesler (1986) examined e-mail communication among 96 people over an 8-week period. They found that electronic media allowed for information to be conveyed that would not have been relayed using more

traditional media. Similarly, e-mail provides a means for distributing information to a larger audience, thus broadening the reach of socialization within an organization (Feldman, 1987). However, the amount of communication has been found to vary by team composition, with diverse groups communicating more frequently than single-sexed groups (Savicki, Kelley & Lingenfelter, 1996).

Researchers have also focused on differences in the type of communication exchanged within virtual and face-to-face teams (e.g., Weisband, 1992). The results have been inconclusive. Hiltz et al. (1986) found that VT communication tended to be more task-oriented than that in face-to-face teams (Hiltz et al., 1986). In contrast, others report that communication in CMC groups is no more task-oriented and no less intimate than that in face-to-face groups (Bordia, DiFonzo & Chang, 1999; Walther, 1995). In assessing communication among VT members over 3 months, Ahuja and Galvin (2003) found that team tenure affected communication patterns. Specifically, newcomers sought information whereas established members provided information, which is consistent with findings in the literature on face-to-face teams. However, compared to newcomers in face-to-face teams, those in VTs used more active means of information seeking.

In addition to focusing on volume and type of communication, many researchers have investigated the impact that virtual interaction has on member participation. Several studies have demonstrated that participation levels become more equalized in VTs than in face-to-face teams (Bikson & Eveland, 1990; Kiesler, Siegel & McGuire, 1984; Straus, 1996; Zigurs, Poole & DeSanctis, 1988). The most commonly cited reason for this is the reduction in status differences resulting from diminished social cues (Hollingshead, 1996). Hence, electronic communication is expected to be a means of establishing equality among group members and lowering distinctions among members (Dubrovsky et al., 1991).

Last, it has been noted that since the communication tools used for virtual interaction allow for records to be retained (e.g., copies of e-mails sent and received are retained on a server), VTs have a means for monitoring team activities that are not available to face-to-face teams (Suchan & Hayzak, 2001). Such archives were found to allow VT members to review team interactions and outputs and to use the most creative ones as templates in future situations (Nemiro, 2002). Additionally, in a computer simulated flight task, the electronic medium enhanced the ability of team leaders to differentiate the quality of member contributions (Hedlund, Igen & Hollenbeck, 1998). Similarly, social comparisons enabled by technology have been found to reduce the effects of social loafing in electronic brainstorming groups (Shepherd, Briggs, Reinig, Yen & Nunamaker, 1996).

*Interpersonal processes.* To date, the majority of VT research pertaining to interpersonal processes has focused on conflict, uninhibited behavior such as swearing and name-calling, informality of communication among group members, interpersonal trust, and group cohesiveness.

Researchers have long stated that conflict is an important process that allows teams to make better decisions because more alternatives are generated and considered prior to a decision being reached (e.g., Jehn & Mannix, 2001). In comparing face-to-face groups to VTs, some researchers have found that conflict is more likely to occur in virtual contexts (e.g., Mortensen & Hinds, 2001). However, the extent and effects of conflict in VTs has been

found to depend on several contingency factors. Mortensen and Hinds (2001) found that, within VTs, members' perception of having a common group identity reduced the amount of conflict. Poole, Holmes and DeSanctis (1991) found that the ability of VTs to manage their conflict in productive ways depended on how teams adapted their virtual teaming technology to handle their conflict. Using 29 virtual student teams, Lind (1999) found that female team members perceived that group conflict was more readily resolved than did males. Finally, Montoya-Weiss et al. (2001) found that successful VTs tended to manage their internal conflict by using either competitive or collaborative conflict management styles. Similarly, Paul, Seetharaman, Samarah and Mykytyn (2004) found that collaborative conflict management styles positively impacted satisfaction, perceived decision quality, and participation.

Related to conflict, researchers have found that the virtual context lends itself to more uninhibited behavior by team members compared to interactions within face-to-face contexts. In particular, Siegel et al. (1986) found that uninhibited behavior such as swearing, insults, and name-calling was significantly more likely in CMC groups than in face-to-face groups. Similarly, Sproull and Kiesler (1986) noted greater self-absorption (individuals focused more on themselves than on others) and uninhibited behavior in e-mail messages. Such results may be influenced by team composition, as members of male-only VTs have been found to use more argumentative and coarse language than members of female-only VTs (Savicki et al., 1996).

Researchers have postulated that because the communication media used by VTs are lower in media richness and synchronicity, the amount of informal or non-task communication may be diminished. For example, Lebie, Rhoades and McGrath (1996) found that interpersonal communications, such as discussion of intimate personal matters not related to the group's task, were exhibited less frequently in CMC groups than in face-to-face groups. Cramton (2001) has argued that this phenomenon may occur because contextual information in VTs is less readily available and members therefore have to seek out additional information to aid in understanding the full meaning of a communication.

It is interesting to note here that members of highly productive VTs have been found to communicate more often in informal, social ways than those in less productive teams (Saphiere, 1996). Walther (1994) found that the group's belief of future interactions has a more significant influence on the extent of informal communication exchanged than does the medium of communication. Similarly, Chidambaram (1996) reported that, although CMC groups had limited informal interaction in the initial phases of the groups' lifecycles, these effects dissipated over time. Tidwell and Walther (2002) found that members of CMC dyads were more likely to ask "deeper," more direct and intimate questions of their teammates and have higher levels of self-disclosure than members of face-to-face dyads, who asked more peripheral questions. Finally, CMC groups have been found to demonstrate better communication flow and more tension release (joking) than do face-to-face groups (Hiltz et al., 1986).

Trust has been studied extensively within the teams literature, and has been noted as a determining factor in the effectiveness of activities requiring coordinated action (e.g., McAllister, 1995). Researchers have suggested that trust is also important in VTs (e.g., Handy, 1995; Jarvenpaa, Knoll & Leidner, 1998; Sarker, Valacich & Sarker, 2003), since it

can diminish the adverse impact that geographic distribution can have on psychological intimacy (Walther, 1994). As such, it has been described as the “glue of the global workspace” (O’Hara-Devereaux & Johansen, 1994: 243).

In a virtual environment, the determinants of trust that have been examined include time (Walther, 1995; Walther & Burgoon, 1992), communication intensity, and the ability to cope with technical and task uncertainty (Ratcheva & Vyakarnam, 2001). Additionally, it has been argued that trust in VTs needs to develop quickly as teams may only interact for a short period of time or may be working on a task that is of great importance and urgency (Alge et al., 2003; Jarvenpaa & Leidner, 1999; Kanawattanachai & Yoo, 2002). Researchers have found that trust in VTs is derived initially from perceptions of ability and integrity as well as members’ propensity to trust (Aubert & Kelsey, 2003; Jarvenpaa et al., 1998). However, as the team’s task progresses, trust appears to be less related to assessments of ability (Jarvenpaa et al., 1998). Furthermore, a recent study by Piccoli and Ives (2003) found that the use of behavioral controls, such as having members file weekly reports and assigning specific tasks, were associated with a decline in trust among VT members.

Additionally, several attributes of team communication (social, predictable, and enthusiastic) have been found to facilitate the formation of trust within VTs (Jarvenpaa & Leidner, 1999). It has also been suggested that a face-to-face meeting during the initial “courtship” period of a VT’s life cycle helps develop trust in the team (Coutu, 1998; Suchan & Hayzak, 2001). Interestingly, while high and low performing VTs may start with the same levels of trust, the high performers appear to be better able to develop and maintain high levels of trust throughout their project (Kanawattanachai & Yoo, 2002).

Finally, the effects of trusting relationships within VTs appear to be similar to those evidenced in traditional teams (Driscoll, 1978). Specifically, trust in VTs has been shown to be positively associated with job satisfaction (Morris, Marshall & Rainer, 2002) and improved working relationships (Sharifi & Pawar, 2002).

