


Realities of Working in Virtual Teams: Affective and Attitudinal Outcomes of Using Computer-Mediated Communication

Small Group Research
40(6) 623–649
© The Author(s) 2009
Reprints and permission: <http://www.sagepub.com/journalsPermissions.nav>
DOI: 10.1177/1046496409346448
<http://sgr.sagepub.com>


Stefanie K. Johnson,¹ Kenneth
Bettenhausen,¹ and Ellie Gibbons¹

Abstract

Many organizations are using computer-mediated communication to facilitate group work among virtual teams. However, little is known about the effects of using computer-mediated communication on team member outcomes. Examining use of computer-mediated communication as a continuum, the authors found that team members who used computer-mediated communication more often experienced lower levels of positive affect while working with their teams and had lower levels of affective commitment to their teams. Positive affect mediated the relationship between use of computer-mediated communication and affective commitment. Moreover, this study identified a tipping point (using computer-mediated communication more than 90% of the time) at which the use of computer-mediated communication was particularly detrimental to team outcomes.

Keywords

team, virtual, affect, computer-mediated communication

¹University of Colorado, Denver

Corresponding Author:

Stefanie K. Johnson, School of Business, University of Colorado, Denver, 1380 Lawrence Street, Suite 390-P, Campus Box 165, P.O. Box 173364, Denver, CO 80217, USA
Email: stefanie.johnson@ucdenver.edu

Teams have become a part of organizational life. Many companies in the United States use teams, and an increasing number of those teams are communicating virtually. It is estimated that 60% of professional employees work in virtual teams (Kanawattanachai & Yoo, 2002). Although research on face-to-face teams has demonstrated the impact of teamwork on member affect (Bartel & Saavedra, 2000), little is known about how working in a virtual team affects the way team members feel. Some scholars argue that virtual teams are devoid of affective content (Handy, 1995), whereas others suggest that virtual teams have even greater room for intimacy than face-to-face teams (McKenna & Bargh, 1998). The current study seeks to explore this question by examining the affective experiences of team members working in teams that vary in the extent that members use computer-mediated communication.

Virtuality

The increase in computer-mediated communication technology has revolutionized the manner in which employees interact with one another, including the reliance on virtual teams to complete work-related tasks (Baltes, Dickson, Sherman, Bauer, & LaGanke, 2002). However, there is still considerable debate over the definition of what is or is not a virtual team and the dimensions around which virtuality should be measured. Cohen and Gibson (2003) considered just two dimensions: electronic dependence and geographic dispersion. Griffith, Sawyer, and Neale (2003) posited three: level of technology support, percentage of time apart while working on task, and degree of physical distance. Kirkman and Mathieu (2005) identified three other dimensions of team virtuality: use of virtual communication tools, amount of informational value provided by those tools, and synchronicity of communication. Martins, Gilson, and Maynard (2004) suggested four: geographic dispersion, use of computer-mediated communication, temporality, and diversity.

In the most comprehensive analysis of the factors of virtual teams, Chudoba, Wynn, Lu, and Watson-Manheim (2005), identified six factors that characterize the virtual teaming environment: geography, time zone, culture, work practices, organization, and technology. They developed questions to measure each discontinuity and collected team-member perceptions in a globally distributed setting. Factor analysis revealed that the items designed to measure the six factors fell onto three dimensions: team distribution, workplace mobility, and variety of work practices, which included both cultural and work process diversity.

Use of Computer-Mediated Communication

Although there are many differences among the conceptualizations of virtual teams, there are two factors that are widely agreed on: (a) virtuality includes the use of computer-mediated communication, and (b) virtuality should be considered a continuous variable rather than a dichotomy of virtual or not virtual. First, all of the major research in this area contends that virtual teams must use some type of computer-mediated communication (Chudoba et al., 2005; Cohen & Gibson, 2003; Griffith et al., 2003; Kirkman & Mathieu, 2005; Martins et al., 2004). Although we recognize that most scholars also agree that virtual teams should also be geographically dispersed (Schiller & Mandviwalla, 2007), others argue that geographic dispersion is not a prerequisite of virtual teams (Kirkman & Mathieu, 2005).

Specifically, Kirkman and Mathieu (2005) argue that although being geographically dispersed is likely to lead team members to use computer-mediated communication to coordinate their activities, teams that are located in the same area may also choose to use virtual means of communication. Indeed, in the study reported here, only 6 of the 150 team members indicated that other members of their team resided in a different country, and only 25 teams had members who resided in a distant city or state. Therefore, in the current study we focus on one dimension of team virtuality: the use of computer-mediated communication. Not only is this facet of virtuality the most widely agreed on element of virtual teams, but it is also the most relevant facet to our topic because of its apparent effects on social and emotional relationships within the team (Maznevski & Chudoba, 2001).

Second, recent theoretical work suggests that virtuality (and the elements of virtuality) should be measured as a continuum. Previous research has primarily examined this construct as dichotomous, possibly because of the reliance on experimental, factorial research designs (Martins et al., 2004). Martins et al. suggest, "in an attempt to move beyond the potentially unsolvable theoretical problem of what is or is not a virtual team, recent definitions have instead focused on a team's extent of virtuality" (p. 807). We will measure use of computer-mediated communication along a continuum ranging from almost completely face-to-face communication to almost completely computer-mediated communication. This is most similar to Griffith et al.'s (2003) dimension of percent of time spent apart while working on task, in that it is a measure of the percentage of time spent working face-to-face compared with the percentage of time spent working virtually. Conceptually and practically, it makes sense that use of computer-mediated communication is considered as a continuum. Given the number of companies using some type

of computer-mediated communication (e.g., e-mail, teleconferencing, telecommuting) it could be argued that nearly all team members rely on computer-mediated communication to communicate with one another at least some of the time. There is a great difference, however, between a team in which one member often works from home, a team that meets exclusively face-to-face for meetings, and a team whose members never meet one another. Each of these teams relies on computer-mediated communication, but they vary in the extent to which they do so.

Although we examine a continuum of use of computer-mediated communication, we are also left with the question of whether the relationship between computer-mediated communication and team outcomes is a linear one. Are team members who occasionally rely on e-mail less committed to their team than members who always communicate face-to-face? Are teams who have an initial face-to-face meeting, but then never meet again, more effective than teams whose members have never met at all? Stated another way, is there a tipping point at which reliance on computer-mediated communication begins to damage team functioning? Given that we do not have the theoretical justification to make a specific prediction about where that tipping point may be, we pose the following research question:

Research Question: Is there a tipping point at which reliance on computer-mediated technology has negative effects on team outcomes (team member affect, affective commitment, task and non-task effectiveness)?

Use of Computer-Mediated Communication and Team Functioning

In this study, we examine the effects of use of computer-mediated communication on team functioning. Although there are many methods of characterizing team functioning, we adopt the framework suggested by Marks, Mathieu, and Zaccaro (2001) in light of our focus on team member affect. "Affective management involves regulating member emotions during mission accomplishment including (but not limited to) social cohesion, frustrations, and excitement" (Marks et al., 2001, p. 369). Affective management is considered an emergent state of group functioning and adds to the commonly used input-process-outcome framework of team process (e.g., Martins et al., 2004).

