The Rules of Virtual Groups: Trust, Liking, and Performance in Computer-Mediated Communication

By Joseph B. Walther and Ulla Bunz

Research on virtual groups reflects concerns about the development of trust and liking and about the performance of partners who do not see each other or work proximally. Previous studies have explored behaviors leading to subjectively experienced trust and/or liking, or trusting behaviors associated with group output, but have not linked behaviors, subjective affect, and output quality. Deriving principles from the social information processing theory of computer-mediated communication, this research identified and tested six communication rules for virtual groups. Employing a quasi-experimental procedure to maximize the variance in rule-following behavior, some distributed groups in a cross-university course were assigned to follow rules as part of their grades on group assignments conducted using computer-mediated communication from which messages were collected and later coded. Through self-reported measures of rule following and affect, results reveal correlations between each rule with trust and liking. Less consistent are the relationships between rule following, specific observed behaviors, and actual performance quality. Interpretations suggest that a powerful set of collaboration rules has been identified or that the mere following of any rules and norms reduces uncertainty and enhances trust in distributed work teams.

A surge of research and increasing adoption of distributed groups in various settings indicate the growing reach of virtual teams. Understanding the promise and problems of these entities can inform contemporary theory in the areas of new technology and group communication and improve the management of distributed groups, learning communities, and virtual organizations.

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Among the concerns over virtual groups is how their members develop trust and liking for partners whom they never see and with whom they do not share physical space and local context. Previous studies have explored behavioral variables leading to subjectively experienced trust and/or liking (e.g., Weisband & Atwater, 1999) or trusting behaviors that are associated with group productivity (e.g., Iacono & Weisband, 1997). These studies, however, do not connect all the elements for a complete view of antecedents to trust and liking perceptions, behaviors, and performance. A number of researchers have examined behaviors ad hoc (e.g., Cramton, 2001) or post hoc (e.g., Jarvenpaa, Knoll, & Leidner, 1998), but fewer have deliberately instigated communication behaviors in virtual group settings in order to evaluate their impact. Previous studies on face-to-face (FtF) groups, however, have shown a variety of "formal procedures" that groups may be induced to use that enhance their processes and outcomes (Sunwolf & Seibold, 1999). Among these are "sets of rules or guidelines which specify how a group should organize its process" to enhance effectiveness and satisfaction (Poole, 1991, p. 55). Moreover, in computer-mediated communication (CMC), the reciprocation of induced group norms may have more potent effects than among FtF partners (Walther, 1997). By deriving principles from the social information-processing (SIP) theory of CMC (Walther, 1992) and drawing on the "best practices," or successful strategies of virtual groups described in other studies, this research employed a quasi-experimental procedure to increase the variance in behaviors expected to affect the experience of virtual groups and to offer empirical interconnections among group communication behaviors, self-reported perceptions of trust and liking, and the quality of outcomes in distributed groups.

Virtual Teams

Virtual teams are groups in which interdependent members collaborate from different locations using communication technology. Virtual teams have the potential to offer greater flexibility, responsiveness, and diversity of perspectives than traditional groups do (see Jarvenpaa et al., 1998). Despite these potentials, however, virtual teams encounter numerous challenges because of their dispersion and communication limitations that can impede their effectiveness or at least require great efforts to accommodate to virtual environments and partners.

Impacts of Virtuality

Geographic dispersion among group members incurs a number of disruptive effects, including incongruities in work environments and temporal differences associated with locations, creating disparities in working contexts disrupting shared work interpretations (Hinds & Bailey, 2000). Cramton (2001), for instance, found that geographic differences in teams leads to disruptions in common knowledge and attributional patterns. Specifically, members remain unaware of the situational and contextual factors that impact other team members, leading to misunderstandings and inappropriate attributions for behaviors that appear situationally based and normal to local actors, but personality-based and disruptive to remote partners.

In addition to geographic issues, the characteristics of CMC may also incur problems affecting relational communication and trust, as well as the productivity or quality of groups' work. Relational communication pertains to the reciprocal processes of how partners regard one another and how they express that regard. The dimensions of this regard include partners' affection, cohesion, task orientation versus social orientation, formality, and dominance, among other themes. Several prominent approaches to the effects of CMC argue that, because relational cues are normally conveyed nonverbally, the absence of nonverbal cues in email and computer conferencing occludes the expression of interpersonal dynamics. As a result, it is argued, CMC may make relational development, which is critical to the social dimensions of group work, difficult or impossible (see Walther & Parks, 2002). Nardi and Whittaker (2002), for example, argued that proximity and FtF interaction are critical for establishing collaborative interpersonal relationships built on nontask communication early in working partners' interactions. Numerous scholars have identified shortcomings of CMC in group communication, a complete review of which is beyond the scope of this research (but see Hinds & Kiesler, 2002).

Trust is another relational dimension that has received particular attention in virtual teams research. Handy (1995) asserted that trust simply cannot be maintained in virtual teams. According to Jarvenpaa and Leidner (1998, n.p.), trust is traditionally considered to be based on "personal relationships and past or future memberships in common social networks that define the shared norms of obligation and responsibility," which may or may not fit the conditions of virtual teamwork. In CMC research, trust has been found to be positively related to performance (Cascio, 2000; Jarvenpaa et al., 1998), problem and uncertainty resolution, and social information exchange (Jarvenpaa & Leidner, 1998). Like other relational dynamics, trust has been found to diminish with the relative lack of visual and vocal cues that text-based CMC implies (Bos, Olson, Gergle, Olson, & Wright, 2002; Rocco, 1998), although not universally (e.g., Feng, Lazar, & Preece, 2003).