Group cohesiveness refers to members’ attraction to the group and to its task (Kozlowski & Bell, 2003). In a study of student teams from multiple universities, Warkentin, Sayeed and Hightower (1997) found that face-to-face groups reported higher levels of cohesiveness than did VTs. Within VTs, cohesiveness has been associated with greater satisfaction; highly cohesive groups, regardless of communication media, were able to exchange information more effectively (Chidambaram, 1996). Also, task cohesiveness was found to positively impact team effectiveness (performance quality) for dispersed student teams working to generate case solutions (Gonzalez, Burke, Santuzzi & Bradley, 2003). In contrast, Aiello and Kolb (1995) found that cohesiveness did not result in a higher rate of work in VTs working on a simple task. Finally, women VT members rated their teams as more cohesive than did men (Lind, 1999).

A shared group identity has been suggested as critical to the effective functioning of teams due to its impact on cooperation, commitment to decisions, and levels of trust (Kramer & Brewer, 1986). Identification may be of even greater significance within VTs particularly when the teams anticipate working together in the future (Walther, 1997). Spears, Lea and Lee (1990) found that even when team members worked in isolation, team identity could be strong if members saw themselves as a significant part of the team rather than as individuals working on a part of the team project. In two 7-week sessions using students, Bouas

and Arrow (1996) found that group identity was initially lower for CMC groups than for face-to-face groups. However, this difference diminished over time and was non-significant by the end of the study.

Prior research focusing on team empowerment has demonstrated a positive relationship with performance (Kirkman & Rosen, 1999). In a study of 35 VTs in a field setting, Kirkman et al. (2004) found that team empowerment was significantly and positively related to process improvement and customer satisfaction. Additionally, this study found that the extent of virtualness, assessed as the number of face-to-face meetings, moderated the relationship between empowerment and performance, such that empowerment was of greater significance for process improvement in teams that rarely met face-to-face.

### *Team Outcomes*

Much of the literature on VTs has been devoted to examining the effects of virtual interaction on team affective outcomes (such as member satisfaction), and on performance outcomes (such as effectiveness, speed of decisions, and decision quality). Further, researchers have examined various contingency factors that may influence the effects of virtual interaction on team outcomes (e.g., Baker, 2002; Maznevski & Chudoba, 2000; Straus & McGrath, 1994). The results regarding outcomes can, at best, be described as mixed. In part, this is based upon the nature of the tasks and the types of VTs studied. A list of studies that have examined team outcomes in the context of VTs is presented in Appendix C.

*Affective outcomes.* For member satisfaction, the effects of virtual interaction appear to be dependent on the nature of the task and on team composition (e.g., Cappel & Windsor, 2000). In general, lower levels of satisfaction are reported in VTs than in face-to-face teams (Jessup & Tansik, 1991; Straus, 1996; Thompson & Coovert, 2002; Warkentin et al., 1997). Additionally, Graetz, Boyle, Kimble, Thompson and Garloch (1998) found that teams using electronic chat reported higher levels of frustration, perhaps because they experienced greater mental demands and had to exert significantly more effort due to the nature of computer-mediated communication. However, for decision-making tasks, members of CMC groups have reported being more satisfied with the group process, in part, because more alternatives were considered and more voting rounds took place (Valacich & Schwenk, 1995). Similarly, members of electronic brainstorming teams have been found to be more satisfied than their face-to-face counterparts (Gallupe et al., 1992). Finally, satisfaction in VTs appears to be affected by a team's gender composition. In particular, all-female VTs tend to report higher levels of satisfaction than all-male VTs (Lind, 1999; Savicki et al., 1996).

*Performance outcomes.* When considering VT performance, researchers have consistently found that virtual interaction increases the amount of time required to accomplish tasks (e.g., Cappel & Windsor, 2000; Daly, 1993; Graetz et al., 1998; Hollingshead, 1996; Straus, 1996; Weisband, 1992). For example, Graetz et al. (1998) found that electronic chat groups took significantly longer to reach a decision and arrived at less accurate decisions than did teams working in face-to-face or teleconferencing contexts. Similarly,

Weisband (1992), using student teams working on decision tasks, found that electronic communication resulted in longer time frames for task completion, as did Siegel et al. (1986) using students working on a choice-dilemma problem in which consensus had to be reached.

Some reasons offered for the increased time required for task completion in VTs are that typing and using computer-mediated communication technology takes longer than face-to-face discussions (Lebie et al., 1996; Straus & McGrath, 1994). Also, the asynchronicity of the communication media in VTs may result in members working on other tasks at the same time as they are participating in teamwork, and thus, the focus of their attention may not be solely on the team's task (Malhotra, Majchrzak, Carman & Lott, 2001). However, it should be noted that researchers have not found any evidence that VTs display less effort than face-to-face teams (Siegel et al., 1986).

The findings for the effects of virtualness on the quality of a team's decisions have been mixed. Several researchers have found no difference in performance quality between virtual and face-to-face teams (e.g., Cappel & Windsor, 2000; Straus & McGrath, 1994). Hiltz et al. (1986) found that although face-to-face groups demonstrated higher levels of agreement than did CMC groups, there were no differences between the two types of groups in the quality of decisions. Using corporate managers performing the desert survival task in a training session, Potter and Balthazard (2002) found that the objective performance and process outcomes of VTs were very similar to those of their face-to-face counterparts. However, in some instances, researchers have found that face-to-face teams outperform VTs (e.g., Andres, 2002; McDonough et al., 2001; Straus & McGrath, 1994). On the other hand, it has also been found that VTs produce better work (Jarvenpaa et al., 1988), make more effective decisions (Schmidt, Montoya-Weiss & Massey, 2001), generate more unique and high quality ideas (Valacich, George, Nunamaker & Vogel, 1994), and report their solutions as being more original (Connolly, Jessup & Valacich, 1990).

### *Moderators of Virtual Team Performance*

In trying to explain these often inconsistent results for VT performance, researchers have pointed to a wide range of contingency factors such as task type, time spent working in a group, and the team's social context.

*Task type.* Task type has been consistently found to moderate the effects of virtualness on team outcomes (Daly, 1993; Hedlund et al., 1998; Tan et al., 1998). For negotiation and intellectual tasks, face-to-face teams have been found to perform significantly better than CMC teams, whereas there were no differences found on decision-making tasks (Hollingshead et al., 1993). Over time, though, the differences decreased, suggesting that time may mitigate the effects of communication modality.

A type of task in which CMC groups seem to outperform face-to-face groups is brainstorming and idea-generation because there is no interruption from other group members, in effect allowing all members to "talk" at the same time. In a study examining the interaction between task type and communication medium, Straus and McGrath (1994) found that the overall effectiveness of CMC groups was lower than that of face-to-face groups, especially

for tasks that required higher levels of coordination. However, such reduced effectiveness appears to be attributable to slower interactions within CMC groups, as no differences were noted in the quality of work completed. An interesting result from this study was that CMC teams made considerably more errors, which was surprising given the belief that a benefit of computer-mediated communication is that work is more easily traceable and member inputs are more visible.

*Time.* Groups evolve over time and many researchers have argued that to understand them, the episodic nature of their work needs to be examined (Gersick, 1988; Marks et al., 2001) as well as the effects of time on group outcomes (Harrison, Price & Bell, 1998). Research on VTs has been predominantly conducted using single work sessions, thus ignoring the role of time on group processes and outcomes. To examine the effects of time, Chidambaram (1996) conducted a study over multiple time periods and found that the social information difficulties associated with non-face-to-face communication ultimately dissipated. The study also found that VT members' satisfaction with the team's processes and outcomes increased with time.