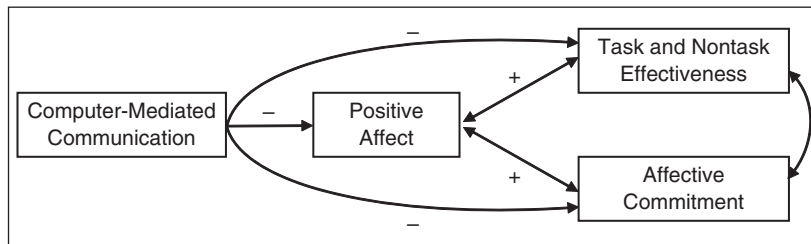


Figure 1. Hypothesized model of the relationship between use of computer-mediated communication and team outcomes

Emergent states describe cognitive, motivational, and affective states of teams, as opposed to the nature of their member interaction. Emergent states do not represent team interaction or team actions that lead toward outcomes. Rather, they are products of team experiences (including team processes) and become new inputs to subsequent processes and outcomes. (Marks et al., 2001, pp. 357-358)

We suggest that use of computer-mediated communication influences team member affect, which influences outcomes, such as team member affective commitment and effectiveness (Figure 1).

Task and Nontask Effectiveness

Although using computer-mediated communication offers a cost-effective method of bringing the best individuals together to complete a project (Martins et al., 2004), there are potentially negative effects of using computer-mediated communication on members' perceptions of team effectiveness (Baltes et al., 2002). Team effectiveness is generally evaluated along two dimensions: task and nontask (Hackman & Morris, 1975). In terms of the task side, the slow and inefficient nature of using computer-mediated communication can result in lowered perceptions of team effectiveness (DeSanctis & Monge, 1999). Teams that use computer-mediated communication experience difficulty when gathering suggestions to modify team goals and activities (Staples & Webster, 2007) and managing member feedback during electronic discussions (DeSanctis & Monge, 1999). Leaner forms of media technology also reduce the sharing of sensitive information, which may impede effectiveness (Staples & Webster, 2007).

In terms of the nontask elements of effectiveness, teams that use computer-mediated communication have lower levels of satisfaction than

face-to-face teams (Baltes et al., 2002). Explanations for the disparity include the lack of social cues inherent in using computer-mediated communication and the increased amount of time required to make decisions (Baltes et al., 2002). Teams that rely on computer-mediated communication also enjoy fewer informal interactions with one another (Tangirala & Alge, 2004) and tend to engage in less off-task and social communication (Bordia, 1997; Martins et al., 2004; Workman, Kahnweiler, & Bommer, 2003). Moreover, the reliance on leaner media can make it easy to misread the emotional message within a conversation, causing dissatisfaction and conflict (Workman et al., 2003). We expect that members of teams that use greater levels of computer-mediated communication will perceive their teams to be less effective in terms of both task and nontask effectiveness than members of teams that have greater levels of face-to-face communication.

Despite the evidence that using computer-mediated communication hurts team effectiveness, we must recognize research to the contrary. Teams that use computer-mediated communication outperform face-to-face teams on tasks requiring divergent thinking, especially, but not solely, when the communicating is done anonymously (DeSanctis & Monge, 1999). Using computer-mediated communication is also beneficial for teams performing idea-generation tasks (brainstorming), perhaps because of lower levels of team pressure (Bordia, 1997). Moreover, although larger face-to-face teams tend to be less effective than smaller face-to-face teams, team size does not seem to affect the effectiveness of teams that use computer-mediated communication (Bordia, 1997; Lowry, Roberts, Romano, Cheney, & Hightower, 2006). Status is also thought to be less influential on team members who use computer-mediated communication (Postmes, Spears, & Lea, 1998). These benefits are thought to occur as a result of, rather than in spite of, the increased anonymity of using computer-mediated communication. Yet anonymity is only characteristic of teams that have little or no face-to-face contact, and it is unclear if the benefits of using computer-mediated communication extend across varying degrees of computer-mediated communication.

Moreover, as Powell, Piccoli, and Ives (2004) note in their review of the literature, many other studies have detected no differences between virtual and face-to-face teams in terms of team effectiveness (Burke & Aytes, 1998; Burke & Chidambaram, 1996; Galegher & Kraut, 1994; Lind, 1999). There are several possible reasons for these inconsistencies. First, many of the studies conducted, to date, have manipulated use of computer-mediated communication into two or three categories, which do not capture the full range of use of computer-mediated communication. For example, Burke and Chidambaram (1996) manipulated use of computer-mediated communication in terms of either entirely face-to-face groups, entirely virtual and

synchronous, or entirely virtual and asynchronous. Likewise, Galegher and Kraut (1994) manipulated use of computer-mediated communication as computer only or face-to-face and phone communication. Second, each of these and many other studies use temporary work groups, and use of computer-mediated communication may have differential effects of long-term groups versus short-term groups (e.g., Zack, 1994). Third, many of these studies use student groups as participants (see Powell et al., 2004 for a review), and the effects may not generalize to organizational work groups.

By examining use of computer-mediated communication as a continuum among intact work groups, we expect that use of computer-mediated communication will be negatively related to task and nontask effectiveness.

Hypothesis 1a: Use of computer-mediated communication will be negatively related to team member perceptions of task and nontask effectiveness.

Affective Commitment

In addition, we expect that use of computer-mediated communication will be negatively related to one's affective commitment to his or her team (Crossman & Lee-Kelly, 2004). Affective commitment involves one's "feelings of identification with and attachment to the team's . . . task," (Bettenhausen, 1991, p. 364). Team members who primarily rely on computer-mediated communication are likely to lack socially meaningful experiences with the team (Tangirala & Alge, 2004), resulting in increased feelings of isolation and lower levels of affective commitment (Workman et al., 2003). Teams that rely on computer-mediated communication often struggle to form a shared identity that promotes affective commitment (Shapiro, Furst, Spreitzer, & Von Glinow, 2002) and tend to feel that their team members are also not committed to the team (Crossman & Lee-Kelly, 2004).

Hypothesis 1b: Use of computer-mediated communication will be negatively related to team members' affective commitment to their team.

Positive Affect

Although affective commitment and effectiveness have been studied by prior studies, we include them as the foundation of our research. We are primarily interested in the effects of use of computer-mediated communication on team member positive affect, as it has not been examined by past research on

virtual teams or teams that use computer-mediated communication. While the term *affect* encompasses many different constructs, including moods, emotions, and personality, we focus on individuals' state affect while working in their teams. Ashforth and Humphrey (1995) define state affect as a subjective feeling as opposed to a disposition. There are at least two types of state affect: moods and emotions. Emotions have clear causes or objects, are shorter in duration, and tend to be more intense and focused than moods (Frijda & Mesquita, 1994). Moods are lower in intensity, are not directed toward a specific object, and are more diffuse than emotions (Forgas, 1992; Lazarus, 1991). That is not to say that moods do not have causes but that moods are not directed at specific objects.

