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The Impact of Characteristics of Face-to-Face Communication on Online Interactions in
Hybrid Teams

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Abstract

Currently, there has been little attention to the interplay between face-to-face communication characteristics and virtual communication characteristics in hybrid teams. This paper examines how a psychologically safe communication climate (PSCC) formed in face-to-face meetings affects team members' willingness to communicate online and exchange different types of messages online. It also investigates the moderating role of the frequency of face-to-face meetings on hybrid team online communication. Analysis of perceptual data from 274 participants revealed that both a high level of PSCC in face-to-face meetings and greater frequency of face-to-face meetings have a positive effect on online interactions in hybrid collaborative teams. The combination of high PSCC and high frequency of FtF meetings also increased the willingness to communicate online, but high PSCC was the stronger predictor of future online communication.

Geographically distributed teams have become more and more popular in both the workplace and in schools. Virtual team is defined as the group of employees who collaborate across time and/or space to accomplish tasks by using communication technologies (Lipnack & Stamps, 2000). As the use of communication technology became engrained in organizational members' daily life, researchers started to realize that most teams fall along a continuum from traditional teams meeting only face-to-face to fully distributed teams. However, not much research attention has been paid to the interplay between offline and online social interaction in virtual teams (Young & Tseng, 2008).

As hybrid teams play an increasingly important role in many organizations, questions about the interplay between their FtF communication and online communication have practical meaning for managers who must plan or oversee virtual work and for team members who must learn to contribute effectively in this context. In this paper, team members' willingness to exchange online messages is viewed as influenced (at least partially) both by the team members' perceptions of a psychologically safe FtF communication climate (PSCC) as well as the frequency of FtF meetings. A psychologically safe team communication climate is characterized by open, supportive communication, speaking up, and risk taking (Baer & Frese, 2003; Edmondson, 1999, 2003; Gibb, 1961). It is expected that a PSCC formed in FtF meetings will affect team members' willingness to communicate online and their willingness to exchange different types of messages online. However it is also expected that the frequency of FtF meetings may also be an important contingency variable moderating that relationship.

In the sections that follow, the interplay between FtF meetings and subsequent

online interactions in hybrid teams is explored. First, research addressing interaction processes in hybrid collaborative teams is reviewed. Then media naturalness theory is identified, and summarized, as a relevant theoretical framework for investigating hybrid team communicative processes. Third, research that focuses upon PSCC and the role of face-to-face communication for hybrid teams' communicative practices is reviewed. Next, hypotheses concerning the relationship between FtF PSCC, FtF meeting frequency, and subsequent online team communication processes are posited. Finally, methods utilized to collect and analyze the data are explained, results are reported, and implications of the findings are discussed.

Online Interactions in Hybrid Collaborative Teams

Nowadays, hybrid or semi-virtual teams have become more and more popular (Griffith & Neale 2001). In hybrid teams, group members interact at least partly via information and communication technologies (e.g. email) rather than only in face-to-face contacts. There is evidence that this mix of communication modes is beneficial. For example, Ocker et al. (1998) found that mixed mode teams outperformed both face-to-face and distributed teams.

Previous studies of hybrid teams concluded that online interactions consist mainly of instrumental information exchanges with few social and expressive information exchanges between team members. In contrast, FtF meetings carry more expressive and communicative ties (Flache, 2004). According to Young and Tseng (2008), virtual communication is traditionally viewed as having limited "social presence" and "loss of verbal nuances (e.g. voice tone, volume), nonverbal cues (e.g. gaze, body language), physical context (e.g. meeting sites, seating arrangements), and observable information

about social characteristics (e.g. age, gender, race)” (p. 218). Griffith and Neale (2001) concluded from their overview of the literature in this area that more virtualized team members may feel less psychologically safe and be less likely to identify with the team as a salient social referent. Similarly, Wong and Burton (2001) suggested that, in online interactions, it is hard to build strong social relationships that bind team members into a group and to facilitate mutual confidence and reciprocity.

While this past work has generated valuable insights into the role of communication in these two types of groups (i.e., FtF and virtual), there has been little attention to the interplay between FtF communication characteristics and virtual communication characteristics in hybrid teams (Flache, 2004). In the next section, media naturalness theory is reviewed as a relevant theoretical framework for investigating this interplay more fully.

Media Naturalness Theory

The potential differences between face-to-face and computer-mediated communication has been explained in a variety of theoretical perspectives that address the use and perceptions of communication media. Both media richness theory (Daft & Lengel, 1986) and social presence theory (Short, Williams, & Christie, 1976) emphasize how features of communication technologies impose intrinsic constraints on the amount of information transmittable via a particular communication technology. Other models however, especially some social models, emphasize participants' creativity in using technologies adaptively. For example, both the social influence model (Fulk, 1993) and the hyper-personal model (Walther, 1996) maintain that through creative usage, people have the capability to overcome the constraints intrinsic to technologies and thus make an

otherwise lean medium capable of conveying rich social information.

Media naturalness theory, developed by Kock (2004), is a more comprehensive psychobiological model that incorporates both technological features and users' psychological needs to explain different perceptions of FtF communication and computer-mediated communication. According to Kock (2004), human beings have been engineered by evolutionary forces to communicate primarily in a co-located and synchronous manner through facial expressions, body language, and speech. Hence media naturalness theory posits that the ability of communication media to support co-located and synchronous communication employing facial expressions, body language, and speech is more natural. Using other communication interaction modes, such as e-mail communication, is likely to put an extra burden on the brain and pose additional cognitive obstacles for communicators.