*Social context.* Social context has been found to moderate the effects of virtual interaction on team outcomes. For example, in a field case study across two organizations in the same industry using the same type of computer-mediated communication, Zack and McKenney (1995) found that cooperation and communication openness improved team performance. Interestingly, liking a team member was found to impact evaluations of the member's contributions in face-to-face groups but not in electronic groups, where a member's actual input was the most salient factor (Weisband & Atwater, 1999). Additionally, groups whose members were more critical of one another produced the greatest number of original solutions; however, supportive groups had the most satisfied members and greater perceived levels of effectiveness (Connolly et al., 1990). Another aspect of social context is the extent of performance monitoring, which is facilitated by the nature of the virtual interaction medium. Using a social facilitation framework to examine the effects of electronic performance monitoring on student VTs, Aiello and Kolb (1995) found that performance on a data-entry task was inhibited by the presence of others.

### Directions for Future Research

The last decade has seen a dramatic increase in research interest in VTs, with the realization that more teams are working virtually and some degree of virtualness is a component of most teams. Researchers are only now beginning to understand how VTs function, and much work remains to be done in order to facilitate the design and management of such teams. Our review suggests that empirical research on VTs has been relatively limited in scope and offers few consistent findings, and that many aspects of VT functioning remain unexamined. Thus, VTs present tremendous opportunities for empirical research. Below we discuss, still using the I-P-O framework, directions for future research. In addition, we also address a number of methodological and theoretical issues related to the study of VTs.



### *Team Inputs*

Based on their geographic, functional, and organizational dispersion, VTs are likely to be diverse with regards to demographics, work-related experiences, and overall KSAs (Bhappu, Zellmer-Bruhn & Anand, 2001; Griffith & Neale, 2001). Nevertheless, there is limited research on diversity in VTs, and the topic holds great promise for future research. The few studies that have examined diversity in VTs have primarily focused on gender (e.g., Savicki et al., 1996) and cultural values (e.g., Tan et al., 1998). Research is needed on other dimensions of diversity, such as race, age, organizational tenure, personality, and attitudes. Arguments can be made for both positive and negative effects of diversity on VTs. For example, the use of asynchronous communication media may allow for more minority participation, and the lack of visual salience of demographic characteristics may reduce stereotyping. On the other hand, lower information richness may increase the difficulty in understanding and working with members who are different from oneself.

Prior research has found that in contexts that reduce the salience of surface-level diversity (e.g., in race), deeper-level diversity (e.g., in values) has strong effects on the functioning of a team (Martins, Milliken, Weisenfeld & Salgado, 2003). Since virtual interaction filters out sensory cues (Sproull & Kiesler, 1986), an examination of the relative effects of diversity in surface-level vs. deep-level dimensions is particularly relevant in the context of VTs. A related area for future research is the development and dynamics of sub-groups and faultlines (Lau & Murnighan, 1998) within VTs. Whereas the development of sub-groups within face-to-face teams is strongly affected by demographic characteristics, sub-group formation in VTs may be based more on co-location and extent of contact with teammates.

The cognitions, affective states, and competencies of VT members have been surprisingly absent from the literature. For example, whereas several definitions of VTs have noted that members can be drawn from a variety of organizations (e.g., Cascio, 2000; Townsend et al., 1998), the impact of dispersed organizational affiliations on team functioning has not been researched. Some questions that might provide interesting insights are: How do team members' organizational identifications factor into the nature of their participation in VTs? How does prior VT experience affect an individual's interactions in future VTs? How does familiarity with other members affect member interaction in VTs? In addition to these questions, the mix of team roles and competencies required for effective virtual teamwork should be examined in future research.

Team size has been discussed extensively in theoretical papers on VTs, but scant empirical attention has been given to its effects on VT functioning. Research on face-to-face teams has found that increases in team size can be detrimental to team performance (e.g., Steiner, 1972). However, whether the same happens in VTs remains to be tested. For example, what are the implications of all members being able to "talk" at the same time for group processes as VT size increases? Also, are the social loafing effects found with increases in size in face-to-face teams also present in VTs, where contributions can be documented more easily? Interestingly, almost all lab studies of VTs conducted using students have used teams that range in size from 3 to 5 members (e.g., Daly, 1993; McLeod et al., 1997), while field research has used teams ranging from 3 to 100 members (e.g., Ahuja & Galvin, 2003; Finholt & Sproull, 1988; Kirkman et al., 2004; Riopelle et al., 2003).

While the topic of leadership in a virtual environment has begun to receive attention (e.g., Hedlund et al., 1998; Johnson, Suriya, Yoon, Berrett & La Fleur, 2002; Sosik, Avolio & Kahai, 1998; Tyran, Tyran & Shepherd, 2003), there is still a need for additional research. In particular, researchers should focus on how leaders define roles, structure interactions, motivate effort, evaluate performance, and provide feedback in a VT context. Further, researchers should examine how the extent of virtualness affects leader-member exchange quality. In addition to leadership, team inputs derived from the organizational context must also be considered in models of VT functioning. In particular, the roles played by training, organizational culture, and management support should be examined (Townsend et al., 1998).

### *Team Processes*

The role of planning processes in the integration of team members' efforts is a fruitful area for future research on VTs. For example, there is a need for research on the optimal timing of planning events during the life-cycle of VTs. Further, researchers should examine if the punctuated-equilibrium models that have gained popularity in research on face-to-face teams during the last decade (see Marks et al., 2001 for a review) function similarly in VTs. Such research should take into account the effects of the greater time that may be required for planning processes in VTs.

The majority of studies that have examined action processes have focused on differences in communication and participation patterns between virtual and face-to-face teams. Much of this work has relied on media richness and social presence theories (e.g., Short, Williams & Christie, 1976) as the bases for arguments that computer-mediated communication cannot provide the socio-emotional qualities present in face-to-face interactions. Others have argued that computer-mediated communication does not differ in its ability to exchange social information but merely requires more time and effort than face-to-face communication to exchange social information and uncover "situated knowledge" within a team (Sole & Edmondson, 2002). Such conflicting perspectives provide opportunities for testing competing models of action processes in VTs.

Several action processes that are affected by the ability to observe other team members may pose unique challenges for VTs. In particular, team monitoring and back-up, which involves providing ongoing feedback, coaching, and assistance to teammates, requires members to be aware of each others' performance at any given time, which is difficult to do in a virtual context. Similarly, social facilitation or the enhancement of one's performance due to the presence of others, may be reduced in VTs. Further, because of the lack of monitoring by teammates, team members may be required to engage in self-management to a greater extent in VTs than in face-to-face teams.

Interpersonal processes represent an area in which major gaps exist in the literature on VTs. In particular, scarcely any research has been conducted on interpersonal processes related to long-term group outcomes, such as affect management, psychological safety, group emotion, collective efficacy, and social integration. Thus far, researchers have focused primarily on conflict and trust in VTs. Although the effects of virtual interaction on the extent of conflict has been examined in some detail, a more interesting direction appears to be understanding mechanisms for the management of conflict in VTs. Also, whereas

researchers have made considerable headway into understanding factors contributing to the creation and destruction of trust within VTs, there is room for future research that differentiates among various types of trust (McAllister, 1995) and their roles in VTs.

Researchers have recently begun to examine socialization in VTs (Ahuja & Galvin, 2003). There is a need for additional research on this topic in order to understand how members evolve into roles as well as develop and transmit norms in the context of virtual interaction and changing team membership. Studies on the effects of virtual interaction on group cohesiveness have produced mixed findings, partly explained by moderating factors such as team task and composition. Given the potential for cohesiveness to enable VTs to overcome the difficulties inherent in virtual interaction, more research is needed on the role of cohesiveness in VTs.