As Lazarus (1991) said, a mood is a "transient reaction to specific encounters with the environment" (p. 47). Moods can be caused by one's environment, one's own emotions as they diffuse (Lazarus, 1991), or the moods of others with whom one works (Hatfield, Cacioppo, & Rapson, 1992). As such, individuals often associate moods with their workplace (Johnson, 2008) and with their work teams (Barsade, 2002; George, 1991; George & Bettenhausen, 1990; Sy, Côté, & Saavedra, 2005). It is also important to distinguish between positive and negative affect. Watson and colleagues conclude that both state and trait affect are comprised of two distinct continua rather than a single continuum ranging from negative to positive (Watson & Clark, 1984; Watson & Tellegen, 1985). They proposed that low positive affect is not the same as negative affect but is rather the lack of positive affect.

Although it is possible that use of computer-mediated communication produces both positive and negative affect, we focus on positive affect in this study. Given that the expression of negative affect is generally unacceptable in organizational settings (Ashforth & Humphrey, 1995), we expect that individuals are unlikely to express a great deal of negative affect when using computer-mediated communication. In fact, individuals are quite successful at controlling the expression of negative affect at work (Gross, 1998; Pugh, 2001). Moreover, although research has suggested that using computer-mediated communication may reduce positive states such as cohesion, trust, or effectiveness, there is considerably less evidence that using computer-mediated communication will result in highly negative outcomes such as deviant behaviors, sabotage, or conflict (see Workman et al., 2003 for an exception). Likewise, research on affect in face-to-face teams has provided greater evidence for the benefits of positive affect than demonstrations of costs of negative affect. The benefits of positive affect in work teams include better team coordination (Sy et al., 2005) greater cooperation and better task performance (Barsade, 2002), among others.

We hypothesize that team members who use greater levels of computer-mediated communication will experience lower levels of positive affect while working with their team as a result of the lack of social time and lack of nonverbal cues inherent among team members who use computer-mediated communication. Because teams that use computer-mediated communication spend less time focusing on social communication (Bordia, 1997; Martins et al., 2004; Workman et al., 2003) we expect that they develop less positive affect while working in their team. Indeed, other research has shown that teams that spend more time on social interactions have better social and emotional relationships (Robey, Khoo, & Powers, 2000). Members of face-to-face teams also have greater access to nonverbal information, through which mood and emotion are transmitted to others (Buck, 1984), whereas using computer-mediated communication reduces one's access to this information, which can make team members feel more disconnected from one another. The exchange of nonverbal cues can share important information and mood, itself, through mood contagion (Barsade, 2002).

Hypothesis 2: Use of computer-mediated communication will result in lower levels of positive affect while working with one's team.

Furthermore, we expect that positive affect will mediate the relationship between use of computer-mediated communication and the outcomes of effectiveness and affective commitment. Individuals make inference about the cohesiveness of a team based on the team members' facial expressions (Magee & Tiedens, 2006), and people are more expressive when they are around others (Hess, Banse, & Kappas, 1995). Not having access to that information can reduce feelings of effectiveness and affective commitment. Ilgen, Hollenbeck, Johnson, and Jundt (2005) also suggest that individuals who use computer-mediated communication may not bond to the same extent as individuals in face-to-face teams. Individuals experiencing positive affect are also more likely to be cooperative and helpful (Isen & Levin, 1972), which may actually enhance the team's effectiveness (Barsade, 2002). Finally, biased processing of information as a result of positive affect can inflate the relationship between positive affect and attitudinal outcomes (e.g., Bower, Gilligan, & Montiero, 1981). This previous research would suggest that positive affect will mediate the relationship between team use of computer-mediated communication and effectiveness. Only a partial mediation is expected, given the potential for other, more cognitively based processes to also mediate the relationship between use of computer-mediated communication and effectiveness.

Hypothesis 3a: Positive affect will partially mediate the relationship between use of computer-mediated communication and task and nontask effectiveness, such that use of computer-mediated communication will result in lower levels of positive affect and, thus, decreased perceptions of team task and nontask effectiveness.

Hypothesis 3b: Positive affect will partially mediate the relationship between use of computer-mediated communication and affective commitment, such that use of computer-mediated communication will result in lower levels of positive affect and, thus, decreased affective commitment to one's team.

Method

Participants

Participants consisted of 150 evening MBA students from a large public university in Colorado. Of these students, 48 were female, 88 were male, and 14 did not indicate their sex. Approximately 85% of the sample was currently employed. Most participants indicated that they were under 30 ($n = 94$), but 40 were between 30 and 40 years old, 3 indicated that they were between 40 and 50 years old, and 13 did not indicate their age. Participants were told to think of a work team with which they currently (or most recently) worked and asked to write a description of that team to ensure that they had a specific team in mind. Although retrospective accounts of mood may be subject to error, there is evidence that individuals' self-reports of past mood are generally quite accurate (Parkinson, Briner, Reynolds, & Totterdell, 1995).

Moreover, we sought to examine whether use of computer-mediated communication was related to any other factors that could potentially influence the results. We examined if use of computer-mediated communication was related to any of the control variables (centrality, size, member tenure, job tenure, or gender); no significant relationships were identified. There were no significant differences in team member turnover, whether the team had a leader, or the extent to which one's performance appraisal was based on his or her team work. As a final step, the descriptions of members' teams were examined. It did not appear that teams from any one industry used computer-mediated communication more than any other. For example, sales teams varied from more than 90% computer-mediated communication to entirely face-to-face. Based on these steps, it does not appear that using computer-mediated communication was related to other differences between teams.

Measures

Control variables. All participants were asked how central their team/group was to their overall job (centrality), the number of people in their team (size), how long they had worked with the team in months (team tenure), and how long they had held their job (tenure). In addition, participant sex was included as a covariate. Previous research has demonstrated the importance of these variables for team and group research.

Use of computer-mediated communication. Use of computer-mediated communication was measured on a 6-point scale assessing the extent to which participants had used computer-mediated communication versus working face-to-face over the past 2 weeks. To help participants recall the amount of time they spent using computer-mediated communication, they were first asked to indicate how many hours over the past 2 weeks they had spent (a) working on the team task alone, without team members, (b) meeting face-to-face with the other team members, (c) on the telephone/voicemail with other team members, (d) e-mailing/text messaging with other team members (including time spent composing e-mail to and reading e-mail from those team members), (e) instant messaging (IM) or work in a chat-room with the other team members, and (f) using video-conferencing software [to communicate] with team members. Participants were also asked to include any other methods of communication with their team and then indicate the amount of time they spent using that method.