The first obstacle is that more cognitive effort is required for computer-mediated communication. Cognitive effort is defined here as the amount of brain activity involved in a communication interaction. The second obstacle is communication ambiguity or uncertainty. A decrease in medium naturalness is likely to lead to an increase in the probability of misinterpretation of communicative cues, and thus an increase in communication ambiguity (Carlson & Zmud, 1999; Graetz, Boyle, Kimble, Thompson, & Garloch, 1998; Kock, 1998; Walther, 1996; Rheingold, 1993).

However, media naturalness theory also posits that users' perception of the naturalness of electronic media is part of the psychological process. Some research suggests that communication via e-mail can establish strong bonds between communicators in virtual teams, and that online interactions do allow individuals to

convey some emotional, social, and contextual content (Walther, 1995). The assumption here is that the relative level of uncertainty of online communication is not only determined by the communication technology, but also by the psychological needs of team members experiencing the equivocality (Hertel et al., 2008). For example, in hybrid collaborative teams, even though virtual information exchanges involve more uncertainty than face-to-face encounters (Handy, 1995; Jarvenpaa & Leidner 1999), it is possible for team member who have already built a psychologically safe communication climate in FtF meetings to overcome the constraints intrinsic to technologies and decrease the perceived uncertainty of online communication, leading to more expressive interactions online.

Psychologically Safe Communication Climate and Online Interactions

Psychologically Safe Communication Climate

A psychologically safe communication climate involves speaking up, raising differences for discussion, engaging in spontaneous and informal communication, providing unsolicited information, bridging differences by suspending judgment, remaining open to others' ideas and perspectives, and engaging in active listening (Gibson & Gibbs, 2006). A PSCC has been shown to predict satisfaction and commitment (Guzley, 1992) and includes variables such as participation in decision making and communication openness (Trombetta & Rogers, 1988). Edmondson (1999) found that psychological safety helped teams learn more effectively by mitigating the interpersonal risks involved and encouraging members to admit mistakes, question current practices, ask for help, and solicit feedback.

The current study argues that a psychologically safe communication climate can

help overcome the challenges posed by elements of virtuality in at least two ways. First, a PSCC formed in face-to-face meetings encourages team members to increase feedback to each other and maintain high quality message exchanges that can mitigate problems such as subtle control, low message clarity, and knowledge misinterpretation resulting from reduced face-to-face interaction and lack of social cues in electronic communication (Gibson & Gibbs, 2006). Second, a PSCC helps create trust and reduce perceptions of risk (Gibson & Cohen, 2003). With the existence of PSCC, collaborators are more likely to provide unsolicited information to other members as a way of showing goodwill and strengthening relationships (Das & Teng, 1998; Zaheer, McEvily, & Perrone, 1998). This sustained information flow may help to overcome the uncertainty and weakened relationship typically associated with the “un-naturalness” of electronic media.

PSCC and Frequency of Online Communication

A psychologically safe communication climate established in FtF meetings may be able to moderate these effects in hybrid teams’ subsequent online communication. That is, for hybrid collaborative teams without a psychologically safe FtF communication climate, the level of uncertainty and the opportunities for misconceptions will likely be high when team members communicate online, and their virtual communication may be perceived as psychologically unsafe as well. Therefore, it will be more difficult for teams lacking psychologically safe communication climates to engage in online communication. In contrast, when trust is built in FtF meetings through a psychologically safe communication climate, the perceived interpersonal risk will likely decrease when moving online, and the level of uncertainty associated with communication technology will be mitigated, leading to more frequent computer-mediated communication and more

online interactions. Hence the following hypothesis is posted:

H1a: Hybrid teams with higher levels of PSCC in their FtF meetings will more frequently exchange online messages than will hybrid teams with lower levels of FtF PSCC.

PSCC and Properties of Online Messages

Properties of online messages are also an important indicator of the quality of virtual communication in hybrid collaborative teams. Previous researchers have emphasized the importance of face-to-face communication for creating expressive and relational messages that enable distributed work, and the importance of computer-mediated communication for carrying most of the instrumental task-related messages (Crowston et al, 2007).

We identify three different types of online messages— expressive messages, communicative instrumental messages, and non-communicative instrumental messages (Ibarra, 1995; Ibarra & Andrew, 1993). In terms of expressive messages, it is hypothesized that teams with a higher level of FtF PSCC will perceive online communication as more natural and therefore will create more expressive messages in computer-mediated communication. For example, more greetings, social support, and relational messages may be used when team members with higher levels of FtF PSCC collaborate online.

The current study differentiates between two types of instrumental messages exchanged in virtual communication forums. Communicative instrumental messages involve communicative information or advice needed to accomplish tasks. When team members discuss projects, seek feedback or articulate ideas by exchanging emails or

posing threads on the discussion board, they are exchanging communicative instrumental messages.. Non-communicative instrumental message are defined as those messages developed for resource exchanges with no communication involved (attaching files or posing links unaccompanied by communicative messages).

Researchers have studied communicative instrumental interactions in face-to-face settings and have shown that a PSCC encourages frequent, spontaneous task-related communication in this setting (Monge, Cozzens, & Contractor, 1992). Since the current study argues that virtual communication has the potential to be perceived as “natural” as FtF communication with the help of a psychologically safe communication climate, we expect the above relationship to hold true in computer-mediated communication as well. Therefore, the following hypothesis is posited:

H1b&c: Hybrid teams with higher levels of PSCC in their FtF meetings will exchange more b) expressive messages, and c) communicative instrumental messages, in online interactions than will hybrid teams with lower levels of FtF PSCC.