### *Team Outcomes*

Behavioral outcomes represent a major omission in the literature on VTs (see Walther, 1997, for an exception). In the face-to-face teams literature, behavioral outcomes have been found to impact members' desire to work together in the future (Kozlowski & Bell, 2003). The lack of focus on behavioral outcomes in research on VTs is likely due to most of the studies being conducted in temporary teams. Nonetheless, with virtual teamwork becoming more of a norm in organizations, it is important to examine long-term behavioral outcomes in future research.

Surprisingly missing from research on VTs are outcomes related to intellectual capital. Whereas issues of knowledge management have been addressed in VT theorizing (e.g., Griffith et al., 2003), there has been little empirical work in the area. In particular, the implications of virtualness for a team's contribution to an organization's tacit and explicit knowledge should be studied in future research. Similarly, higher level cognitive outcomes such as team creativity and learning have not been examined extensively and are important areas for the extension of research on VTs. Given that a major benefit of VTs is their ability to draw the best expertise regardless of where it resides (Solomon, 2001) and the capability of the interaction medium to capture a large portion of team processes and products (Nemiro, 2002), topics related to the intellectual capital of teams and the organizations in which they operate are likely very fruitful avenues for future research.

### *Methodological and Theoretical Issues*

From a methodological perspective, a majority of empirical research has sought to compare VTs to "traditional" or "conventional" face-to-face teams. Whereas such an approach is useful in isolating effects of virtualness on teams, it limits the generalizability of findings as pure face-to-face teams are becoming rare in organizations (Griffith et al., 2003). Thus, there is a need for a shift away from seeking to compare VTs to face-to-face ones, to an examination of how the extent of virtualness affects VT functioning (Driskell, Radtke & Salas, 2003; Guzzo & Dickson, 1996).

Another methodological concern with the current state of the literature on VTs is that much of the empirical research has been conducted in laboratory settings, using student teams working on short-term tasks (e.g., Connolly et al., 1990; McLeod et al., 1997).

It is understandably difficult to obtain data on VTs in field settings, and the complexity of studying VTs will only increase as new work arrangements are implemented and more advanced information and communication technologies are created. It is imperative, though, that empirical research move out of laboratory settings and into the field in order to advance the literature through the asking and answering of questions that cannot be adequately tested in a laboratory setting. Some interesting questions for future research include: What are the implications of organizational power differentials among VT members? How do organizational culture and structure affect the functioning of VTs?

In addition to examining the direct effects of virtualness on team functioning, researchers should also examine both mediating and moderating variables. Thus far, task type, time, and social context have received a fair amount of attention. Other variables, derived from theories of power, motivation, interpersonal relations, and social cognition, could be incorporated as mediators and moderators into models of VT functioning. Such extensions to the literature would help develop a richer, more theoretically grounded understanding of the underlying dynamics in VTs. Further, there is potential for cross-level research examining how organizational characteristics such as culture and support mechanisms affect VT functioning.

In conclusion, VTs are increasingly prevalent in organizations and, with rare exceptions, all organizational teams are virtual to some extent. Given their ability to transcend the traditional constraints of time, location, social networks, and organizational boundaries, VTs can enhance the competitive flexibility of organizations. Empirical research on this important new type of organizational unit is still in its infancy and shows tremendous promise for future research. In order to advance our understanding of VTs, researchers must move beyond simply comparing them to face-to-face teams. Further, researchers need to draw on the theoretical foundations that have been utilized in prior research on teams, as well as on new theoretical bases that are uniquely relevant to virtual interaction, to develop a more theoretically grounded understanding of the functioning of VTs. These next steps are critical if the research literature on VTs is to advance from its current pre-paradigmatic state to a more meaningful basis for academic inquiry and practical application in the future.

### Appendix A. Team Inputs

Authors	Inputs			
	Year	Technology	Task	Composition
Ahuja and Galvin	2003			X
Aubert and Kelsey	2003			X
Baker	2002	X		
Bhappu, Griffith and Northcraft	1997			X
Bouas and Arrow	1996			X

## Appendix A. (Continued)

Authors	Year	Inputs		
		Technology	Task	Composition
Burgoon, Bonito, Ramirez, Dunbar, Kam and Fischer	2002	X		
Daly	1993		X	
El-Shinnawy and Vinze	1998		X	X
Gallupe, Dennis, Cooper, Valacich, Bastianutti and Nunamaker	1992			X
Gefen and Straub	1997			X
Graetz, Boyle, Kimble, Thompson and Garloch	1998	X		
Hiltz, Johnson and Turoff	1986		X	
Hinds and Kiesler	1995	X		
Hollingshead, McGrath and O'Connor	1993		X	
Hollingshead	1996			X
Jarvenpaa, Rao and Huber	1988	X		
Kayworth and Leidner	2000	X		X
Lea and Spears	1992			X
Leenders, van Engelen and Kratzer	2003		X	X
Lind	1999			X
May and Carter	2001	X		
Maznevski and Chudoba	2000		X	
McLeod, Baron, Marti and Yoon	1997			X
Nowak	2003			X
Paul, Seetharaman, Samarah and Mykytyn	2004			X
Pauleen and Yoong	2001	X		
Potter and Balthazard	2002			X
Savicki, Kelley and Lingenfelter	1996			X
Siegel, Dubrovsky, Kiesler and McGuire	1986	X		
Sproull and Kiesler	1986			X
Straus and McGrath	1994		X	
Straus	1996			X
Suchan and Hayzak	2001	X		
Tan, Wei, Watson, Clapper and McLean	1998		X	X

## Appendix A. (Continued)

Authors	Inputs			
	Year	Technology	Task	Composition
Valacich, Dennis and Nunamaker	1992			X
Valacich, Dennis and Connolly (a)	1994			X
Valacich, George, Nunamaker and Vogel (b)	1994			X
Weisband, Schneider and Connolly	1995			X
Workman, Kahnweiler and Bommer	2003	X		

## Appendix B. Team Processes

Authors	Processes			
	Year	Planning	Action	Interpersonal
Ahuja and Galvin	2003		X	
Aiello and Kolb	1995			X
Alge, Wiethoff and Klein	2003		X	X
Aubert and Kelsey	2003			X
Baker	2002		X	
Bhappu, Griffith and Northcraft	1997		X	
Bordia, DiFonzo and Chang	1999		X	
Bouas and Arrow	1996			X
Chidambaram	1996			X
Connolly, Jessup and Valacich	1990			X
Cramton	2001		X	X
Dubrovsky, Kiesler and Sethna	1991		X	X
Feldman	1987		X	
Gonzalez, Burke, Santuzzi and Bradley	2003			X
Hedlund, Ilgen and Hollenbeck	1998		X	
Hiltz, Johnson and Turoff	1986		X	X
Hinds and Kiesler	1995		X	
Hollingshead	1996		X	

## Appendix B. (Continued)

Authors	Year	Processes		
		Planning	Action	Interpersonal
Huang, Wei, Watson and Tan	2002	X		X
Jarvenpaa, Rao and Huber	1988		X	
Jarvenpaa, Knoll and Leidner	1998		X	X
Jarvenpaa and Leidner	1999		X	X
Jessup and Tansik	1991		X	
Johnson, Suriya, Yoon, Berrett and La Fleur	2002			X
Kanawattanachai and Yoo	2002			X
Kayworth and Leidner	2000	X	X	X
Kiesler, Siegel, and McGuire	1984		X	X
Kirkman, Rosen, Tesluk and Gibson	2004			X
Lebie, Rhoades and McGrath	1996	X	X	X
Leenders, van Engelen and Kratzer	2003		X	
Lind	1999			X
Lurey and Raisinghani	2001	X		
Maznevski and Chudoba	2000		X	
McDonough, Kahn and Barczak	2001	X	X	X
McLeod, Baron, Marti and Yoon	1997		X	
Montoya-Weiss, Massey and Song	2001			X
Morris, Marshall and Rainer	2002			X
Mortensen and Hinds	2001			X
Nemiro	2002		X	
Paul, Seetharaman, Samarah and Mykytyn	2004			X
Piccoli and Ives	2003			X
Poole, Holmes and DeSanctis	1991	X	X	X
Potter and Balthazard	2002			X
Ratcheva and Vyakarnam	2001		X	X
Saphiere	1996			X
Sarker, Valacich and Sarker	2003			X
Savicki, Kelley and Lingenfelter	1996		X	X