After answering these questions, participants were asked to indicate the percentage of their interactions that had used computer-mediated communication over the past 2 weeks on a scale of 1 to 6 where 1 = *less than 10% face-to-face*, 2 = *10% to 30%*, 3 = *30% to 50%*, 4 = *50% to 70%*, 5 = *70% to 90%*, and 6 = *more than 90% face-to-face*. This measure was then reversed so that a higher number indicates greater reliance on computer-mediated communication. The mean was closest to the 30% to 50% computer-mediated communication.

Task and nontask effectiveness scale. The task and nontask effectiveness scale was created for the current study to encompass perceptions of teams' task and nontask effectiveness. Ten items were developed based on Hackman and Morris's (1975) description of team effectiveness. The scale was submitted to a principal components analysis using a varimax rotation. As expected, two factors emerged. The first factor consisted of four items (e.g., My group's overall performance meets my expectations; I am satisfied with my experience as a group member) and had an adequate level of internal consistency ($\alpha = .86$). This scale was labeled *nontask effectiveness*. The second scale

consisted of six items (e.g., My group produces high quality work outcomes; This group is very productive) and had an adequate level of internal consistency ($\alpha = .87$). We labeled this scale *task effectiveness*. All items for all the scales used in this study are included in the appendix.

Affective commitment. We adapted the affective commitment scale of organizational commitment (Allen & Meyer, 1990) to represent commitment to one's team. This adaptation is justified given that affective commitment represents one's attachment toward a social unit (Bettenhausen, 1991). The same psychological dynamics are assumed to be at work whether one is examining a person's commitment to the organization or to his or her assigned work team. A principal components analysis using a varimax rotation yielded three factors, two of which consisted of one item each and the other six items factored together. The six-item scale was used (e.g., This work group has a great deal of personal meaning for me; I do not feel a strong sense of belonging to my work group) and had an adequate level of internal consistency ($\alpha = .86$).

Positive affect. Positive affect was measured by asking individuals to indicate their levels of positive affect while working in their focal teams using the Job Affect Scale (Brief, Burke, George, Robinson, & Webster, 1988). The Job Affect Scale consists of 20 items describing positive and negative mood and is based on the framework provided by Watson and Tellegen (1985). Participants were asked to indicate how they feel "while working in your group" ($\alpha = .70$).

Results

Means, standard deviations, and correlations are reported in Table 1. Missing data were replaced with the grand mean for that item. Because all the variables were self-report it is important to test for possible common method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Although this is less of a concern for the hypotheses related to use of computer-mediated communication (which is not an attitude), it is important to establish the independence of the attitudinal variables (positive affect, task effectiveness, nontask effectiveness, and affective commitment). As such, a confirmatory factor analysis was conducted to determine the independence of these constructs. Individual items were randomly averaged to create a smaller number of variables. This is commonly done in confirmatory factor analysis procedures to reduce the number of items in the variables in the model (Arbuckle, 1997).

Table 1. Zero-Order Correlations Between Study Variables ($n = 150$)

	<i>M</i>	<i>SD</i>	1	2	3	4	5
1. Computer-mediated communication	3.08	1.74					
2. Positive affect	3.03	0.55	-.24**				
3. Nontask effectiveness	3.75	.81	-.07	.51**			
4. Task effectiveness	3.77	0.77	-.10	.38**	.60**		
5. Affective commitment	3.05	0.80	-.23*	.44**	.58**	.46**	

* $p < .05$. ** $p < .01$.

Each latent construct was correlated with the others, and two error variances were allowed to correlate based on the modification indices. The chi-square test for the model was not significant, $\chi^2(12) = 19.70$, $p > .05$, indicating a good fit of the model. A measure of residual fit, the root mean square error of approximation (RMSEA), was .04. RMSEA values $< .08$ indicate moderate fit (Browne & Cudeck, 1993; Hu & Bentler, 1995). The comparative fit index (CFI) was .98 and values $> .95$ indicate a good fit (Arbuckle, 1997; Hu & Bentler, 1999). The indices suggest a good fit of the model. In addition, all of the items had acceptable factor loadings (Figure 2). Based on the results of the confirmatory factor analysis, there is evidence that positive affect, task and nontask effectiveness, and affective commitment represent more than common method variance; therefore, we continued to test the hypotheses.

Hypotheses were tested using regression analyses with team centrality, size, tenure, job tenure, and sex as control variables. All tests included the full sample of 150 participants, although the degrees of freedom reflect the inclusion of the control variables. A power analysis using a medium effect size and α of .05 indicated that 97 participants would be needed to have an 80% chance of finding an effect, or 146 participants would be needed to have a 95% chance of finding an effect, if an effect were there. All assumptions of regression analyses were checked and were met. One concern is that use of computer-mediated communication may not be a truly continuous variable, as it was measured here. As a result, all analyses were also run using analysis of variance (ANOVA), in which the linear contrast effect for use of computer-mediated communication was examined. All results were consistent with those reported for the regression analyses. The regressions were preferable so that we could test the hypothesized mediation effects. As a measure of effect size, r^2 has been included, after partialling out the variance

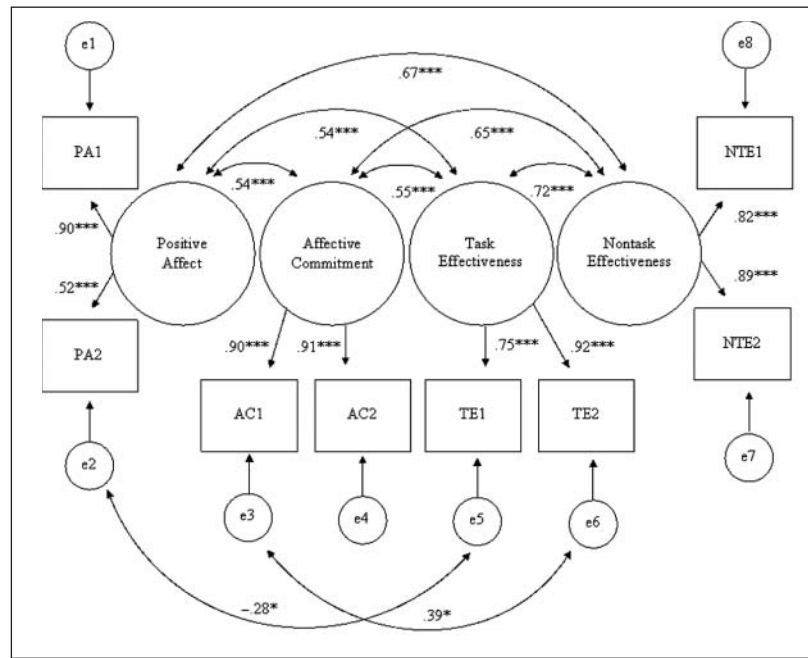


Figure 2. Confirmatory factor analysis of positive affect, task effectiveness, nontask effectiveness, and affective commitment

of the control variables. Table 1 reports the basic correlations among variables.