Finally, the quality of CMC groups' output—productivity and decision making—may be suboptimal compared to that of FtF counterparts. These decrements may be due to the relational dynamics discussed above or to discretionary participation in asynchronous interaction, free riding, difficulty integrating information, or other information-processing aspects of virtual work (see, e.g., Smith & Vanacek, 1990).

In sum, a number of problems associated with distance and restricted communication media have been alleged to impact the ability of distributed groups to function as effectively as nonmediated groups. From one perspective, these disparities may seem insurmountable, given that the constraints of distance and media are relatively impervious when groups operate virtually. However, other research indicates that the bases for the deleterious effects of distance and media are more permeable. Accommodations may emerge or be instigated by which participants adjust to the alternative environment, and/or the bases of the relational dynamics themselves may change.

Accommodations to Virtuality

Alternative approaches and findings challenge the contention that virtual groups are impotent with regard to relational dynamics, trust, and performance. They

also suggest strategies for the deliberate remediation of virtual groups' potential problems.

Liking, for instance, accrues differently in CMC than in FtF groups. Weisband and Atwater (1999) compared brief experimental CMC and FtF groups on the members' liking for one another. They found a significant correlation in CMC groups between the frequency of a member's task-related messages and the degree to which other members liked the contributor. In FtF groups there was no such relationship. The authors concluded that liking in offline groups is based on nonrational or nontask bases of attraction, whereas in CMC, partners like more those who contribute to their groups' endeavors. One implication of this finding may be to encourage virtual group members to communicate task contributions very frequently.

Whereas liking in short-term groups may be based on task-related behavior, long-term groups seem to benefit from the exchange of sociability that accrues over time despite the limitations of CMC. Walther's (1992) SIP theory predicts that CMC users adapt to the restriction of nonverbal cues by imbuing their messages with both task and social information. Because of the decrements in carrying capacity of CMC, such communication requires more frequent interactions and/or more time in order for users to reach the level of relational development that FtF partners accomplish more quickly. Given enough time, however, CMC groups achieve liking, trust, and sociable states (Walther & Burgoon, 1992). Indeed, CMC group members who exchanged a number of messages over several weeks and projects liked each other more than did short-term groups (Walther, Slovacek, & Tidwell, 2001). Both the Weisband and Atwater (1999) results and those of Walther et al. suggest that accumulated messages lead to greater liking. It is unclear whether task-related, socially related, or either kind of messages will do. Both have been implicated in the literature (e.g., Abrams, Cross, Lesser, & Levin, 2003). Thus, another implication may be to encourage frequent exchange of social messages in addition to task messages. A research question addresses this issue:

> RQ: What are the relative effects of social- and task-related messages on affective and substantive outcomes in virtual groups?

Like the effects of group liking, SIP shows that trust develops over time in longer term virtual groups (Walther & Burgoon, 1992). Jarvenpaa and Leidner (1998) argued that online trust is behaviorally based, inferred from observations about other members' electronic communication. These researchers facilitated 29 global, virtual student teams comprised of six to eight members over 6 weeks' time. Participants completed self-reported measures of trust after a median time period and at the end of the teams' work. On that basis the researchers classified teams as high, moderate, or low in trust and then analyzed the transcripts of teams' interactions in order to identify behaviors common to trusting and untrusting teams. Team members with the highest levels of trust had been sociable, exchanged intensely frequent messages, showed interest in other members' responses, showed initiative, provided substantive feedback to one another, and notified others of their expected participation periods or absences. Those with the lowest

levels of trust exhibited little initiative and had little social content in their messages. Groups with moderate trust levels had predictable but infrequent communication, focused their messages on tasks only, and devoted a disproportionate level of messages to establishing rules and procedures.

In another investigation of trust, Iacono and Weisband (1997) argued that "action forms" promote trust in virtual groups. These researchers focused specifically on the exchange of messages initiating work processes (asking a specific question or proposing action, implicating a response from others) and on messages responding directly to and thereby confirming such initiations, as behaviors that equate to trust. Iacono and Weisband facilitated 14 self-selected virtual teams among students at several universities for 3 weeks. They coded groups' messages for initiations and responses in several categories: getting together, work process, work content, technical aspects, contact regulation, and fun. They also evaluated the quality of the groups' collaborative papers as a measure of performance. Results showed that initiations and responses in the categories of work process (how to work as a group) and work content (substantive contributions to the project) were significantly associated with the quality of performance. Additionally, whereas fun messages were few and not statistically related to quality, the majority of fun messages occurred in high performing teams. Additional analyses revealed that high performing teams formed quickly and handled several activities at once:

> If groups focus exclusively or primarily on work *process* issues, they push the hard work related to work *content* to the last minute. [I]n electronic communications, people can send multi-layered messages with a variety of types of interactions (e.g. fun, procedure, contact, technical information), but if they ignore a focus on work content, trust development and performance may suffer. (p. 8)

Low performing teams struggled to meet deadlines and worked most intensely immediately prior to deadlines, interacted less frequently overall, and included members who went absent without explanation.