The other type of instrumental messages, non-communicative instrumental messages, are developed in the current study as a unique type of online interaction (e.g. attaching files via email or posting links on discussion board without verbal/non-verbal communication) and were not investigated in previous research on face-to-face settings (see Ibarra, 1995; Ibarra & Andrew, 1993). Therefore, it is difficult to predict the relationship between PSCC and the frequency of non-communicative instrumental interactions. Hence, the following research question is posited:

RQ1: In hybrid teams, what is the relationship between the level of a PSCC formed in face-to-face meetings and the frequency of exchanging non-communicative

instrumental messages in online interactions?

Frequency of FtF Meetings and Online Interactions

Frequency of FtF Meetings and Online Interactions

According to Deci and Ryan (1980), in teams with high frequency of face-to-face meetings, it is easier to build trust. Therefore, in hybrid teams that meet FtF more frequently, the level of uncertainty associated with communication technology might be mitigated, leading to more frequent online interaction as well. Hence it is possible that high frequency of face-to-face meetings may lead to more expressive messages and communicative instrumental messages in computer-mediated communication just because greater frequency of FtF meetings creates a norm or expectation of more, and more varied communication. In contrast, teams that meet infrequently face-to-face may be less likely to meet and communicate with their team members online because they have not built that foundation (Gibson & Cohen, 2003; Lipnack & Stamps, 2000). Thus, the following hypotheses were posited:

H2a: Hybrid teams with a higher frequency of face-to-face meetings will communicate more frequently online than will teams with a lower frequency of face-to-face meetings.

H2b&c: Hybrid teams with a higher frequency of face-to-face meetings will exchange b) expressive messages, and c) communicative instrumental messages, more frequently online than will teams with a lower frequency of face-to-face meetings.

As non-communicative instrumental messages were not investigated in previous research on face-to-face settings, the following research question is posited:

RQ2: In hybrid teams, what is the relationship between the frequency of

face-to-face meetings and the frequency of exchanging non-communicative instrumental messages in online interactions?

The Additive Impact of the Frequency of FtF Meetings

Finally, an additive impact is expected such that the willingness to engage in online communication and exchange different types of online messages with other team members will be the strongest in teams that meet more frequently face-to-face and have higher levels of PSCC. The following hypotheses and research question are posited:

H3a: A hybrid team's frequency of face-to-face meetings and levels of PSCC will be additive and increase the willingness to communicate online.

H3b&c: A hybrid team's frequency of face-to-face meetings and levels of PSCC will be additive and increase the willingness to exchange b) expressive messages, and c) communicative instrumental messages online.

RQ3: What is the relationship between a high FtF PSCC and high FtF frequency of meetings and the exchange of non-communicative instrumental messages?

Methods

Sample

Data were collected from 273 students enrolled in a business communication course at a medium-sized midwestern U.S. university. As summarized in Table 1, the sample was 56% male ($n = 154$) and 44% female ($n = 119$) ranging in age from 18 to 54 ($M = 21$, $SD = 3.55$). Approximately 35% of the respondents were sophomores, 30% were juniors, 21% were freshmen, followed by 13% seniors, and 1% graduate students. Around 76% of the respondents indicated that they felt comfortable using electronic communication (email, class discussion board, etc.) in general. Approximately 70% of

respondents indicated that they felt comfortable working with other people and working with other people via electronic media.

Procedures

Undergraduates enrolled in a business communication course were directed to a website containing an online survey as part of a class assignment or for extra credit. (See Appendix for a copy of the online survey). The first part of the survey provided a scenario description and the measure of a psychologically safe communication climate (described below). Respondents were asked to read only one of the scenarios about a particular face-to-face team work experience. After reading the scenario, the respondents were asked a series of questions about how they perceived the face-to-face communication climate in the scenario. Secondly, they completed a questionnaire that asked how they might communicate electronically with members of the team in this scenario. They were asked to report the expected frequency of online communication, as well as the expected willingness to exchange expressive messages, communicative instrumental messages and non-communicative instrumental messages. Finally demographic data were collected.

Scenarios

To test the hypotheses and answer the research questions, four distinct scenarios were prepared for a 2X2 design. Scenarios were hypothetical but were also quite consistent with the types of group work experiences respondents would complete during the semester. The scenario descriptions involved a group interacting and collaborating while working on a group project in face-to-face meetings. Both independent variables, PSCC in face-to-face meetings (high and low) and frequency of face-to-face meetings

(high and low), were clearly delineated in the four scenarios (See Appendix). The PSCC scales developed by Gibson and Gibbs (2006) and Edmondson (1999) were used as a basis for creating high and low levels of PSCC in the scenarios,

Manipulation Check

After reading the scenario, respondents were asked to report how they perceived the group communication climate described in the scenario. As indicated in Table 2, a one-way ANOVA indicated significant differences, $F(1, 273) = 300.64, p < .01$, in perceived PSCC between high- ($M = 4.13, SD = .99$) and low-PSCC scenarios ($M = 2.00, SD = 1.00$). As indicated in Table 3, there was also a significant difference, $F(1, 273) = 64.36, p < .01$, in perceived frequency of face-to-face communication between high ($M = 3.69, SD = 1.32$) and low FtF frequency scenarios ($M = 2.54, SD = 1.02$). The manipulation checks indicated that the perceptions of the scenarios were as intended.

Questionnaire

A 15-item questionnaire asked respondents to keep the scenario description they read in mind and imagine how they would communicate with group members via electronic media (e.g. email, class discussion board, etc.) if they were required to complete the group project (described in the scenario) using only online communication. The questionnaire asked respondents to report their expected frequency of online communication and their willingness to exchange each of the three types of online messages (expressive, communicative instrumental, and non-communicative instrumental) within the group. Based on Ibarra's (Ibarra, 1995; Ibarra & Andrew, 1993) conceptual framework for network tie classifications, the current study developed five items for measuring each of the three types of online messages. See Appendix for a copy of all the

items on the questionnaire.