To test Hypotheses 1a and 1b, that use of computer-mediated communication would be negatively related to task effectiveness, nontask effectiveness, and affective commitment, three regressions were conducted with task effectiveness, nontask effectiveness, and affective commitment as the dependent variables. Only Hypothesis 1b was supported, such that use of computer-mediated communication was negatively related to affective commitment, $\beta = -.20$, $t(143) = -2.48$, $p < .05$, $r^2 = .05$. There was no effect for use of computer-mediated communication on participants' perceptions of task effectiveness, $\beta = -.08$, $t(143) = -.94$, $p > .05$, $r^2 = .01$, or nontask effectiveness, $\beta = -.07$, $t(143) = -.88$, $p > .05$, $r^2 = .01$. As such, Hypothesis 1a was not supported.

To test Hypothesis 2, that use of computer-mediated communication would be negatively related to positive affect, we conducted an additional regression with positive affect as the dependent variable. Use of computer-mediated

communication was negatively related to positive affect, $\beta = -.24$, $t(143) = -2.88$, $p < .01$, $r^2 = .06$, supporting Hypothesis 2.

Next, we tested the mediating effects of positive affect on the relationship between use of computer-mediated communication and affective commitment (Hypothesis 3b). We did not test Hypothesis 3a, that positive affect will mediate the relationship between use of computer-mediated communication and task or nontask effectiveness because use of computer-mediated communication was unrelated to these dependent variables. To test for mediation for Hypothesis 3b, we followed the steps delineated by Baron and Kenny (1986). First, we demonstrated that use of computer-mediated communication (the independent variable) was negatively related to positive affect (the mediator) and affective commitment (the dependent variable), through Hypotheses 1b and 2. Positive affect was significantly related to affective commitment, $\beta = .43$, $t(143) = 6.02$, $p < .001$. Next, we added positive affect to a regression with use of computer-mediated communication. The effect of use of computer-mediated communication on affective commitment was reduced from $\beta = -.20$, $t(143) = -2.44$, $p < .05$, to a nonsignificant level, $\beta = -.10$, $t(142) = -1.34$, $p > .10$, and the effect of positive affect on affective commitment remained statistically significant, $\beta = .42$, $t(142) = 5.56$, $p < .001$. A Sobel test (Sobel, 1982) revealed that the reduction in the effect of use of computer-mediated communication on affective commitment was statistically significant ($Z = 2.56$, $p < .01$), providing additional evidence of mediation. This test of mediation provides evidence that using computer-mediated communication results in lower levels of affective commitment because of the lower levels of positive affect that one experiences when working in his or her team.

Research Question

Finally, to test our research question, related to a tipping point at which use of computer-mediated communication results in the hypothesized decrements in positive affect, effectiveness, and affective commitment, we conducted an ANOVA with use of computer-mediated communication included as a categorical variable (1 = *less than 10% use of computer-mediated communication*, 2 = *10% to 30%*, 3 = *30% to 50%*, 4 = *50% to 70%*, 5 = *70% to 90%*, and 6 = *more than 90% use of computer-mediated communication*). The same control variables were entered as covariates. Rather than testing the omnibus ANOVA test, we examined the point at which a difference occurs using a Helmert contrast, which compares the lowest level of a categorical variable with the mean of all of the subsequent

levels. It compares Level 1 with the mean of Level 2 through 6, Level 2 with the mean of Level 3 through Level 6, and so on. Planned contrasts can be used to reduce Type 1 error rates, because they reduce the total number of tests conducted (Winer, 1962).

The Helmert contrast revealed significant differences between Level 6 (more than 90% use of computer-mediated communication) and the previous levels of positive affect, affective commitment, task effectiveness, and nontask effectiveness ($ps < .05$). There was a significant difference between teams that used computer-mediated communication more than 90% of the time and all other teams. There were no other differences. To confirm our findings, an ANOVA was conducted comparing Level 6 (more than 90% use of computer-mediated communication, $n = 20$) to the mean of the other levels (0% to 90% use of computer-mediated communication, $n = 130$). Team members who use computer-mediated communication more than 90% of the time had significantly lower levels of positive affect ($M = 2.76$, $SD = 0.57$) than team members who used computer-mediated communication less than 90% of the time, $M = 3.08$, $SD = 0.54$, $F(1, 148) = 5.83$, $p < .05$, $\eta^2 = .04$. Team members who use computer-mediated communication more than 90% of the time also reported lower levels of task effectiveness ($M = 3.36$, $SD = 1.00$) than team members who use computer-mediated communication less than 90% of the time, $M = 3.81$, $SD = .76$; $F(1, 148) = 4.94$, $p < .05$, $\eta^2 = .03$, and lower levels of nontask effectiveness ($M = 3.40$, $SD = .99$) than other team members, $M = 3.82$, $SD = .72$, $F(1, 148) = 5.60$, $p < .05$, $\eta^2 = .04$. Finally, team members who use computer-mediated communication more than 90% of the time were less affectively committed to their team ($M = 2.64$, $SD = .94$) than team members who use computer-mediated communication less than 90% of the time, $M = 3.11$, $SD = .77$, $F(1, 148) = 2.98$, $p < .05$, $\eta^2 = .03$. Accordingly, the tipping point at which use of computer-mediated communication hurts performance appears to be at levels greater than 90%.

Discussion

The current study examined the effects of using computer-mediated communication on team member affect, affective commitment, and perceptions of effectiveness. We found that individuals who used greater levels of computer-mediated communication reported lower levels of positive affect. Use of computer-mediated communication also negatively affected affective commitment, and this relationship was mediated by positive affect. A second contribution of the current research was the examination of use of

computer-mediated communication as a continuum. Whereas previous research has generally compared teams that rely solely on computer-mediated communication to face-to-face teams, we attempted to capture varying degrees of use of computer-mediated communication.

Although we found that use of computer-mediated communication (as a range) affected positive affect and affective commitment, we did not find a relationship between use of computer-mediated communication and perceptions of task or nontask effectiveness. Instead, we found a tipping point at which use of computer-mediated communication results in lower levels of task and nontask effectiveness. Teams that used computer-mediated communication more than 90% of the time saw their teams as less effective than those that used computer-mediated communication less than 90% of the time. After that point, we did not find a negative effect of use of computer-mediated communication on effectiveness. The same results were found for positive affect and affective commitment. One conclusion from the current findings is that future research should be careful about creating arbitrary distinctions as far as what does and does not constitute a virtual team.