Virtual Team Behavior Control and Rules of Virtual Groups

Previous research on virtual groups has focused on emergent behaviors rather than on the manipulation of behaviors. According to Piccoli and Ives (2000, p. 575), "Previous studies seem to implicitly assume that virtual teams will be self-directed—i.e., that managerial control mechanisms are not required in this setting." Even when virtual groups are specifically instructed about useful practices or rules, but left to their own discretion to adopt them or not, such groups tend to ignore these rules until direct interventions and social arrangements draw explicit attention to their rule-following failures (Walther, Boos, & Jonas, 2002). Similarly, Mark (2002) found that explicit conventions invented by some virtual groups were frequently violated, although her analysis did not reveal the benefits of such conventions when they were followed, nor did it reveal the deliberate introduction of rules or conventions as a managed or incentivized system. However, the managerial manipulation or incentivization of such behaviors may provide a worthwhile

approach to understanding and improving virtual teams. The deliberate management of virtual teams is a topic that is receiving growing attention (e.g., Kirkman, Rosen, Gibson, Tesluk, & McPherson, 2002), just as the management of FtF teams has been studied in the past.

In sociological and psychological literatures, the identification of communication rules and norms provides understanding of how groups and relationships work and how they might be affected by deviations from normative or preferred behaviors (Argyle & Henderson, 1985; Shimanoff, 1992). Indeed, Gouldner (1954) equated rules to be a substitute for implicit trust, and rule adherence as a test by which trustworthiness can be explicitly assessed. The imposition of discussion rules in small groups, however, may be best viewed as a formal "structuring procedure" akin to those reviewed comprehensively by Sunwolf and Seibold (1999). These authors reviewed the myriad problems faced by "naturally occurring" or "'free' group discussion" (p. 396) without rules or structures, as well as catalogued a variety of interventions that they classified by function as

> *Structuring procedures* (which) outline the order and manner in which communication occurs during group meetings; *analyzing procedures* help members evaluate, question, investigate, and rank ideas; *creating procedures* are used to generate new ideas; and *agreeing procedures* are used to indicate individual members' preferences, manage conflict, and reach a group decision. (p. 399, italics in original)

Norms and rules may be particularly potent in CMC: According to Lea and Spears (1992), CMC offers little apparent information about individual characteristics, making attributions based on the conformity to or deviance from group norms more salient. In terms of devising rules, SIP theory offers propositions about both the timing and frequency of messages as factors that affect online group dynamics, as well as dicta regarding the conversion of nonverbal to verbal forms of expression in CMC. Given the positive impacts of these adaptations on virtual groups' relational and instrumental processes (see Walther & Parks, 2002), behaviors reflecting these adaptations and conversions, if encouraged or mandated, might help optimize virtual groups. Thus, based on the findings and theories articulated above, structuring rules were devised and empirically tested with respect to the relational and instrumental dynamics of virtual teams by explicitly encouraging, and in some cases incentivizing, the following rules.

Rule 1: Get started right away. SIP theory (Walther, 1992) alerts us that it takes longer for users to imbue CMC with both task and socioemotional elements to allow satisfactory development and accomplishment. Groups tend to procrastinate the production phase of their work until halfway through their existence (Gersick, 1988). Such delays may be normal in FtF groups but can be more deleterious in CMC as a group's remaining calendar time may not provide sufficient interaction opportunity, given the retardation of information flow via CMC. This problem is especially difficult using asynchronous CMC where delays between messages further strain temporal resources. Thus, CMC groups should start work early in order to avoid running out of time even more severely than in procrasti-

nating FtF groups. Iacono and Weisband (1997) also indicated that more successful groups begin their work quickly.

Rule 2: Communicate frequently. As with the first rule, SIP theory (Walther, 1992) indicates the importance that ample messaging portends for group development. The value of communicating frequently was also identified as critical in Iacono and Weisband's (1997) and Jarvenpaa and Leidner's (1998) research because trusting behaviors, or trust perceptions, were associated with frequent exchanges. Communicating frequently also allows the dispersion of activity over time, avoiding the pileup of activity toward the end of groups' work time periods. The limited nature of electronic and asynchronous communication may otherwise impede adequate rates of information-per-message-per-time exchanges.

Rule 3: Multitask getting organized and doing substantive work simultaneously. This principle is also derived from issues about temporal pace in CMC and the normal sequencing of events in FtF groups. Traditionally, groups begin organizing, defining, and allocating tasks before executing them. This sequence can be counterfunctional in CMC groups for two reasons. First, if approached linearly and sequentially, organizing activities may consume so much time that there is insufficient opportunity for substantive exchange given the pace of CMC. Secondly, the perception that it is undesirable to begin working on collaborative tasks before organizing them is fallacious in many cases. In tasks where duplication of effort might lead to multiple perspectives, minimizing duplication is not only unnecessary but disadvantageous. Not all tasks are of the magnitude to benefit from some duplication of effort, but neither must all tasks be organized and allocated before substantive steps can be taken. For the most efficient use of time in virtual groups it may be better to begin substantive efforts on group tasks immediately rather than to wait until every aspect has been negotiated. Iacono and Weisband's (1997) findings on the simultaneous value of work process and work content exchanges lend credence to this rule.