## Appendix B. (Continued)

Authors	Year	Processes		
		Planning	Action	Interpersonal
Sharifi and Pawar	2002			X
Shepherd, Briggs, Reinig, Yen and Nunamaker	1996		X	
Siegel, Dubrovsky, Kiesler and McGuire	1986		X	X
Sole and Edmondson	2002		X	
Spears, Lea and Lee	1990			X
Sproull and Keisler	1986		X	X
Straus	1996		X	
Suchan and Hayzak	2001		X	X
Tan, Wei, Huang and Ng	2000		X	
Tan, Wei, Watson, Clapper and McLean	1998			X
Tidwell and Walther	2002			X
Valacich and Schwenk	1995		X	
Valacich, Dennis and Nunamaker	1992		X	
Walther and Burgoon	1992		X	X
Walther	1994		X	X
Walther	1995		X	X
Walther	1997			X
Warkentin, Sayeed and Hightower	1997		X	X
Warkentin and Beranek	1999	X		X
Weisband	1992		X	X
Weisband, Schneider and Connolly	1995		X	
Yoo and Kanawattanachai	2001		X	X
Zack and McKenney	1995		X	X
Zigurs, Poole and DeSanctis	1988		X	



**Appendix C. Team Outcomes**

Authors	Outcomes		
	Year	Affective	Performance
Aiello and Kolb	1995	X	X
Alge, Wiethoff and Klein	2003		X
Andres	2002	X	X
Aubert and Kelsey	2003	X	X
Baker	2002		X
Burgoon, Bonito, Ramirez, Dunbar, Kam and Fischer	2002		X
Cappel and Windsor	2000	X	X
Chidambaram	1996	X	
Connolly, Jessup and Valacich	1990	X	X
Daly	1993		X
Gallupe, Dennis, Cooper, Valacich, Bastianutti and Nunamaker	1992	X	X
Gonzalez, Burke, Santuzzi and Bradley	2003		X
Graetz, Boyle, Kimble, Thompson and Garloch	1998	X	X
Hedlund, Ilgen and Hollenbeck	1998		X
Hiltz, Johnson and Turoff	1986		X
Hollingshead, McGrath and O'Connor	1993		X
Hollingshead	1996		X
Huang, Wei, Watson and Tan	2002	X	X
Jarvenpaa, Rao and Huber	1988	X	X
Jarvenpaa and Leidner	1999	X	
Jessup and Tansik	1991	X	
Kanawattanachai and Yoo	2002		X
Kayworth and Leidner	2000		X
Kirkman, Rosen, Tesluk and Gibson	2004		X
Leenders, van Engelen and Kratzer	2003		X
Lind	1999	X	X
Lurey and Raisinghani	2001	X	X
May and Carter	2001		X
Maznevski and Chudoba	2000		X

## Appendix C. (Continued)

Authors	Year	Outcomes	
		Affective	Performance
McDonough, Kahn and Barczak	2001		X
Montoya-Weiss, Massey and Song	2001		X
Morris, Marshall and Rainer	2002	X	
Mortensen and Hinds	2001		X
Paul, Seetharaman, Samarah and Mykytyn	2004	X	
Pauleen and Yoong	2001	X	
Potter and Balthazard	2002	X	X
Saphiere	1996		X
Savicki, Kelley and Lingenfelter	1996	X	
Schmidt, Montoya-Weiss and Massey	2001	X	X
Sharifi and Pawar	2002		X
Shepherd, Briggs, Reinig, Yen and Nunamaker	1996		X
Siegel, Dubrovsky, Kiesler and McGuire	1986		X
Sosik, Avolio and Kahai	1998		X
Straus and McGrath	1994	X	X
Straus	1996	X	X
Tan, Wei, Huang and Ng	2000	X	
Thompson and Coovert	2002	X	
Tidwell and Walther	2002	X	
Valacich, Dennis and Nunamaker	1992	X	X
Valacich, Dennis and Connolly (a)	1994	X	X
Valacich, George, Nunamaker and Vogel (b)	1994		X
Valacich and Schwenk	1995	X	X
Walther	1994	X	
Warkentin, Sayeed and Hightower	1997	X	X
Warkentin and Beranek	1999	X	
Weisband	1992		X
Weisband and Atwater	1999	X	
Workman, Kahnweiler and Bommer	2003	X	
Yoo and Kanawattanachai	2001		X
Zack and McKenney	1995		X

## References

- Ahuja, M., & Galvin, J. 2003. Socialization in virtual groups. *Journal of Management*, 29: 161–185.
- Aiello, J. R., & Kolb, K. J. 1995. Electronic performance monitoring and social context: Impact on productivity and stress. *Journal of Applied Psychology*, 80: 339–353.
- Alge, B. J., Wiethoff, C., & Klein, H. J. 2003. When does the medium matter? Knowledge-building experiences and opportunities in decision-making teams. *Organizational Behavior and Human Decision Processes*, 91: 26–37.
- Andres, H. P. 2002. A comparison of face-to-face and virtual software development teams. *Team Performance Management*, 8: 39–48.
- Aubert, B. A., & Kelsey, B. L. 2003. Further understanding of trust and performance in virtual teams. *Small Group Research*, 34: 575–618.
- Baker, G. 2002. The effects of synchronous collaborative technologies on decision making: A study of virtual teams. *Information Resources Management Journal*, 15: 79–93.
- Bell, B. S., & Kozlowski, S. W. J. 2002. A typology of virtual teams. *Group & Organization Management*, 27: 14–49.
- Bhappu, A. D., Griffith, T. L., & Northcraft, G. B. 1997. Media effects and communication bias in diverse groups. *Organizational Behavior and Human Decision Processes*, 70: 199–205.
- Bhappu, A. D., Zellmer-Bruhn, M., & Anand, V. 2001. The effects of demographic diversity and virtual work environments on knowledge processing in teams. *Advances in the Interdisciplinary Study of Work Teams*, 8: 149–165.
- Bikson, T., & Eveland, J. D. 1990. The interplay of work group structures and computer support. In J. Galegher, R. Kraut, & C. Egido (Eds.), *Intellectual teamwork: Social and technological foundations of cooperative work*. Hillsdale, NJ: Lawrence Erlbaum.
- Blackburn, R., Furst, S. A., & Rosen, B. 2003. Building a winning virtual team: KSA's, selections, training, and evaluation. In C. B. Gibson & S. G. Cohen (Eds.), *Virtual teams that work: Creating conditions for virtual team effectiveness*. San Francisco: Jossey-Bass.
- Bordia, P., DiFonzo, N., & Chang, A. 1999. Rumor as group problem solving: Development patterns in informal computer-mediated groups. *Small Group Research*, 30: 8–28.
- Bouas, K. S., & Arrow, H. 1996. The development of group identity in computer and face-to-face groups with membership change. *Computer Supported Cooperative Work*, 4: 153–178.
- Burgoon, J. K., Bonito, J. A., Ramirez, A., Jr., Dunbar, N. E., Kam, K., & Fischer, J. 2002. Testing the interactivity principle: Effects of mediation, propinquity, and verbal and nonverbal modalities in interpersonal interaction. *Journal of Communication*, 52: 657–677.
- Cappel, J. J., & Windsor, J. C. 2000. Ethical decision making: A comparison of computer-supported and face-to-face group. *Journal of Business Ethics*, 28: 95–107.
- Carlson, J. R., & Zmud, R. W. 1999. Channel expansion theory and the experiential nature of media richness perceptions. *Academy of Management Journal*, 42: 153–170.
- Cascio, W. F. 2000. Managing a virtual workplace. *Academy of Management Executive*, 14: 81–90.
- Chidambaram, L. 1996. Relational development in computer-supported groups. *MIS Quarterly*, 20: 143–165.
- Connolly, T., Jessup, L. M., & Valacich, J. S. 1990. Effects of anonymity and evaluative tone on idea generation in computer-mediated groups. *Management Science*, 36: 689–703.
- Coutu, D. L. 1998. Trust in virtual teams. *Harvard Business Review*, 76: 20–21.
- Cramton, C. D. 2001. The mutual knowledge problem and its consequences for dispersed collaboration. *Organization Science*, 12: 346–371.
- Cramton, C. D. 2002. Finding common ground in dispersed collaboration. *Organizational Dynamics*, 30: 356–367.
- Cramton, C. D., & Orvis, K. L. 2003. Overcoming barriers to information sharing in virtual teams. In C. B. Gibson & S. G. Cohen (Eds.), *Virtual teams that work: Creating conditions for virtual team effectiveness*: 214–230. San Francisco: Jossey-Bass.
- Daft, R. L., & Lengel, R. H. 1984. Information richness: A new approach to managerial behavior and organization design. *Research in Organizational Behavior*, 6: 191–233.
- Daly, B. L. 1993. The influence of face-to-face versus computer-mediated communication channels on collective induction. *Accounting, Management, and Information Technology*, 3: 1–22.