This study has important implications for the research and practice of using computer-mediated communication. First, in terms of research, this study may begin to explain some of the inconsistencies related to research on this dimension of virtual teams. Some studies have demonstrated benefits of using computer-mediated communication, some have demonstrated no effects, and others have demonstrated negative outcomes of using computer-mediated communication. It is possible that such differences may reflect how use of computer-mediated communication was measured, or more often how use of computer-mediated communication was manipulated in a given study. Given that much laboratory research on using computer-mediated communication has manipulated the teams in the study to be either completely computer-mediated or completely face-to-face, it is likely that we have overestimated or underestimated the impact of use of computer-mediated communication on team outcomes (see Powell et al., 2004, for a review). The findings reported here highlight the need for more research that examines use of computer-mediated communication as a continuum, or punctuated continuum, rather than just examining extreme high or low levels of use of computer-mediated communication. There are also implications from this research for organizations. As noted, using computer-mediated communication and working virtually is very prevalent in organizations. We suggest that the reliance on computer-mediated communication negatively affects employees' emotional attachment to their teams. It is possible that these effects are driven by a lack of social time with team members and a lack of

the social and nonverbal cues that create friendships, such as positive facial expressions and voice. It is also possible that individuals working virtually spend more time on task, rather than sharing personal information or off-task information. We expect that the detriment to positive affect is of concern for organizational outcomes. Individuals' affective experiences can affect work performance (George & Bettenhausen, 1990). Positive affect is related to lower absenteeism (George, 1989) and greater organizational citizenship behavior (Lee & Allen, 2002). Furthermore, any one person's affective experience may affect others' affect through emotional contagion (Barsade, 2002). Therefore, the positive moods and emotions of one can influence many.

In addition, our findings suggest that having even a small amount of face-to-face time may improve team effectiveness. Insofar as the findings reported here are replicated in future research, organizations would be advised to use communication technology as a supplement to face-to-face interactions, rather than as the sole method by which individuals communicate. More specifically, we found that it was those teams that communicate face-to-face less than 10% of the time that really suffered in terms of effectiveness. Needless to say, the results reported here may not apply to all persons in all types of organizations. For example, we have taken a broad approach to use of computer-mediated communication. It is possible that individuals who have a great deal of experience with using computer-mediated communication, such as those working in large global companies, may not show the same effects demonstrated here (Chudoba et al., 2005; Connaughton & Shuffler, 2007).

Further, the results presented here may not generalize to all types of virtual teams. Previous research has identified several other important aspects of virtual teams, including geographic dispersion or degree of physical distance (Chudoba et al., 2005; Gibson & Gibbs, 2006; Martins et al., 2004), temporality (Martins et al., 2004), diversity (Gibson & Gibbs, 2006; Martins et al., 2004), and variety of work practices (Chudoba et al., 2005), to name a few. As such, it is unclear if the results reported here would generalize to more geographically dispersed or diverse teams, for example. Given cultural differences in the expression of emotions, it is possible that use of computer-mediated communication has stronger effects on emotions in some cultures and weaker effects on emotions in other cultures. Individuals from cultures in which the expression of emotion is much lower than in the United States may find fewer differences between interacting virtually and interacting face-to-face. Conversely, in highly emotive cultures, there may be an even greater effect of virtuality on team outcomes. Future research should consider the effects of other aspects of virtuality on emotional outcomes.

Finally, in the current study, we measured the percent of time that team members spent using computer-mediated communication in the absence of information relating to the team's stage of development. When, or in what stage of team development, the team members interacted face-to-face may have important implications for team outcomes. Face-to-face interactions seem to enhance group processes when they occur early on (Zack, 1994), and teams who already have a history do not seem to be affected by the use of computer-mediated technology (Alge, Wiethoff, & Klein, 2003). Likewise, Maznevski and Chudoba (2001) found that having face-to-face interactions early in group development affected team members' ability to develop stronger interpersonal relationships. We expect that having social interactions early in team development would enhance the emotional bonds between team members (Robey et al., 2000).

However, if team members are dispersed, which is often the case with virtual teams, there may be methods of creating this social time in a virtual environment. Organizations might weigh the costs of providing an opportunity for a team to meet face-to-face (such as flights, hotel, time lost) with the benefits of an increase in team members' affective reactions to the team. Teams that cannot interact face-to-face may find other ways to build rapport. It is possible that using richer media, such as video conferencing, would add to the nonverbal cues that are lacking in other forms of computer-mediated communication. Moreover, it may be beneficial to hold virtual team-building sessions to enhance the personal relationships among team members. If some team members are closer to one another in proximity, it is possible that even meeting a subset of team members could increase those members' commitment to the team. In sum, organizations would be advised to spend some effort in creating cohesiveness among virtual teams, just as they do for face-to-face teams.

Limitations and Future Studies

There were several limitations to the current study. The use of individuals' retrospective accounts of their team experiences creates several concerns. First, although confirmatory factor analysis demonstrated the independence of task and nontask effectiveness, positive affect, and affective commitment in this study, common method bias is still a concern. For example, it would have been preferable to obtain hard criteria for the team effectiveness measures rather than self-report. Another limitation relates to the fact that we did not collect data from all members of one's team within an organization. The other team members may have had different experiences and impressions of

the team. The use of retrospective accounts of mood may also introduce a certain level of error in the ratings of mood. Moreover, because participants were asked to indicate how they felt while working in their team, it is unclear whether participants were recalling how they felt while most recently while working in their team, or how they used to feel when working with their team, or the average of all of their feelings when working with their teams.

An alternative is to measure affect with a more specific time referent, such as asking participants how they have felt while working in their teams over the past 2 weeks. A concern of using the more specific referent is that if participants have had a difficult past 1 to 2 weeks working with their teams, they may report having experienced lower levels of positive affect that are not reflective of their general feelings while working with the group. Moreover, recent theoretical work on unconscious affect suggests that individuals' affect at work is likely to build up over time through classical conditioning and other psychological processes, such that when individuals report their affect at work, their reported affect is a conglomeration of their feelings while interacting with that stimulus, termed an affective association (Johnson & Johnson, 2009). Indeed, previous research on affect at work (Johnson, 2008) and affect in teams (Tse & Dasborough, 2008) has used general referents, such as the one used here to measure individuals' affect in a given context. However, more specific instructions (such as how one feels generally or on average while working with the group) would have been useful.

Finally, there is concern that there may be other differences related to team members' use of computer-mediated communication that could have influenced members' affect in the current study. There were no differences related to use of computer-mediated communication on any of the control or descriptive team variables (e.g., team turnover, member tenure, team leadership) examined in this study. Also, despite the effects of computer-mediated communication on positive affect and affective commitment, use of computer-mediated communication as a continuum was not related to task or nontask effectiveness. Finally, based on the descriptions of members' teams, use of computer-mediated communication was unrelated to the type of teams in this study. Future research may focus on a single type of team (e.g., sales) and then examine the effects of differing levels of use of computer-mediated communication on members' affect. For this initial step, the authors weighed the importance of obtaining a diverse sample as more important than controlling for team type. Individuals in a single organization might have similar team experiences, impeding our ability to examine the full of range of use of computer-mediated communication.

Conclusion

Despite these limitations, the current study adds to our knowledge of computer-mediated communication by demonstrating that differences in positive affect (as one emergent state) may begin to explain the effects of using computer-mediated communication on team outcomes. Because using computer-mediated communication results in lower levels of positive affect, members of those teams also experience lower levels of affective commitment to their teams. Furthermore, we identify a possible tipping point at which team outcomes sharply decline. Members who used computer-mediated communication more than 90% of the time experienced significantly lower levels of positive mood, task effectiveness, nontask effectiveness, and affective commitment than members who used computer-mediated communication less than 90% of the time. As such, organizational members should be cognizant of how computer-mediated communication is used in work teams. Although computer-mediated communication allows dispersed team members to work together, there may be some cost in terms of the socioemotional processes that occur in teams.