Results

Online Communication Measures

Principle components factor analysis was used to determine how the five items for each of the three types of online messages clustered. Analysis showed that one item for expressive messages and two items for communicative instrumental messages were cross-loaded and, therefore, these three items were dropped from the statistical analysis. An alpha coefficient was then used to estimate the internal reliability of the new scales for willingness to exchange expressive messages ($\alpha = .85$, $M = 3.23$, $SD = 3.45$), willingness to exchange communicative instrumental messages ($\alpha = .75$, $M = 3.93$, $SD = 2.03$), and willingness to exchange non-communicative instrumental messages ($\alpha = .87$, $M = 3.24$, $SD = 4.45$). These reliabilities were considered acceptable (Cronbach, 1951).

Levels of PSCC and Online Communication

Hypothesis 1a predicted that in hybrid collaborative teams, online communication will be more frequent when the level of the psychologically safe communication climate in FtF meetings is high than when the level of the PSCC in FtF meetings is low. As indicated in Table 4, a two-way ANOVA indicated that high PSCC groups ($M = 3.71$, $SD = .91$) had significantly higher expected frequency of online interactions, $F(1, 269) = 43.99$, $p < .01$, than low PSCC groups ($M = 2.94$, $SD = .98$). Hypothesis 1a was supported.

Hypothesis 1b, Hypothesis 1c and RQ1 examined the impact of PSCC in FtF meetings on the frequency of exchanging different types of online messages. As indicated in Table 5, the MANOVA comparing team members' willingness to exchange expressive,

communicative instrumental, and non-communicative instrumental messages, across levels of PSCC was not significant, Wilks lambda = .98, $F(3, 267) = 1.60, p > .05$. Due to the exploratory nature of this study, univariate effects were also examined. These indicated that in high PSCC groups ($M = 3.99, SD = .71$), participants indicated a greater willingness to produce instrumental messages, $F(1, 269) = 3.88, p < .05$, than in low PSCC groups ($M = 3.84, SD = .61$). There were no significant differences between high PSCC groups and low PSCC groups in terms of participants' predictions of frequency of expressive or non-communicative instrumental messages. Hence perceived level of higher PSCC in FtF meetings appears to lead to a greater likelihood of exchanging communicative instrumental messages online, but not expressive or non-communicative instrumental messages. H1b was not supported, H1c was supported, and the response to RQ1 is that frequency of non-communicative messages is not linked to PSCC.

Frequency of FtF Meetings and Online Communication

Hypothesis 2a predicted that online communication will be more frequent in teams with a higher frequency of face-to-face meetings, than in teams with a lower frequency of face-to-face meetings. Table 4 shows that there was no significant difference between high FtF frequency groups ($M = 3.46, SD = 1.09$) and low FtF frequency groups ($M = 3.00, SD = .93$), in terms of perceived frequency of online communication, $F(1, 269) = 1.08, p > .05$. Hypothesis 2a was not supported.

Hypothesis 2b, Hypothesis 2c and RQ2 examined the impact of the frequency of FtF meetings on members' frequency of exchanging different types of online messages. An initial comparison of members' willingness to exchange the three types of messages online in high FtF frequency groups and low FtF frequency groups was significant, Wilks

lambda = .97, $F(3, 267) = 3.06, p < .05$. More specifically, the data indicated that in teams with a higher frequency of FtF meetings ($M = 3.34, SD = .87$) there was a significantly stronger willingness to exchange expressive messages online, $F(1, 269) = 5.63, p < .05$, than in teams with a lower frequency of FtF meeting ($M = 3.11, SD = .84$). Data also showed that in teams with a higher frequency of FtF meetings ($M = 4.03, SD = .69$) there was a significantly stronger willingness to exchange communicative instrumental messages online, $F(1, 269) = 6.92, p < .05$, than in teams with a lower frequency of FtF meetings ($M = 3.82, SD = .64$). For non-communicative messages, the data showed no significant differences between high frequency f2f meeting teams ($M = 3.26, SD = .94$) and low frequency FtF meeting teams ($M = 3.22, SD = .84$). $F = .08, p > .05$. See Table 5. Both H2b and H2c were supported, and the data for RQ2 indicated that frequency of FtF meetings and frequency of non-communicative messages were not linked.

Additive Impact of Face-to-Face Meetings and PSCC

The third set of hypotheses aimed to test the additive effects of number of face-to-face meetings and levels of PSCC in FtF settings on online interaction. H3a predicted that the more frequent the FtF meetings and the higher the levels of PSCC, the greater the perceived frequency of online communication. H3a was partially supported, $F(1, 269) = 4.04, p < .05$. As can be seen in Table 4, in teams with both high levels of PSCC in FtF meetings and a high frequency of FtF meetings, the expected frequency of communicating online was greater than frequency of FtF meetings alone, but not greater than in teams with high PSCC alone. Hence teams that met more frequently were not expected to communicate frequently online unless there was also high PSCC in those

groups. However, as indicated in Table 5, this additive relationship did not hold for any of the specific types of messages.

Table 6 provides the means for the perceived frequency of the three types of online messages within each of the four scenarios. A cursory look at the raw means shows they are highest for instrumental online messages across all scenario types. In addition, all messages types have higher means in the High PSCC and High Frequency condition as compared to the other three conditions. Respondents also indicated that in the Low PSCC and Low Frequency condition, they would be less likely to use expressive and instrumental online messages than in the other three conditions.