- de Lisser, E. 1999. Update on small business: Firms with virtual environments appeal to workers. *Wall Street Journal*, B2.
- Driscoll, J. W. 1978. Trust and participation in organizational decision making as predictors of satisfaction. *Academy of Management Journal*, 21: 44–56.
- Driskell, J. E., Radtke, P. H., & Salas, E. 2003. Virtual teams: Effects of technological mediation on team performance. *Group Dynamics: Theory, Research, and Practice*, 7: 297–323.
- Dubrovsky, V., Kiesler, S., & Sethna, B. 1991. The equalization phenomenon: Status effects in computer-mediated and face-to-face decision making groups. *Human Computer Interaction*, 6: 119–146.
- El-Shinnawy, M., & Vinze, A. S. 1998. Polarization and persuasive argumentation: A study of decision making in group settings. *MIS Quarterly*, 22: 165–198.
- Feldman, M. S. 1987. Electronic mail and weak ties in organizations. *Office: Technology and People*, 3: 83–101.
- Finholt, T., & Sproull, L. S. 1988. Electronic groups at work. *Organization Science*, 1: 41–61.
- Gallupe, R., Dennis, A., Cooper, W., Valacich, J., Bastianutti, L., & Nunamaker, J., Jr. 1992. Electronic brainstorming and group size. *Academy of Management Journal*, 35: 350–369.
- Gefen, D., & Straub, D. W. 1997. Gender differences in the perception and use of e-mail: An extension to the technology acceptance model. *MIS Quarterly*, 21: 389–400.
- Gersick, C. J. G. 1988. Time and transition in work teams: Toward a new model of group development. *Academy of Management Journal*, 31: 9–41.
- Gibson, C. B., & Cohen, S. G. 2003. *Virtual teams that work: Creating conditions for virtual team effectiveness*. San Francisco: Jossey-Bass.
- Gonzalez, M. G., Burke, M. J., Santuzzi, A. M., & Bradley, J. C. 2003. The impact of group process variables on the effectiveness of distance collaboration groups. *Computers in Human Behavior*, 19: 629–648.
- Graetz, K. A., Boyle, E., Kimble, C., Thompson, P., & Garloch, J. 1998. Information sharing in face-to-face, teleconferencing and electronic chat groups. *Small Group Research*, 29: 714–743.
- Griffith, T. L., & Neale, M. A. 2001. Information processing in traditional, hybrid, and virtual teams: From nascent knowledge to transactive memory. *Research in Organizational Behavior*, 23: 379–421.
- Griffith, T. L., Sawyer, J. E., & Neale, M. A. 2003. Virtualness and knowledge in teams: Managing the love triangle of organizations, individuals, and information technology. *MIS Quarterly*, 27: 265–287.
- Guzzo, R. A., & Dickson, M. W. 1996. Teams in organizations: Recent research on performance and effectiveness. *Annual Review of Psychology*, 47: 307–338.
- Hackman, J. R., & Morris, C. G. 1975. Group tasks, group interaction process, and group performance effectiveness: A review and proposed integration. In L. Berkowitz (Ed.), *Advances in experimental social psychology*: Vol. 8. 45–99. San Diego, CA: Academic Press.
- Handy, C. 1995. Trust and the virtual organization. *Harvard Business Review*, 73: 40–50.
- Harrison, D. A., Price, K. H., & Bell, M. P. 1998. Beyond relational demography: Time and the effects of surface- and deep-level diversity on work group cohesion. *Academy of Management Journal*, 41: 96–107.
- Hedlund, J., Ilgen, D. R., & Hollenbeck, J. R. 1998. Decision accuracy in computer-mediated versus face-to-face decision-making teams. *Organizational Behavior and Human Decision Processes*, 76: 30–47.
- Hiltz, S. R., Johnson, K., & Turoff, M. 1986. Experiments in group decision making: Communication process and outcome in face-to-face versus computerized conferences. *Human Communication Research*, 13: 225–252.
- Hinds, P., & Kiesler, S. 1995. Communication across boundaries: Work, structure, and use of communication technologies in a large organization. *Organization Science*, 6: 373–393.
- Hollingshead, A. B. 1996. Information suppression and status persistence in group decision making. *Human Communication Research*, 23: 193–219.
- Hollingshead, A. B. 1998. Retrieval processes in transactive memory systems. *Journal of Personality and Social Psychology*, 74: 659–671.
- Hollingshead, A. B., McGrath, J. E., & O'Connor, K. M. 1993. Group task performance and communication technology: A longitudinal study of computer-mediated versus face-to-face work groups. *Small Group Research*, 24: 307–333.
- Huang, W. W., Wei, K. K., Watson, R. T., & Tan, B. C. Y. 2002. Supporting virtual team-building with a GSS: An empirical investigation. *Decision Support Systems*, 34: 359–367.
- Jarvenpaa, S. L., Knoll, K., & Leidner, D. E. 1998. Is anybody out there? Antecedents of trust in global virtual teams. *Journal of Management Information Systems*, 14: 29–64.