Appendix

All items for scales used in this study. All responses were indicated on a 1-5 Likert-type scale ranging from strongly disagree to strongly agree.

Positive Affect $\alpha = .70$

Instructions: Circle the one number to the right of each word which best indicates how you *feel while working in this group*. Remember, your *true* feelings are important to us.

Active	Peppy	Excited	Enthusiastic	Strong
Calm	At rest	Elated	Placid	Relaxed

Task and Nontask Effectiveness

Instructions: To what extent do you agree with the following statements about your group?

Nontask Effectiveness $\alpha = .87$

I am satisfied with my experience as a group member
I feel positive about my experience working with this group

I would be would be willing to work on a similar group in the future
 My group's overall performance meets my expectations

Task Effectiveness $\alpha = .86$

My group produces high quality work outcomes
 My group regularly meets its deadlines
 My group regularly meets its performance goals
 This group is very productive
 This group performs better than other groups in the company
 This group performs better than other groups I have worked with

Affective Commitment $\alpha = .86$

Instructions: Please answer the following questions in terms of the group that you are focusing on. Indicate the extent to which you agree with the following statements using the scale below.

I would be very happy to spend the rest of my career with this work group
 I enjoy discussing my work group with people outside it
 I do not feel like "part of the family" with my work group (R)
 I do not feel "emotionally attached" to this work group (R)
 This work group has a great deal of personal meaning for me
 I do not feel a *strong* sense of belonging to my work group (R)
 *I really feel as if this work group's problems are my own
 *I think that I could easily become as attached to another work group as I am to this one (R)

*Not included because of low item-total correlations.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The authors received no financial support for the research and/or authorship of this article.

References

- 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.

- Allen, N. A., & Meyer, J. P. (1990). The measurement and antecedents of affective, continuance, and normative commitment to the organization. *Journal of Occupational Psychology, 63*, 1-18.
- Arbuckle, J. L. (1997). *Amos users' guide* (Version 3. 6). Chicago: Small Waters Corporation.
- Ashforth, B. E., & Humphrey, R. H. (1995). Emotion in the workplace: A reappraisal. *Human Relations, 48*, 97-125.
- Baltes, B. B., Dickson, M. W., Sherman, M. P., Bauer, C. C., & LaGanke, J. S. (2002). Computer-mediated communication and group decision making: A meta-analysis. *Organizational Behavior and Human Decision Processes, 87*, 156-179.
- Baron, R., & Kenny, D. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182.
- Barsade, S. G. (2002). The ripple effect: Emotional contagion and its influence on group behavior. *Administrative Science Quarterly, 47*, 644-675.
- Bartel, C. A., & Saavedra, R. (2000). The collective construction of work group moods. *Administrative Science Quarterly, 45*, 197-231.
- Bettenhausen, K. L. (1991). Five years of groups research: What we've learned and what needs to be addressed. *Journal of Management, 17*, 345-381.
- Bordia, P. (1997). Face-to-face versus computer-mediated communication: A synthesis of the experimental literature. *Journal of Business Communication, 34*, 99-120.
- Bower, G. H., Gilligan, S. G., & Montiero, K. P. (1981). Selectivity of learning caused by affective states. *Journal of Experimental Social Psychology: General, 110*, 451-473.
- Brief, A. P., Burke, M. J., George, J. M., Robinson, B., & Webster, J. (1988). Should negative affectivity remain an unmeasured variable in the study of job stress? *Journal of Applied Psychology, 73*, 193-198.
- Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136-162). Newbury Park, CA: Sage.
- Buck, R. (1984). *The communication of emotion*. New York: Guilford Press.
- Burke, K., & Aytes, K. (1998). A longitudinal analysis of the effects of media richness on cohesion development and process satisfaction in computer-supported workgroups. In *Proceedings of the Thirty-First Hawaii International Conference on Systems Sciences* (pp. 135-144). Washington, DC: IEEE Computer Society.
- Burke, K., & Chidambaram, L. (1996). Do mediated contexts differ in information richness? A comparison of collocated and dispersed meetings. *Proceedings of the Twenty-Ninth Annual Hawaii International Conference on System Sciences* (pp. 92-101). Washington, DC: IEEE Computer Society.

- Chudoba, K. A., Wynn, E., Lu, M., & Watson-Manheim, M. B. (2005). How virtual are we? Measuring virtuality and understanding its impact in a global organization. *Information Systems Journal, 15*, 279-306.
- Cohen, S. G., & Gibson, C. B. (2003). In the beginning: Introduction and framework. In C. B. Gibson & S. G. Cohen (Eds.), *Virtual teams that work: Creating conditions for virtual team effectiveness* (pp. 1-13). San Francisco: Jossey-Bass.
- Connaughton, S. L., & Shuffler, M. (2007). Multinational and multicultural distributed teams: A review and future agenda. *Small Group Research, 38*, 387-412.
- Crossman, A., & Lee-Kelly, L. (2004). Trust, commitment, and team working: The paradox of virtual organizations. *Global Networks, 4*, 375-390.
- DeSanctis, G., & Monge, P. (1999). Introduction to the special issue: Communication processes for virtual organizations. *Organization Science, 10*, 693-703.
- Forgas, J. P. (1992). Affect in social judgments: A multiprocess model. *Advances in Experimental Social Psychology, 25*, 227-275.
- Frijda, N. H., & Mesquita, B. (1994). The social roles and functions of emotions. In S. Kitayama & H. R. Markus (Eds.), *Emotion and culture: Empirical studies of mutual influence* (pp. 51-87). Washington, DC: American Psychological Association.
- Galegher, J., & Kraut, R. E. (1994). Computer-mediated communication for intellectual teamwork: An experiment in group writing. *Information Systems Research, 5*, 110-138.
- George, J. M. (1989). Mood and absence. *Journal of Applied Psychology, 74*, 317-324.
- George, J. M. (1991). State or trait: Effects of positive mood on prosocial behaviors at work. *Journal of Applied Psychology, 76*, 299-307.
- George, J. M., & Bettenhausen, K. (1990). Understanding prosocial behavior, sales performance, and turnover: A group level analysis in a service context. *Journal of Applied Psychology, 75*, 698-709.
- Gibson, C. B., & Gibbs, J. L. (2006). Unpacking the concept of virtuality: The effects of geographic dispersion, electronic dependence, dynamic structure, and national diversity on team innovation. *Administrative Science Quarterly, 51*, 451-495.
- 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.
- Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology, 2*, 271-299.
- 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. 4, pp. 45-99). San Diego, CA: Academic Press.
- Handy, C. B. (1995). Trust and the virtual organization. *Harvard Business Review, 73*, 40-50.