Discussion

The present study examined two factors associated with the impact of face-to-face interactions on hybrid collaborative teams--a psychologically safe communication climate in FtF meetings and the frequency of face-to-face meetings. Three conclusions are warranted from the data. First, respondents indicated that if there was a psychologically safe climate in FtF group meetings, they would be more likely to communicate online with their team members, and in particular, to exchange communicative instrumental messages. Second, respondents indicated that in teams that met more frequently face-to-face, they would be more likely to communicate both expressive and communicative instrumental online messages, but would not necessarily be more likely to communicate more frequently online. Third, when frequent FtF meetings were combined with a psychologically safe communication climate in FtF meetings, respondents indicated that they would be more likely to communicate online.

PSCC and Online Interaction

The results of this investigation suggest that in teams with higher levels of a psychologically safe FtF communication climate, team members indicate they are more likely to communicate online with other team members. Previous research has focused on critical effects of PSCC on attitudes such as satisfaction and commitment in collocated teams, but has suggested that PSCC in distributed teams can be weakened because of the lack of social cues in the virtual environment (Gibson & Gibbs, 2006). This study contributes to the literature by suggesting the importance of PSCC for semi-virtual (hybrid) teams.

The results of this study suggest that there may be an important interplay between PSCC and online communication behaviors. This is probably because when individuals feel psychologically safe in FtF meetings, it is easier for them to establish relationships and develop a sense of belonging to the team, allowing participants to put a face to a name when they interact online. Therefore, FtF PSCC lays the groundwork for team members' favorable attitudes towards computer-mediated communication and encourages a relatively high intensity of online interactions.

In addition, results suggested that a higher perceived level of PSCC in FtF meetings might lead to a greater likelihood of exchanging communicative instrumental messages online. This finding extends Edmondson (1999)'s study, which reported that psychological safety plays a critical role in fostering team learning and innovation by increasing instrumental communication in face-to-face meetings. It seems likely that PSCC also facilitates online instrumental communication required to complete tasks.

Interestingly, PSCC only had an effect on the perceived exchange of communicative instrumental messages, not non-communicative instrumental messages.

One reason for this may be because non-communicative messages do not really involve communication and therefore would not be impacted by levels of PSCC which is a primarily a mechanism for developing communicative ties between members. Hence participants may have assumed there would be no relationship between these two variables.

In addition, participants indicated that PSCC would not have a significant effect on their willingness to exchange expressive messages with other team members in online interactions. This difference between expressive and instrumental messages might be explained by the nature of hybrid teams, which offer both face-to-face and electronic media choices. It may be members of hybrid teams don't feel it necessary to exchange expressive messages online because they have the option of exchanging these types of messages in face-to-face meetings. This finding lends credence to the cost minimization theory (Reinsch, 1990) which posits that media choice is in part an attempt to reduce perceived personal costs. For communication tasks that are significant relational issues, rich media--media that protect against impact discrepancy and relationship disruption--will be less costly than lean media. Hence, face-to-face communication might be viewed as less risky for expressive messages than computer-mediated communication.

Frequency of FtF Meetings and Online Interaction

The second set of hypotheses examined the interplay between the frequency of face-to-face communication and online interactions in hybrid teams. Results revealed that the frequency of meetings was not significantly related to the perceived frequency of online messages but was significantly related to the perceived frequency of exchange of both expressive and instrumental messages online.

These results indicate that frequency of meetings is more important in encouraging the exchange of expressive messages than is the presence of PSCC. This finding is consistent with some practitioner literature on distributed teams which emphasizes the need for frequent face-to-face meetings for improved project planning (Powell, Piccoli, & Ives, 2004), project definition (Ramesh & Dennis, 2002), team development (Saunders, 2000), and building relationships and trust among team members (Suchan & Hayzak, 2001).

One possible explanation for why the frequency of FtF meetings seems to have a greater impact on team members' willingness to exchange expressive messages online is that respondents linked frequency of FtF meetings (more so than PSCC) with relationship building. It may be that the measures of PSCC (e.g. risk taking, speaking up, etc.) are more measures of instrumental communication than expressive communication, so respondents viewed teams with a psychologically safe climate as exchanging primarily task-related information, not expressive information. Hence they may have assumed that these types of teams would also not exchange expressive information online. Answering questions about the links between various FtF team characteristics and subsequent types of online messages clearly requires much additional investigative work.

Additive Effect of PSCC and Frequency of FtF Meetings

The third objective of the current study was to examine whether the number of face-to-face meetings and the levels of PSCC together affected perceived frequency of computer-mediated communication. Supporting our expectation, it appears that frequency of online communication (as least as perceived by these respondents) would be increased in teams with both high levels of PSCC and high frequency of FtF meetings, as compared

to teams that just had frequent meetings. In other words, although frequency of meetings alone would not produce a greater frequency of online communication, if teams with high PSCC also held frequent meetings, then those types of teams would also be likely to communicate frequently online.

The findings suggest that high frequency of meetings is best accompanied by high levels of PSCC in those meetings if a higher frequency of online communication is desired. However, this is only true for *frequency* of communication and does not apply to members' willingness to exchange specific types of online messages. A possible explanation for this finding is the fifteen items developed in the current study to measure team members' willingness to exchange different types of messages online do not include all online communication possibilities. The current study asked respondents to indicate how often they would send three types of messages online. However, it is possible that even though respondents thought they would communicate more frequently online, they would not produce these types of messages. If this explanation is correct, it is a puzzle as to what those other types of messages might be. Future research is needed to explore this phenomenon further.

Moreover, it is important to remember that frequency of FtF communication does not indicate valence of online messages in this study. So teams that meet frequently and don't feel comfortable working with each other may be more likely to produce expressive and instrumental communication online (as these results suggest), but that virtual communication may be equally as unproductive as that produced in their frequent FtF meetings. Parceling out frequency and valence of the subsequent online communication is an important project for future research.