- Jarvenpaa, S. L., & Leidner, D. E. 1999. Communication and trust in global virtual teams. *Organization Science*, 10: 791–815.
- Jarvenpaa, S. L., Rao, V. S., & Huber, G. P. 1988. Computer support for meetings of groups working on unstructured problems: A field experiment. *MIS Quarterly*, 12: 645–666.
- Jehn, K. A., & Mannix, E. A. 2001. The dynamic nature of conflict: A longitudinal study of intragroup conflict and group performance. *Academy of Management Journal*, 44: 238–251.
- Jessup, L. M., & Tansik, D. A. 1991. Decision making in an automated environment: The effects of anonymity and proximity group decision support system. *Decision Sciences*, 22: 266–279.
- Johnson, S. D., Suriya, C., Yoon, S. W., Berrett, J. V., & La Fleur, J. 2002. Team development and group processes of virtual learning teams. *Computers and Education*, 39: 379–393.
- Kanawattanachai, P., & Yoo, Y. 2002. Dynamic nature of trust in virtual teams. *Journal of Strategic Information Systems*, 11: 187–213.
- Kayworth, T., & Leidner, D. 2000. The global virtual manager: A prescription for success. *European Management Journal*, 18: 183–194.
- Kiesler, S., Siegel, J., & McGuire, T. W. 1984. Social psychological aspects of computer-mediated communication. *American Psychologist*, 39: 1123–1134.
- Kirkman, B. L., & Rosen, B. 1999. Beyond self-management: Antecedents and consequences of team empowerment. *Academy of Management Journal*, 42: 58–74.
- Kirkman, B. L., Rosen, B., Tesluk, P. E., & Gibson, C. B. 2004. The impact of team empowerment on virtual team performance: The moderating role of face-to-face interaction. *Academy of Management Journal*, 47(2): 175–192.
- Kozlowski, S., & Bell, B. S. 2003. Work groups and teams in organizations. In W. C. Borman, D. R. Ilgen, & R. J. Klimoski (Eds.), *Handbook of psychology: Industrial and organizational psychology*: Vol. 12. 333–375. London: Wiley.
- Kramer, R. M., & Brewer, M. B. 1986. Social group identity and the emergence of cooperation in resource conservation dilemmas. In H. Wilke, C. Rutte, & D. M. Messick (Eds.), *Experimental studies of social dilemmas*: 205–234. Frankfurt, Germany: Peter Lang.
- Lau, D., & Murnighan, J. K. 1998. Demographic diversity and faultlines: The compositional dynamics of organizational groups. *Academy of Management Review*, 23: 325–340.
- Lea, M., & Spears, R. 1992. Paralinguistic and social perception in computer-mediated communication. *Journal of Organizational Computing*, 2: 321–341.
- Lebie, L., Rhoades, J. A., & McGrath, J. E. 1996. Interaction process in computer-mediated and face-to-face groups. *Computer Supported Cooperative Work*, 4: 127–152.
- Leenders, R. T., van Engelen, J., & Kratzer, J. 2003. Virtuality, communication, and new product team creativity: A social network perspective. *Journal of Engineering and Technology Management*, 20: 69–92.
- Lind, M. R. 1999. The gender impact of temporary virtual work groups. *IEEE Transactions on Professional Communication*, 42: 276–285.
- Lipnack, J., & Stamps, J. 1999. Virtual teams: The new way to work. *Strategy & Leadership*, 27: 14–18.
- Lurey, J. S., & Raisinghani, M. S. 2001. An empirical study of best practices in virtual teams. *Information & Management*, 38: 523–544.
- Malhotra, A., Majchrzak, A., Carman, R., & Lott, V. 2001. Radical innovation without collocation: A case study at Boeing-Rocketdyne. *MIS Quarterly*, 25: 229–249.
- Marks, M. A., Mathieu, J. E., & Zaccaro, S. J. 2001. A temporally based framework and taxonomy of team processes. *Academy of Management Review*, 26: 356–376.
- Martins, L. L., Milliken, F. J., Wiesenfeld, B. M., & Salgado, S. R. 2003. Racioethnic diversity and group members' experiences: The role of the racioethnic diversity of the organizational context. *Group and Organization Management*, 28(1): 75–106.
- May, A., & Carter, C. 2001. A case study of virtual team working in the European automotive industry. *International Journal of Industrial Ergonomics*, 27: 171–186.
- Maznevski, M. L., & Chudoba, K. M. 2000. Bridging space over time: Global virtual team dynamics and effectiveness. *Organization Science*, 11: 473–492.
- McAllister, D. J. 1995. Affect- and cognition-based trust as foundations for interpersonal cooperation in organizations. *Academy of Management Journal*, 38: 24–59.

- McDonough, E. F., III, Kahn, K. B., & Barczak, G. 2001. An investigation of the use of global, virtual, and collocated new product development teams. *The Journal of Product Innovation Management*, 18: 110–120.
- McLeod, P. L., Baron, R. S., Marti, M. W., & Yoon, K. 1997. The eyes have it: Minority influence in face-to-face and computer-mediated groups. *Journal of Applied Psychology*, 82: 706–718.
- Montoya-Weiss, M., Massey, A., & Song, M. 2001. Getting it together: Temporal coordination and conflict management in global virtual teams. *Academy of Management Journal*, 44: 1251–1262.
- Morris, S. A., Marshall, T. E., & Rainer, R. K., Jr. 2002. Impact of user satisfaction and trust on virtual team members. *Information Resources Management Journal*, 15: 22–30.
- Mortensen, M., & Hinds, P. J. 2001. Conflict and shared identity in geographically distributed teams. *International Journal of Conflict Management*, 12: 212–238.
- Nemiro, J. E. 2002. The creative process in virtual teams. *Creativity Research Journal*, 14: 69–83.
- Nowak, K. L. 2003. Sex categorization in computer mediated communication (CMC): Exploring the utopian promise. *Media Psychology*, 5: 83–103.
- Odenwald, S. 1996. Global work teams. *Training & Development*, 50: 54–57.
- O'Hara-Devereaux, M., & Johansen, R. 1994. *Globalwork*. San Francisco: Jossey-Bass.
- Owens, D. A., Neale, M. A., & Sutton, R. I. 2000. Technologies of status management: Status dynamics in e-mail communications. *Research on managing groups and teams*: Vol. 3. 205–230. Greenwich, CT: JAI Press.
- Paul, S., Seetharaman, P., Samarah, I., & Mykytyn, P. P. 2004. Impact of heterogeneity and collaborative conflict management style on the performance of synchronous global virtual teams. *Information & Management*, 41: 303–321.
- Pauleen, D. J., & Yoong, P. 2001. Facilitating virtual team relationships via Internet and conventional communication channels. *Internet Research*, 11: 190–202.
- Piccoli, G., & Ives, B. 2003. Trust and the unintended effects of behavior control in virtual teams. *MIS Quarterly*, 27: 365–395.
- Poole, M. S., Holmes, M., & DeSanctis, G. 1991. Conflict management in a computer-supported meeting environment. *Management Science*, 37: 926–953.
- Potter, R. E., & Balthazard, P. A. 2002. Understanding human interaction and performance in the virtual team. *Journal of Information Technology Theory and Application*, 4: 1–23.
- Ratcheva, V., & Vyakarnam, S. 2001. Exploring team formation processes in virtual partnerships. *Integrated Manufacturing Systems*, 12: 512–523.
- Riopelle, K., Gluesing, J. C., Alcorido, T. C., Baba, M., Britt, D., McKether, W., Monplaisir, L., Ratner, H. H., & Wagner, K. H. 2003. Context, task, and the evolution of technology use in global virtual teams. In C. B. Gibson & S. G. Cohen (Eds.), *Virtual teams that work: Creating conditions for virtual team effectiveness*: 239–264. San Francisco: Jossey-Bass.
- Saphiere, D. M. H. 1996. Productive behaviors of global business teams. *International Journal of Intercultural Relations*, 20: 227–259.
- Sarker, S., Valacich, J. S., & Sarker, S. 2003. Virtual team trust: Instrument development and validation in an IS educational environment. *Information Resources Management Journal*, 16: 35–55.
- Savicki, V., Kelley, M., & Lingenfelter, D. 1996. Gender and group composition in small task groups using computer-mediated communication. *Computers in Human Behavior*, 12: 209–224.
- Schmidt, J. B., Montoya-Weiss, M. M., & Massey, A. P. 2001. New product development decision-making effectiveness: Comparing individuals, face-to-face teams, and virtual teams. *Decision Sciences*, 32: 575–600.
- Shapiro, D. L., Furst, S. A., Spreitzer, G. M., & Von Glinow, M. A. 2002. Transnational teams in the electronic age: Are team identity and high performance at risk? *Journal of Organizational Behavior*, 23: 455–467.
- Sharifi, S., & Pawar, K. S. 2002. Virtually co-located product design teams: Sharing teaming experiences after the event? *International Journal of Operations & Production Management*, 22: 656–679.
- Shepherd, M. M., Briggs, R. O., Reinig, B. A., Yen, J., & Nunamaker, J. F., Jr. 1996. Invoking social comparison to improve electronic brainstorming: Beyond anonymity. *Journal of Management Information Systems*, 12: 155–170.
- Short, J., Williams, E., & Christie, B. 1976. *The social psychology of telecommunications*. New York, NY: John Wiley.
- Siegel, J., Dubrovsky, V., Kiesler, S., & McGuire, T. 1986. Group processes in computer-mediated communication. *Organizational Behavior and Human Decision Processes*, 37: 157–187.