Rule 4: Overtly acknowledge that you have read one another's messages. In FtF settings message reception may be more passively inferred through the attention monitoring that co-presence provides (Nardi & Whittaker, 2002). In asynchronous CMC, it is difficult to tell whether others have read one's postings. Failure to do so may be due to senders' errors (e.g., emailing to an individual rather than the group), system errors (e.g., network, server, or software malfunctions), or receiver behavior (failing to check). Moreover, unless the CMC software has an automatic notification option, once a receiver has gotten a message, it requires overt acknowledgement in order for the sender to know. As Cramton (2001) has detailed, it is easy to assume that common knowledge is operating in distributed groups when in fact it is not. Following SIP theory's notion of making verbal that which is traditionally signaled nonverbally, explicit acknowledgments should combat this problem. Iacono and Weisband's (1997) findings on the value of responses to proposals, not just the proposals themselves, support this suggestion.

Rule 5: Be explicit about what you are thinking and doing. Given that there is no nonverbal backchanneling in CMC, message senders cannot take advantage of partners' nods of assent or head-shaking disagreement in order to know whether proposals have been accepted. Specific responses are beneficial, as seen in Iacono

and Weisband's (1997) analysis. Related to the notion of common knowledge problems (Cramton, 2001), when one does not explicitly state agreement or disagreement with a proposal in a virtual group, other members do not know if the group agrees, but may falsely assume that it does. Explicit verbal feedback about suggestions and proposals, although easier to avoid and potentially face threatening, may allow virtual groups to cohere on decisions and action plans more effectively than when suggestions go unconfirmed or unchallenged.

Rule 6: Set deadlines and stick to them. Accomplishing subtasks in a timely way reduces the uncertainty that participants may experience in an interaction environment in which there is less perceived accountability (Staples & Ratnasingham, 1998). One theoretical perspective suggests that for trust to develop there must be a pattern of vulnerability. If a member could do the job herself, or wait for a partner to do it, there is vulnerability due to the greater costs if the member must share in the failure or do the work herself if the partner reneges (Millar & Rogers, 1976). Vulnerability and validation lead to trust over repetitions, and a great demonstration of trustworthiness may be honoring agreements.

In order to test the utility of these rules and the principles on which they are based, the following general hypothesis was generated:

> Hypothesis: The greater the adherence to each rule of virtual groups, the more those virtual team members (a) trust the group, (b) like each other, and (c) perform better work.

Most research on virtual teams have used post hoc interpretations and analyses or compared online to offline groups with little other manipulation. This research, however, assessed whether behaviors could be stimulated and instigated in order to detect their impact, that is, if variation in their adherence could be deliberately manipulated, as is common in experimental research. Such an approach would have great practical implications for the management of virtual groups, as well as important theoretical implications about the cause-and-effect cycle of behavior leading to perception and outcome. Whereas previous research has examined any two of these three components, the complete relationship of all three critical issues remained uncharted. At the same time, it was not clear to what extent any rule must be incentivized rather than encouraged in order to achieve variation in adherence. Thus, given the multiplicity of rules and the limited field conditions for their evaluation, a purely experimental study of all rules in a setting active enough for their dynamics to accrue was neither desirable nor necessary. The following section describes a field experiment that created variance in adherence to various rules and the methods by which their effects were assessed.

Methods

Participants

Participants (N = 44) were students from two major research universities in the northeastern United States (28 from one; 16 from the other) enrolled in two inter-

university, senior-level courses focusing on the topic of CMC. The courses were electives that did not require particular expertise in technological applications. The students were informed at the courses' inception about the simultaneous instructional and research objectives involved in course participation, for which continuation in the courses implied consent. Among other requirements, the courses involved three major group papers of which the first two provided the test bed for this research. Participants were assigned to groups of three or four members using a randomized/blocking strategy, so that each group had at least one member from a different university, and four-member groups were evenly distributed.

Treatments and Channels

Groups had 18 days in which to develop each paper. Papers were to review six primary research articles, which were provided to the groups. The first paper was on virtual community and the second was on media selection. Communication was restricted to the use of asynchronous bulletin-board discussions with file-sharing capability and of synchronous chat, both of which were embedded in a course support system that recorded all postings and chats for later analysis. Participants were admonished not to use email or Instant Messenger for several reasons: First, despite their appeal, research has shown how email exchanges often develop among subsets of group members, sometimes unknowingly, causing groups to lose common knowledge about ideas (Cramton, 2001); dyadic Instant Messaging is similar in this respect. Second, alternative systems evade storage and retrieval by instructors who cannot resolve participation complaints should they arise later. Further, the interactions are unavailable for research analysis, to which participants understood they were contributing. Groups were later asked to indicate, without penalty, if they had used other systems, and one group that did so was dropped from further analysis.