Implications for Practice

Managing a hybrid (or virtual) team may take more effort than managing a face-to-face team and may require a different kind of effort than most managers are used to expending. Findings from the current study have some important implications for managers of these types of teams in terms of encouraging frequency of meetings and establishing a psychologically safe communication climate.

First, in terms of frequency of meetings, results suggest that face-to-face communication prior to online interactions is important to create and sustain social relationships that enable distributed work. These findings suggest that distributed teams should make time to have face to face meetings with their hybrid team early on in the project. Periodic face-to-face meetings throughout the project would probably also be useful to encourage team members to maintain active and rich communication networks in the virtual collaborative environment. By creating bonds and raising the comfort level amongst team members through face to face meetings, productivity in a virtual team may actually increase. Hence, virtual team managers might take advantage of the moments of physical contact before virtual collaboration to build group social capital and trust, thus increasing team members' willingness to contribute to subsequent distributed work via CMC.

Second, if managers have very little control over face-to-face meeting frequency because of dispersion of members or resource constraints, they should work to develop a psychologically safe communication climate in limited face-to-face meetings. According to Edmondson (2003), team leaders have a powerful effect on psychological safety. Researchers have shown that team members are particularly aware of the behavior of the

leader, and leaders' responses to events and behaviors influence other members' perceptions of appropriate and safe behavior (Winter et al., 1997). As Edmondson (2003) suggested, "skilled team leaders can reward excellence, sanction poor performance, and at the same time embrace the imperfection and error that are inevitable under conditions of uncertainty and change." (p. 256)

One way to create a psychologically safe communication climate is to increase the non-task-related, informal communication among team members in meetings. According to Haythornthwaite, Wellman and Mantei (1995), informal communication, not related to organizational hierarchy, is based on personal friendships among coworkers. Informal communication supports the needs of individual group members so that they feel satisfied with their work, their relationships, and their membership in the group. Informal communication might increase both expressive and instrumental information exchange in meetings, and lead to richer online interactions.

Team leaders might also remind team members to contribute to shared leadership. In most virtual teams, which are composed of experts from different fields and thus do not necessarily have hierarchical leadership structures, the manager usually has to work to create a structure that fosters teamwork and helps the team regulate itself. In such a situation, having a leadership structure in which everyone shares leadership is likely to produce a more psychologically safe communication climate than would a hierarchical leadership structure.

In conclusion, these findings suggest that both increasing the number of face-to-face meetings, and working to build a PSCC among team members, are important prior to online interactions of hybrid teams. In the best of all worlds, it appears that a

strong FtF PSCC alone, or a combination of high frequency of FtF meetings and high PSCC, result in more subsequent online communication (especially communicative instrumental messages). In situations where only one or the other of these options may be possible, it appears either will increase frequency of message online.

Limitations

A few limitations of this study should be noted when interpreting the findings. First, the current study relies heavily on individuals' perceptions of hypothetical scenarios collected through an online survey. None of the data was gathered from actual channel choices. Therefore, the research reported here may suffer from the common-method bias. Second, only undergraduate students were recruited as the study sample which might not be generalizable to all hybrid teams. For example, compared to work teams in which team members have longer relationship history, student groups might be more task-oriented and have a lower likelihood of sharing expressive messages such as their personal feelings and informal types of communication. Third, to examine how face-to-face interactions affect online interactions, current methods only included scenarios of hybrid teams that begin with face-to-face contacts. Such a scenario might not hold true for many hybrid collaborative teams. The scenarios utilized in the current study may have provided a limited view of how hybrid teams progress through a project.

Future Research Directions

In addition to efforts to address the methodological limitations described above, this investigation points to some future lines of inquiry. First, future research is needed to understand what factors associated with FtF interactions might affect members' willingness to share expressive messages online such as their personal feelings and more

informal types of communication. One possible factor is the frequency of informal communication (Haythornthwaite, Wellman & Mantej, 1995). It is likely that such non-task related information exchange in FtF meetings helps recruit and socialize members, and keeps them happy enough so that they want to maintain memberships in online interactions.

Future studies might investigate the role of frequency of face-to-face meetings on virtual communication in teams with mixed types of interaction modes. Some hybrid teams start off face-to-face and then later include virtual communication. Other teams start off with virtual communication and then later incorporate FtF meetings. According to Fiol and O'Connor (2005), the motivators of group trust and identification differ across face-to-face and virtual settings. So it is highly likely the initial interaction medium (FtF or virtual) has an impact on how heavily team members rely on face-to-face meetings to build trust and maintain relationships.

Finally, to explore the nature of the interplay between FtF communication and online interactions, actual hybrid teams should be recruited in future investigations. The current study relied heavily on individuals' perceptions of group communication climate and their perceived propensity to use computer-mediated communication. However, PSCC is more a group-level measure, and behavioral data would allow researchers to explore the nature of this interplay on the team level. For example, both group FtF communication climate data and online communication behavior data could be collected by averaging team members' self-report data, or even by coding their communication transcripts.

Conclusion

The present study examined two factors associated with the impact of face-to-face interactions on hybrid collaborative teams--a psychologically safe communication climate in FtF meetings and the frequency of face-to-face meetings. With the growing popularity of hybrid collaborative teams, these findings suggest a vital role for both face-to-face meetings in improving the frequency and richness of team members' online interactions, as well as the importance of a PSCC in their FtF meetings. Results suggest that hybrid teams that require a considerable amount of online interaction to accomplish tasks should be encouraged to hold face-to-face meetings prior to online interaction (if possible), and to make extra efforts to develop a psychologically safe communication climate in these meetings in order to improve virtual team communicative practices.