- Sole, D., & Edmondson, A. 2002. Situated knowledge and learning in dispersed teams. *British Journal of Management*, 13: 517–534.
- Solomon, C. M. 2001. Managing virtual teams. *Workforce*, 80: 60–64.
- Sosik, J. J., Avolio, B. J., & Kahai, S. S. 1998. Inspiring group creativity: Comparing anonymous and identified electronic brainstorming. *Small Group Research*, 29: 3–31.
- Spears, R., Lea, M., & Lee, S. 1990. De-individuation and group polarization in computer-mediated communication. *British Journal of Social Psychology*, 29: 121–134.
- Sproull, L., & Kiesler, S. 1986. Reducing social context cues: Electronic mail in organizational communication. *Management Science*, 32: 1492–1512.
- Steiner, I. D. 1972. *Group process and productivity*. New York: Academic Press.
- Straus, S. G. 1996. Getting a clue: The effects of communication media and information distribution on participation and performance in computer-mediated and face-to-face groups. *Small Group Research*, 27: 115–142.
- Straus, S. G., & McGrath, J. E. 1994. Does the medium matter: The interaction of task type and technology on group performance and member reactions. *Journal of Applied Psychology*, 79: 87–97.
- Suchan, J., & Hayzak, G. 2001. The communication characteristics of virtual teams: A case study. *IEEE Transactions on Professional Communication*, 44: 174–186.
- Tan, B. C. Y., Wei, K., Huang, W. W., & Ng, G. N. 2000. A dialogue technique to enhance electronic communication in virtual teams. *IEEE Transactions on Professional Communication*, 43: 153–165.
- Tan, B. C. Y., Wei, K., Watson, R. T., Clapper, D. L., & McLean, E. R. 1998. Computer-mediated communication and majority influence: Assessing the impact in an individualistic and collectivistic culture. *Management Science*, 44: 1263–1278.
- Thompson, L. F., & Coovert, M. D. 2002. Steeping up to the challenge: A critical examination of face-to-face and computer-mediated team decision making. *Group Dynamics*, 6: 52–64.
- Tidwell, L. C., & Walther, J. B. 2002. Computer-mediated communication effects on disclosure, impressions, and interpersonal evaluations. *Human Communication Research*, 28: 317–348.
- Townsend, A. M., DeMarie, S. M., & Hendrickson, A. R. 1998. Virtual teams: Technology and the workplace of the future. *Academy of Management Executive*, 12: 17–29.
- Tyran, K. L., Tyran, C. G., & Shepherd, M. 2003. Exploring emerging leadership in virtual teams. In C. B. Gibson & S. G. Cohen (Eds.), *Virtual teams that work: Creating conditions for virtual team effectiveness*: 183–195. San Francisco: Jossey-Bass.
- Valacich, J. S., Dennis, A. R., & Connolly, T. 1994. Idea generation in computer-based groups: A new ending to an old story. *Organizational Behavior and Human Decision Processes*, 57: 448–467.
- Valacich, J. S., Dennis, A. R., & Nunamaker, J. F., Jr. 1992. Group size and anonymity effects on computer-mediated idea generation. *Small Group Research*, 23: 49–73.
- Valacich, J. S., George, J. F., Nunamaker, J. F., Jr., & Vogel, D. R. 1994. Physical proximity effects on computer-mediated group idea generation. *Small Group Research*, 25: 83–104.
- Valacich, J. S., & Schwenk, C. 1995. Devil's advocacy and dialectical inquiry effects on face-to-face and computer-mediated group decision making. *Organizational Behavior and Human Decision Processes*, 63: 158–173.
- Walther, J. B. 1994. Anticipated ongoing interaction versus channel effects on relational communication in computer-mediated interaction. *Human Communication Research*, 20: 473–501.
- Walther, J. B. 1995. Relational aspects of computer-mediated communication: Experimental observations over time. *Organization Science*, 6: 186–203.
- Walther, J. B. 1997. Group and interpersonal effects in international computer-mediated collaboration. *Human Communication Research*, 23: 342–369.
- Walther, J. B., & Burgoon, J. K. 1992. Relational communication in computer-mediated interaction. *Human Communication Research*, 19: 50–88.
- Warkentin, M. E., & Beranek, P. M. 1999. Training to improve virtual team communication. *Information Systems Journal*, 9: 271–289.
- Warkentin, M. E., Sayeed, L., & Hightower, R. 1997. *Virtual teams versus face-to-face teams: An exploratory study of a web-based conference system*, 28: 975–996.
- Weingart, L. R. 1997. How did they do that? The ways and means of studying group process. *Research in Organizational Behavior*, 19: 189–239.

- Weisband, S. 1992. Group discussion and first advocacy effects in computer-mediated and face-to-face decision making groups. *Organizational Behavior and Human Decision Processes*, 53: 352–380.
- Weisband, S., & Atwater, L. 1999. Evaluating self and others in electronic and face-to-face groups. *Journal of Applied Psychology*, 84: 632–639.
- Weisband, S., Schneider, S. K., & Connolly, T. 1995. Computer-mediated communication and social information: Status salience and status differences. *Academy of Management Journal*, 38: 1124–1151.
- Workman, M., Kahnweiler, W., & Bommer, W. 2003. The effects of cognitive style and media richness on commitment to telework and virtual teams. *Journal of Vocational Behavior*, 63: 199–219.
- Yoo, Y., & Kanawattanachai, P. 2001. Developments of transactive memory systems and collective mind in virtual teams. *International Journal of Organizational Analysis*, 9: 187–208.
- Zack, M. H., & McKenney, J. L. 1995. Social context and interaction in ongoing computer-supported management groups. *Organization Science*, 6: 394–422.
- Zigurs, I. 2003. Leadership in virtual teams: Oxymoron or opportunity? *Organizational Dynamics*, 31: 339–351.
- Zigurs, I., Poole, M. S., & DeSanctis, G. L. 1988. A study of influence in computer-mediated group decision making. *MIS Quarterly*, 12: 625–644.

**Luis L. Martins** is an Associate Professor of Organizational Behavior at the College of Management at the Georgia Institute of Technology. He received his Ph.D. in Management and Organizational Behavior from the Stern School of Business at New York University. His research focuses on diversity, work–family conflict, and managerial cognition. He is currently examining these topics in the context of organizational arrangements and processes enabled by new information technologies.

**Lucy L. Gilson** is an Assistant Professor of Management at the University of Connecticut. She received her Ph.D. from the Georgia Institute of Technology. Her research predominantly focuses on work teams, specifically, creativity, diversity, justice, empowerment, and extent of virtual communication.

**M. Travis Maynard** is a doctoral candidate in Organizational Behavior at the University of Connecticut. He holds an undergraduate degree in Accounting from the College of William and Mary, and an MBA degree in Organizational Behavior from the Daniels College of Business at the University of Denver. His current research interests focus on work team development and specifically on the effect that team context has on the development of team psychological states.