Treatments encouraging rule-related behavior were implemented as follows. One third of the groups were instructed that they would be evaluated entirely on the quality of their group papers. Eight groups completed this condition between the two rounds. Another third of the groups (n = 10) were instructed that 40% of their paper grade would be determined by their adherence to a rule requiring frequent communication. Each member of these groups had to post a message to the group at least 5 out of 7 consecutive days (and posting more than one message per day did not fulfill a subsequent day's quota). The final set of groups (n = 10) was required to post at least as many substantive messages as organizing messages for 40% of their paper grade. Substantive messages discuss the content of the assigned readings or reflect syntheses based on the readings. In contrast, organizing messages suggest or discuss procedures for allocating, writing, and organizing work on the paper. In the first round of papers, this rule was defined as a simple ratio of substantive to organizing comments, but this version did not facilitate frequent early posting of substantive messages to the extent that had been intended. Organizing messages predominated early postings, and substantive message postings "caught up" in later exchanges. For the second round of group work, the rule was modified to require that on any day that an organizing message was posted, at least one substantive message must also be posted. For-

mulas were presented by which decrements from each rule would be penalized. Finally, it is very important to note that all groups were strongly and repeatedly encouraged to follow all the rules whether or not they were graded on adherence. Participants were informed that instructors would not follow their online group discussion and that their rule following would be assessed independently by a graduate assistant.

Measurement

Dependent variables included several self-administered and observational measures. After finishing each paper, participants completed a web-administered questionnaire. It featured a single-item, five-interval scale measuring the participants' assessment of the quality of their group's paper and additional scales with which participants rated the degree to which their groups adhered to each of the rules (from *not at all* to *completely*): getting started right away, communicating frequently, acknowledging others' messages, being explicit about expectations and progress, multitasking content and organizing, and sticking to deadlines. Next, participants completed scales assessing the relational communication of geographically distributed, virtual partner(s) (see Walther & Burgoon, 1992): immediacy/affection (13 items, Cronbach's α = .93), task–social orientation (four items, α = .67), and dominance (four items, α = .86). Participants evaluated the same partners on the two liking scales reported by Weisband and Atwater (1999, p. 5; "how much participants enjoyed working with a particular member" and their "desire to work with the other member again"), which were similar in nature to the notion of task attraction developed by McCroskey and McCain (1974). For comparison, McCroskey and McCain's measures of task attraction and social attraction were also administered, and factor analysis produced two clean dimensions, with Weisband and Atwater's items loading task attraction, whereas social attraction formed a distinct second factor. Final measures, with items dropped for low reliability, consisted of eight items for task attraction (α = .85) and nine items for social attraction (α = .94). Finally, participants rated their trust in their group, using the five-item scale Jarvenpaa and Leidner (1998) developed from several related sources (α = .88).

In terms of observational measures, coders who were unaware of hypotheses or experimental conditions analyzed the participants' postings from the asynchronous discussion boards and chat systems. A coding scheme was developed that focused on behaviors implied in the rules and research questions. Two pairs of coders were used to assess messages, with all messages coded by at least one pair who resolved disagreements through discussion. In line with Bales and Strodtbeck's (1951) approach, coders classified postings either as assertions or as requests (e.g., gives feedback, as well as asks for feedback), but the low frequency of behavior in some of these subcategories deflated reliability assessments, and subcategories were collapsed for further analysis. Intercoder reliability was assessed periodically among all four coders, covering 10% of the data, the mean Cohen's κs for which are reported below for each category. Task-related categories included comments related to organizing (allocation of readings, identification and allocation of tasks; κ = .82), content contributions (what a reading reported, conclusions drawn, verbiage for the paper; κ = .71), feedback on content (praise and criticism

of content postings; κ = .59), and coordination (when members can or should check or post messages, or are [un]available; κ = .73). Social comments were coded (exchanging personal information or discussing other topics than the course or the paper; κ = .89), and greetings and closings were coded separately (κ= .97). In line with the explicitness rule, statements and requests related to overt acknowledgments of others' messages were identified (κ = .71). As seen in Lebie, Rhodes, and McGrath's (1996, p. 135) analysis, a good proportion of online groups' comments focused on "mechanics of the production process" (how to use the technology system and which aspect to use), and this category was also analyzed (κ = .71). A category called "filler" was originally used for messages that were obviously for no purpose other than to meet the daily posting requirement that applied to a third of the groups, but these were ultimately rare and did not appear during reliability checks. Although some reliabilities are not great, this may be due in some part to true differences among the frequencies in messages reflecting different multiple categories, which reduces intercoder reliability calculations even if there is great agreement among coders (Scott, 1955).

The quality of the groups' output was determined by using the average grade from both instructors' assessments of the group papers (using a 0–100 grading scale). Overall alpha for interrater agreement was .75 before adjustment on the first assignment; three papers' grades were discrepant between instructors. After the disagreement was negotiated, final interrater reliability achieved .94. On the second round of papers, reliability was .88 prior to discussion.

Results

Manipulation Check

The purpose of the rule assignments was not to create a factorial design, but rather, to encourage greater variance in rule-related behavior. Nevertheless it was worthwhile to see if the rule assignments affected groups' rule following. As a manipulation check, therefore, an ANOVA was conducted to examine the effects of rule assignments on reported group rule following, which involved collapsing groups into three categories: those assigned to communicate frequently, those assigned to multitask organizing and substantive messages, and those with no specific rule assignment.