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APPENDIX

Survey of Face-to-face Communication Climate and Online Message Exchanges

By completing the following survey, you are voluntarily agreeing to take part in this research study. Completing the survey indicates that you have read the consent form on the previous page, have had all of your questions answered, and that you are 18 years of age or older.

For the purpose of this survey, you will be asked to imagine yourself in the group described next. This description indicates how the group interacts and collaborates while working on a group project. After reading the description of this group, you will be asked to imagine how you would communicate with group members via electronic media (e.g. email, D2L, etc) if you were required to complete the group project using only online communication. Please read the following description carefully before you answer the survey questions.

High Communication, High PSCC

Scenario 1: This semester you are enrolled in Communication 105-Business and Professional Communication. For this class you are required to complete a group project that accounts for 60% of your final grade. Your instructor has assigned you into a group with four other students to work on this group project for the rest of this semester.

You have already spent a lot of time communicating face-to-face with your group members about the group project. In other words, you communicate with group members in face-to-face meetings very frequently, and you find the group communication to be very comfortable. Everyone in the group seems to be willing to say that they think and feel. Whenever there is a problem, group members talk about it openly. Group members use communication that is considerate of other group members' feelings. The communication climate in this group is open and welcoming, and team members are willing to take risks without fear of rejection. Working in this group, you feel that your unique skills and talents are valued and utilized.

Low Communication, High PSCC

Scenario 2: This semester you are enrolled in Communication 105-Business and Professional Communication. For this class you are required to complete a group project that accounts for 60% of your final grade. Your instructor has assigned you into a group with four other students to work on this group project for the rest of this semester.

You have not spent much time communicating face-to-face with your group members about the group project. In other words, you don't communicate very frequently with group members in face-to-face meetings, but the small amount of communication that has taken place has been very comfortable. Everyone in the group seems to be willing to say that they think and feel. Whenever there is a problem, group members talk about it

openly. Group members use communication that is considerate of other group members' feelings. The communication climate in this group is open and welcoming, and team members are willing to take risks without fear of rejection. Working in this group, you feel that your unique skills and talents are valued and utilized.

High Communication, Low PSCC

Scenario 3: This semester you are enrolled in Communication 105-Business and Professional Communication. For this class you are required to complete a group project that accounts for 60% of your final grade. Your instructor has assigned you into a group with four other students to work on this group project for the rest of this semester.

You have already spent a lot of time communicating face-to-face with your group members about the group project. In other words, you communicate with group members in face-to-face meetings very frequently, but you find the group communication to be very uncomfortable. None of the group members seems willing to say that they think and feel. Whenever there is a problem, group members do not talk about it. Group members use communication that is inconsiderate of other group members' feelings. The communication climate in this group is rejecting and hostile, and team members are unwilling to take risks for fear of rejection. Working in this group, you feel that your unique skills and talents are not valued and never utilized.

Low Communication, Low PSCC

Scenario 4: This semester you are enrolled in Communication 105-Business and Professional Communication. For this class you are required to complete a group project that accounts for 60% of your final grade. Your instructor has assigned you into a group with four other students to work on this group project for the rest of this semester.

You have not spent much time communicating face-to-face with your group members about the group project. In other words, you don't communicate very frequently with your group members in face-to-face meetings, and you find the group communication to be very uncomfortable. None of the group members seems willing to say that they think and feel. Whenever there is a problem, group members do not talk about it. Group members use communication that is inconsiderate of other group members' feelings. The communication climate in this group is rejecting and hostile, and team members are unwilling to take risks for fear of rejection. Working in this group, you feel that your unique skills and talents are not valued and never utilized.

Please answer the following two questions regarding the group description you just read.

1. Based on the group description you just read, please indicate the degree to which agree or disagree with each of the statements below.

1 = Strongly Disagree, 2= Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

-
1. Group members feel comfortable asserting their opinions and feelings.
 2. When there's a problem, group members talk about it.
 3. Group members are able to say what they think.
 4. Group members are considerate of others' feelings.
-
2. Please rate your perception of the how supportive/positive the communication climate is within this group.
 1. Not at all
 - 2.
 3. Average
 - 4.
 5. Very much so.
 3. Please rate how comfortable you think you would be working in this group.
 1. Very Uncomfortable
 2. Uncomfortable
 3. Average
 4. Comfortable
 5. Very Comfortable
-

3. Based on the group description you just read, please indicate how frequently you think this group communicates.

- 1 = Very Infrequently
- 2 = Infrequently
- 3 = Average
- 4 = Frequently
- 5 = Very Frequently

Part 2

Now assume that you are halfway through this group project. To this point in the project your group has only worked together face-to-face. But now your instructor wants you to gain experience using electronic communication (a reality in the business world), so your group is required to use email or a D2L discussion board, or other electronic means for communication to accomplish the rest of your group project. Please keep the group description you read in Part 1 in mind, and answer the following questions regarding how you think you would communicate with your group members using only electronic communication to complete your group project.

1. How frequently do you think you would communicate via electronic media (e.g. emails, D2L discussion board, Facebook, etc.) with members in this group?

- 1 = Very Infrequently

- 2 = Infrequently
- 3 = Average
- 4 = Frequently
- 5 = Very Frequently

3. How comfortable do you think you would be communicating via electronic media (e.g. emails, D2L discussion board, Facebook, etc.) with members in this group?

- 1=Very Uncomfortable
- 2=Uncomfortable
- 3=Neutral
- 4=Comfortable
- 5=Very Comfortable

4. How likely do you think it is that you will send the following types of messages to members in this group via electronic media (e.g. emails, D2L discussion board, Facebook)?