- Hatfield, E., Cacioppo, J. T., & Rapson, R. L. (1992). Primitive emotional contagion. In M. S. Clark (Ed.), *Review of personality and social psychology: Emotions and social behavior* (Vol. 14, pp. 151-177). Newbury Park, CA: Sage.
- Hess, U., Banse, R., & Kappas, A. (1995). The intensity of facial expression is determined by underlying affective state and social situation. *Journal of Personality and Social Psychology, 69*, 280-288.
- Hu, L. T., & Bentler, P. M. (1995). Evaluating model fit. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues, and applications* (pp. 76-99). Thousand Oaks, CA: Sage.
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1-55.
- Ilgen, D. R., Hollenbeck, J. R., Johnson, M., & Jundt, D. (2005). Teams in organizations: From input-process-output models to IMOI models. *Annual Review of Psychology, 56*, 517-543.
- Isen, A. M., & Levin, A. F. (1972). Effects of feeling good on helping: Cookies and kindness. *Journal of Personality and Social Psychology, 21*, 384-388.
- Johnson, S. K. (2008). I second that emotion: Effects of emotional contagion and affect at work on leader and follower outcomes. *Leadership Quarterly, 19*, 1-19.
- Johnson, S. K., & Johnson, C. S. (in press). The secret life of mood: Causes and consequences of unconscious affect at work. In C. E. J. Härtel, N. M. Ashkanasy, & W. J. Zerbe (Eds.), *Research on emotions in organizations* (Vol. 5). Bingley, UK: Emerald Group /JAI Press.
- Kanawattanachai, P., & Yoo, Y. (2002). Dynamic nature of trust in virtual teams. *Journal of Strategic Information Systems, 11*, 187-213.
- Kirkman, B. L., & Mathieu, J. E. (2005). The dimensions and antecedents of team virtuality. *Journal of Management, 31*, 700-718.
- Lazarus, R. S. (1991). *Emotion and adaptation*. New York: Oxford University Press.
- Lee, K., & Allen, N. J. (2002). Organizational citizenship behavior and workplace deviance: The role of affect and cognitions. *Journal of Applied Psychology, 87*, 131-142.
- Lind, M. (1999). The gender impact of temporary virtual work groups. *IEEE Transactions on Professional Communication, 42*, 276-285.
- Lowry, P., Roberts, T., Romano, N., Cheney, P., & Hightower, R. (2006). The impact of group size and social presence on small-group communication: Does computer-mediated communication make a difference? *Small Group Research, 37*, 631-661.
- Magee, J. C., & Tiedens, L. Z. (2006). Emotional ties that bind: The roles of valence and consistency of group emotion in inferences of cohesiveness and common fate. *Personality and Social Psychology Bulletin, 32*, 1703-1715.
- 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., Gilson, L. L., & Maynard, M. T. (2004). Virtual teams: What do we know and where do we go from here? *Journal of Management*, *30*, 805-835.
- Maznevski, M., & Chudoba, K. (2001). Bridging space over time: Global virtual team dynamics and effectiveness. *Organization Science*, *11*, 473-492.
- McKenna, K. Y. A., & Bargh, J. (1998). Coming out in the age of the internet: Identity "demarginalization" through virtual group participation. *Journal of Personality and Social Psychology*, *75*, 681-694.
- Parkinson, B., Briner, R. B., Reynolds, S., & Totterdell, P. (1995). Time frames for mood: Relations between momentary and generalized ratings of affect. *Personality and Social Psychology Bulletin*, *21*, 331-339.
- Podsakoff, P. M., MacKenzie, S. B., Lee, J., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*, 879-903.
- Postmes, T., Spears, R., & Lea, M. (1998). Breaching or building social boundaries? Side-effects of computer-mediated communication. *Communication Research*, *25*, 689-715.
- Powell, A., Piccoli, G., & Ives, P. (2004). Virtual teams: A review of current literature and directions for future research. *The DATA BASE for Advances in Information Systems*, *35*, 6-36.
- Pugh, S. D. (2001). Service with a smile: Emotional contagion in the service encounter. *Academy of Management Journal*, *44*, 1018-1027.
- Robey, D., Khoo, H., & Powers, C. (2000). Situated learning in cross-functional virtual teams. *IEEE Transactions on Professional Communication*, *43*, 51-66.
- Schiller, S., & Mandviwalla, M. (2007). Virtual team research: An analysis of theory use and a framework for theory appropriation. *Small Group Research*, *38*, 12-59.
- 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.
- Sobel, M. E. (1982). Asymptotic intervals for indirect effects in structural equation models. In S. Leinhardt (Ed.), *Sociological methodology* (pp. 290-312). San Francisco: Jossey-Bass.
- Staples, D., & Webster, J. (2007). Exploring traditional and virtual team members' "best practices": A social cognitive theory perspective. *Small Group Research*, *38*, 60-97.
- Sy, T., Côté, S., & Saavedra, R. (2005). The contagious leader: Impact of the leader's mood on group members, group affective tone, and group processes. *Journal of Applied Psychology*, *90*, 295-305.
- Tangirala, S., & Alge, B. J. (2004). Reactions to unfair events in computer-mediated groups: A test of uncertainty management theory. *Organizational Behavior and Human Decision Processes*, *100*, 1-20.

- Tse, H. H. M., & Dasborough, M. T. (2008). A study of exchange and emotions in team member relationships. *Group & Organization Management, 33*, 194-215.
- Watson, D., & Clark, L. A. (1984). Negative affectivity: The disposition to experience aversive emotional states. *Psychological Bulletin, 96*, 465-490.
- Watson, D., & Tellegen, A. (1985). Toward a consensual structure of mood. *Psychological Bulletin, 98*, 219-235.
- Workman, M., Kahnweiler, W., & Bommer, W. (2003). The effects of cognitive style and media richness in commitment to telework and virtual teams. *Journal of Vocational Behavior, 63*, 199-219.
- Winer, B. J. (1962). *Statistical principles in experimental design*. New York: McGraw-Hill.
- Zack, M. H. (1994). Electronic messaging and communication effectiveness in an ongoing work group. *Information and Management, 26*, 231-241.

Bios

Stefanie K. Johnson (PhD, Rice University) is an assistant professor of management at the University of Colorado, Denver's School of Business. Her research interests include leadership and teams, including the role of emotions in each of these domains. Her other work has focused on gender, work-family balance, and leadership development.

Kenneth Bettenhausen (PhD, University of Illinois) is an associate professor and Management Program/Discipline Director at the University of Colorado, Denver. He has served on the *Academy of Management Journal*, *Academy of Management Review*, and *Journal of Management* editorial boards. His work on norm formation and social processes in small groups, published in *Administrative Science Quarterly*, *Journal of Applied Psychology*, and elsewhere is widely cited.

Ellie Gibbons (BS, University of Colorado, Denver) is a research assistant for the IMAGE (Investigation in Metabolism, Aging, Gender, and Exercise) research group at the University of Colorado, Denver Anschutz Medical Campus in the Division of Geriatric Medicine. Her research interests relate to health, weight, and gender.