There was a significant difference in the extent to which participants reported frequent messaging, $F(2, 83) = 13.62$, $p < .001$, $\eta^2 = .25$. Group members assigned to this rule reported significantly higher adherence, according to post hoc Scheffé analysis, than did members of multitasking rule groups, which in turn communicated more frequently than groups with no rule. (See Table 1 for descriptive statistics for the adherence of groups in different conditions on each rule.) In terms of differences in multitasking, a significant difference in self-reported rule following also occurred, $F(2, 83) = 5.59$, $p = .005$, $\eta^2 = .12$. Those assigned the multitasking rule reported significantly more multitasking than did those with no rule. Those who had the rule to communicate frequently also showed a moderate degree of multitasking but were not different from the multitasking rule or no rule

Table 1. Means (and Standard Deviations) for Self-Reported Rule Adherence Among Groups by Rule Assignment Condition

Rule	Rule assignment		
	No rule (n = 25)	Communicate frequently (n = 30)	Multitask (n = 31)
Start immediately	2.68 (.90) [a]	3.47 (.94) [b]	3.00 (1.30) [a, b]
Communicate frequently	2.64 (1.11) [a]	4.17 (.99) [b]	3.39 (1.15) [c]
Acknowledge others	2.72 (1.21) [a]	3.73 (.94) [b]	3.42 (1.21) [b]
Explicitness	2.72 (1.26) [a]	3.60 (.97) [b]	3.32 (.91) [b]
Multitasking	2.80 (1.56) [a]	3.23 (.97) [a, b]	3.71 (.94) [b]
Observe deadlines	2.72 (1.34) [a]	3.17 (1.12) [a]	3.45 (1.23) [a]

Notes. SD in parentheses. Different superscript letters indicate significant differences, Scheffé tests based on harmonic mean and harmonic mean sample size, $p < .05$.

groups. There were also significant differences in adherence to other rules, according to assignment conditions: getting started right away, $F(2, 83) = 3.79$, $p = .027$, $\eta^2 = .08$; acknowledging others, $F(2, 83) = 5.73$, $p = .005$, $\eta^2 = .12$; and explicitness, $F(2, 83) = 4.95$, $p = .009$, $\eta^2 = .11$. No effect obtained on self-reports of sticking to deadlines, $F(2, 83) = 2.47$, $p = .091$, power = .78 with alpha = .05. In most cases groups who were assigned to one rule exhibited greater adherence to most rules. For five of the six rules tested, there was a significant degree of variance in rule-following behavior, at least to the extent reported by the participants themselves, which had been the purpose of the rule assignment manipulation.

Hypothesis Tests

The next analyses examined the general hypothesis about the impacts of rules by computing correlations between the reports about groups' rule following and the various outcomes to which they were predicted to relate. These correlations were conducted with 86 *df,* with power = .51 to detect a one-tailed difference at alpha = .05. Most striking were the relatively strong and consistent correlations between the degree to which participants reported following each and every rule with the level of trust that they experienced, with each correlation $p < .001$: getting started right away, $r = .43$; communicating frequently, $r = .65$; acknowledging others, $r = .57$; being explicit, $r = .67$; multitasking, $r = .45$; and sticking to deadlines, $r = .65$.[1]

[1] When dealing with groups, group-level rather than the individual-level data analyses are sometimes warranted because members influence each other, affecting their scores, and this interdependence of observations may violate an assumption for ANOVA. This study tested hypotheses with correlation analyses rather than ANOVA, yet we reanalyzed the data using aggregated group averages and found no significant differences in results. Some coefficients actually inflated somewhat; for example, the one-tailed relationships of each rule with trust ($n = 28$, $p < .001$; getting started immediately, $r = .64$; communicating frequently, $r = .76$; being explicit, $r = .86$; multitasking, $r = .70$; acknowledging others, $r = .75$; and sticking to deadlines, $r = .85$). Only one significant relationship at the individual level failed to achieve significance at the group level: the getting started right away rule, with self-assessed grade ($r = .30$, $p = .059$).

Rule following was also associated with task attraction, $p < .001$ in each case: getting started right away, $r = .41$; communicating frequently, $r = .53$; acknowledging others, $r = .53$; being explicit, $r = .60$; multitasking, $r = .41$; and sticking to deadlines, $r = .60$.

Social attraction was also predicted by the extent each rule was followed, $p < .021$: getting started right away, $r = .22$; communicating frequently, $r = .45$; acknowledging others, $r = .37$; being explicit, $r = .40$; multitasking, $r = .29$; and sticking to deadlines, $r = .43$.

Additionally, rule following corresponded with how well the participants thought they had done on their collaborative tasks, with $p < .025$ for each rule's correlation with self-rated success: getting started right away, $r = .21$; communicating frequently, $r = .37$; acknowledging others, $r = .38$; being explicit, $r = .49$; multitasking, $r = .41$; and sticking to deadlines, $r = .42$.

Interestingly, the objective quality of the participants' collaborative papers was not correlated with each and every rule. Specifically, the multitasking rule was not significantly associated with paper quality, $r = .12$, $p = .16$. All other rules did enhance the objectively rated quality of teams' work, $p \leq .025$: getting started right away, $r = .21$; communicating frequently, $r = .41$; acknowledging others, $r = .28$; being explicit, $r = .29$; and sticking to deadlines, $r = .31$.

In order to assess which of the rules were most influential in terms of each of these outcomes, multiple regression analyses were conducted. The level of trust in groups was predicted most strongly by three rule-following variables, with a total adj. $R^2 = .55$, $F(3, 82) = 35.02$, $p < .001$: being explicit ($\beta = .62$), sticking to deadlines ($\beta = .30$), and communicating frequently ($\beta = .23$).