- 1 = Very Unlikely
- 2 = Unlikely
- 3 = Average
- 4 = Likely
- 5 = Very Likely

ITEMS

Items for “non-comm instrumental” messages

1. I would use electronic media to transmit files to team members without including any other message.
2. I would use electronic media to attach files such as helpful articles to team members without including any other message.
3. I would use electronic media to attach information such as a helpful website link for our project without including any other message.
4. I would use electronic media to provide any helpful files, articles, or links without including any other message.
5. I would use electronic media to attach or post any files that might be helpful to team members without including any other message.

Items for “comm. instrumental” messages

6. I would use electronic media to exchange ideas about the group project
7. I would use electronic media to provide feedback about other group members' ideas
8. I would use electronic media to offer task-related assistance to other group members
9. I would use electronic media to discuss the tasks and work that is required to complete our project

10. I would use electronic media to communicate about the work needed to complete the project.

Items for “expressive” messages

11. I would use electronic media to send messages that make others in the group feel valued.
12. I would use electronic media to provide messages that indicate how much I appreciate other group members
13. I would use electronic media to support the feelings of other group members.
14. I would use electronic media to talk with members in this team about my personal life or things beyond just work.
15. I would use electronic media to send messages that would improve the relationships among the team’s members.

Part 3. Please answer the following questions based on your own experience.

1. In general, how comfortable are you when you use electronic communication (email, D2L, etc)?

- 1=Very Uncomfortable
 2=Uncomfortable
 3=Neutral
 4=Comfortable
 5=Very Comfortable
 6=Have never used electronic media

2. Have you ever had any group work experience?

1. Yes
 2. No

3. If you have ever worked in a group, how comfortable are you when you work with other people?

- 1=Very Uncomfortable
 2=Uncomfortable
 3=Neutral
 4=Comfortable
 5=Very Comfortable
 6=Have never worked in a group

4. Have you ever used electronic media (email, D2L, etc) for group work?

1. Yes
 2. No

5. If you have ever used electronic media for group work, how comfortable are you when you work with other people via electronic media (email, D2L, etc)

- 1=Very Uncomfortable
 2=Uncomfortable

-
- 3=Neutral
4=Comfortable
5=Very Comfortable
6=Have never used electronic media for group work

Part 4: Participant Characteristics

1. Gender
 Male
 Female
 Other
Please specify: _____
2. Age _____ (Please specify in years)
3. Current year in school (in terms of credit hours)
 Freshman Sophomore
 Junior Senior
 Graduate Other Please specify: _____

Table 1 Respondent Demographics

Demographic variables	Mean		SD
Age	21.13		3.55
Current year in school		Freshman: .21	
		Sophomore: .35	
		Junior: .30	
		Senior: .13	
		Graduate: .01	
Sex (percentage)		Female: .44	
		Male: .56	
Comfort level of using electronic communication	4.12		1.16
Comfort level of working with other people	3.99		.91
Comfort level of working with other people via electronic communication	4.00		0.10

Table 2 Manipulation Check for Perceived High and Low PSCC

Source of Variation	Sum of Squares	d.f.	Mean Square	F	<i>p</i>
Between Groups	298.71	1	298.71	300.64	.00**
Within Groups	271.25	273	.994		
Total	569.96	274			

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

Table 3 Manipulation Check for Perceived Meeting Frequency

Source of Variation	Sum of Squares	d.f.	Mean Square	F	<i>p</i>
Between Groups	90.84	1	90.84	64.36	.00**
Within Groups	385.34	273	1.41		
Total	476.18	274			

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

Table 4 Meeting Frequency, PSCC Levels, and Willingness to Communicate Online

Source of Variation	Sum of Squares	d.f.	Mean Square	F	<i>p</i>
Main effects					
FtF frequency	.938	1	.938	1.08	.301
PSCC	38.37	1	38.37	43.99	.00**
FtF frequency*PSCC	3.52	1	3.52	4.04	.045*
Error	234.61	269	.87		
Total	3441.99	273			

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

Table 5 Meeting Frequency, PSCC Levels, and Willingness to Exchange Expressive, Communicative, Instrumental, and Non-Communicative Instrumental Messages Online

Source of Variation	Dependent Variable	Sum of Squares	d.f.	Mean Square	F	<i>p</i>
Main effects						
FtF frequency	expmean	4.12	1	4.12	5.63	.02*
	instmean	3.08	1	3.08	6.92	.01**
	nonmean	.07	1	.07	.08	.77
PSCC	expmean	1.99	1	1.99	2.72	.10
	instmean	1.73	1	1.73	3.88	.05*
	nonmean	.58	1	.58	.73	.39
FtF frequency*PSCC	expmean	.61	1	.61	.83	.36
	instmean	.00	1	.00	.01	.94
	nonmean	.24	1	.24	.30	.58
Error	expmean	196.59	269	.73		
	instmean	119.60	269	.45		
	nonmean	214.41	269	.80		
Total	expmean	3051.88	273			
	instmean	4346.78	273			
	nonmean	3084.36	273			

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

Table 6 Descriptive for Four Scenarios

	Expressive		Communicative Instrumental		Non-Communicative Instrumental	
	Mean	SD	Mean	SD	Mean	SD
High PSCC	3.37	.81	4.10	.74	3.33	.91
High Frequency						
High PSCC	3.21	.88	3.89	.67	3.23	.87
Low Frequency						
Low PSCC	3.29	.96	3.94	.62	3.17	.97
High Frequency						
Low PSCC	2.94	.74	3.72	.59	3.20	.80
Low Frequency						