Task attraction was influenced most by sticking to deadlines ($\beta = .37$) and being explicit ($\beta = .35$), adj. $R^2 = .42$, $F(2, 83) = 31.50$, $p < .001$, whereas social attraction was predicted by communicating frequently ($\beta = .23$) and sticking to deadlines ($b = 19$), adj. $R^2 = .22$, $F(2, 83) = 12.86$, $p < .001$.

Although the self-assessed quality of the groups' work was predicted most strongly by explicitness, $\beta = .80$, adj. $R^2 = .23$, $F(1, 84) = 26.50$, $p < .001$, the objective assessment of the groups' work quality was affected most strongly by adherence to the rule for frequent communication, $\beta = 1.70$, adj. $R^2 = .16$, $F(1, 84) = 16.68$, $p < .001$.

The research question about the relative impacts of social- and task-oriented messaging was addressed by examining the relationships of participants' assessments of partners' affectionate communication and task-oriented communication to liking, trust, and performance quality. Consistent with Weisband and Atwater's (1999) findings on work-related liking and task message frequency, participants' assessments of partners' task-oriented communication was strongly associated with task attraction, $r = .57$, $p < .001$. However, the correlation between affectionate communication ratings and task attraction, $r = .82$, $p < .001$, was significantly greater, $Z = 3.28$, $p < .001$; people liked working with one another to a greater extent due to affectionate than due to task-oriented communication, although both affected liking. Social attraction was associated with affectionate communication, $r = .82$, $p < .001$, and, to a lesser extent, with task-oriented communication, $r = .23$, $p < .03$. Trust, too, was associated with affection, $r = .66$, $p < .001$, and task-

Table 2. Correlations Between Rule Adherence Reports and Coded Communication Behaviors

	Rule					
Coded comments	Start immed.	Frequent commun.	Acknowledge others	Be explicit	Multitask	Observe deadlines
Organizing	.21	.29*	.24*	.32**	.06	.21
Technical	.24*	.33**	.17	.16	-.04	-.02
Content	.11	.02	.01	.08	.03	.07
Feedback	.35***	.31*	.25*	.24*	.19	.12
Coordinating	-.04	.18	.27*	.33**	.12	.22
Acknowledgment	.25*	.19	.25*	.21	.22	.02
Social comment	.00	.09	-.01	.14	-.02	-.05
Greeting	.15	.38***	.28*	.35***	.01	.18

Notes. $n = 54$, one-tailed. *$p < .05$. **$p < .01$. ***$p < .005$.

oriented communication, $r = .37$, $p < .001$. Groups experiencing more affectionate communication also performed better on their work, both according to their own performance assessments, $r = .57$, $p < .001$, and that of the instructors, $r = .47$, $p < .001$.

Observational Data Analyses

Additional analyses examined the specific observed behaviors that were associated with rule following and with the perceptual outcomes in this study. Two levels of coded behavior were examined. First, macrolevel composites were examined by combining statements and requests within each category. For example, both making organizing statements and asking for organizing suggestions were combined into the macrocategory of organizing. Correlations were based on the 54 observations for which complete records were available, and each correlation test had power = .45 to detect significance at one-tailed alpha = .05. Correlation coefficients are reported in Table 2. Second, following these tests, microlevel analyses were conducted using multiple regressions for each uncombined behavior, so that a more precise depiction of the most important predictors could be identified.

The rule advising participants to get started early was associated with technical comments, feedback, and acknowledgments of others' messages. These results appear consistent with Lebie et al.'s (1996) findings that more of the earlier comments in electronic groups focus on how to use the meeting system. Feedback and acknowledgments seem to echo Iacono and Weisband's (1997) groups' trustworthy responsiveness patterns. Comparing all these variables, multiple regression analysis revealed that feedback was most strongly associated with getting started early, $\beta = .35$, adj. $R^2 = .10$, $F(1, 52) = 7.17$, $p = .01$.

The rule to communicate frequently was related to several of the communication categories, as would be expected. Significant correlations with adherence to this rule involved organizing comments, technical comments, feedback, and greetings. Greetings was the behavior most strongly associated with the frequent communication rule in regression analysis, $\beta = .36$, followed by feedback, $\beta = .26$, adj. $R^2 = .18$, $F(2, 51) = 6.73$, $p = .003$.

Greetings was also significantly associated with adherence to the rule about acknowledging others, where it was the strongest predictor of acknowledging others, $\beta = .28$, adj. $R^2 = .06$, $F(1, 52) = 4.44$, $p = .04$. Greetings was also the behavior most strongly associated with the rule for being explicit, $\beta = .35$, adj. $R^2 = .12$, $F(1, 52) = 7.26$, $p = .009$. These findings suggest that greetings accompanied the adherence to several rules, whether or not greetings functioned as a manifestation of that rule or simply as coincidental accompaniment or social facilitator of other rule-related comments. Sarbaugh-Thompson and Feldman (1998) discussed the potential of greetings leading to other forms of social interplay, facilitating cohesiveness, trust, and mutual awareness. Their research empirically demonstrated that "saying hi" and other greetings declined commensurate with a shift from FtF to email communication in an organization, although the relationship of greetings to other communication behaviors and outcomes was speculative in that report. The present results reaffirm that saying hi matters, but show equally as clearly that electronic communication does not preclude it from being said. Indeed, in line with findings by Bunz and Campbell (2004), CMC partners appeared quite sensitive to greetings.

The acknowledging rule demonstrated zero-order correlations with organizing comments, feedback, and coordinating comments. Coordinating comments and feedback were also significant predictors of the explicitness rule, overriding the zero-order relationship the rule also exhibited with organizing comments. Neither the multitasking rule nor the deadlines rule showed zero-order or multiple correlations with the specific coded comments. Multitasking may have been distributed evenly over several categories, favoring none in particular. Sticking to deadlines may be a behavioral but not a communicative phenomenon, and thus no comments on this topic were made in the discussions. It is interesting to note that the category of content contributions did not show any correlations with rule-following reports. Perhaps other types of comments facilitated content, the quantity of which does not vary much among groups who compose collaborative papers, but the quality of which does vary, as seen in earlier results, as a partial function of social and coordinating efforts.

Discussion

This study examined the degree to which some problems of virtual groups could be ameliorated by specific behavioral guidance associated with several formal communication procedures, or rules. Previous studies have identified problems for distributed groups, focusing on communication limits due to media bandwidth, presence, and interactivity constraints. Other approaches counter that virtual groups sometimes do overcome these constraints, and if we recognize the

theoretical and behavioral differences between effective and ineffective virtual groups, we may effectively intervene and manage them. This research evaluated such prospects through rule assignments and encouragements that led to variations in key behaviors, and it assessed the impacts of those assignments and behaviors on the task and social evaluations of virtual groups. Results supported the viability of these behavioral routines for virtual groups, such that in most cases, the more these routines were adopted, the better the affective and material results of virtual teams' efforts.

The results of this study supported the effectiveness of each of six hypothetical rules and, on some dimensions, did so surprisingly strongly. Indeed, the consistent and high correlations between self-reported rule-following, with perceived trust and task attraction, were somewhat remarkable. Notable also were the correlations of each rule with social attraction and perceived quality of work. Further, the perceptual states corresponded relatively well with objective assessments of groups' work quality: Almost every one of the rule-following self-reports correlated with instructors' outside evaluation of the groups' project quality, with multitasking substantive/organizing messages being the only rule that did not predict actual grade.

The rules that were instigated in this study were derived primarily from SIP theory (Walther, 1992) although several also echo the results of previous studies. For instance, Cramton's (2001) findings about mutual awareness problems in virtual groups suggested the importance of message explicitness, and Jarvenpaa et al.'s (1998) documentation of virtual group members not knowing if anyone is "out there" implied the importance of acknowledging others' messages as well. Iacono and Weisband's (1997) examination of frequent initiations and responses in virtual groups addressed specific aspects of virtual group communication and their relationship with trust. However, SIP theory, in a more general sense, emphasizes the capacity for CMC users (a) to send and accumulate cues via messages over time in order to overcome the limitations of the medium, and by attending to social/affective cues, as well as task-related cues, (b) to develop normal relationships and effective group outputs, albeit more slowly and less efficiently than through FtF communication. In order to counteract cue-by-rate inefficiencies, the rules in this study promoted, in a variety of forms, increased messaging over time: in admonitions for virtual groups to begin communicating immediately, frequently, and in specific forms that made task and coordination mechanisms more salient and explicit more quickly. Whereas the effects of some rules parallel findings articulated without the SIP framework, such as Weisband and Atwater's (1999) findings about task-oriented liking accruing from frequent task messaging, the application of SIP extends previous findings by addressing questions not only about task-oriented communication but about the role of social messages in the development of trust, social attraction, and group performance. Indeed, social messaging was found to affect a variety of outcomes, related not only to affective states but also in relation to task-related success as well. Whereas the importance of social messages is sometimes highlighted in small groups research's occasional focus on socioemotional (Bales & Strodtbeck, 1951) and maintenance functions (Lebie et al., 1996), it is often overlooked in virtual

groups research, where affective dimensions are frequently assumed to be muted by CMC's characteristics.

Some limitations of the study should be noted. Questions about the potential influence of the researchers on their students, and the possibility of demand characteristics or social desirability effects between researcher/teachers and student/subjects, deserve scrutiny. The researchers evaluated group papers in as masked a manner as possible but were not absolutely prevented from discovering which paper came from which group under what condition. The ranges and deviations in scores suggest no strong bias, but the differences in scores between rule-assigned and no-rule groups do not disprove it. It is instructive to note, however, that the instructors' ratings of the papers mirrored the directions of the participants' own evaluations, data that were unknown to the instructors at the time they made the evaluations. In terms of whether participants exhibited social desirability effects that led to inflated associations between rule following and evaluations, the data suggest this not to be the case. The rules were intended to generate variation in rule-following behavior, and they did so. Some participants followed rules more and some followed them less, mitigating the likelihood of an across-the-board demand characteristic. Had participants adhered to rules uniformly (or even if they had reported having done so), there would have been insufficient variation to detect the observed correlations. The nature of the relationship indicates that those who followed the rules least also reported doing worse work and trusting partners less; if participants were motivated to distort their behaviors or self-reports, the lower end of the correlation should not have occurred. Finally, an additional limitation was the direct manipulation of only two of the six rules, although the tendency for groups that were assigned to follow a single rule, to follow all the rules, mitigates this concern somewhat.

Two possible explanations for the effectiveness of the rules, as a set, are available. One is that, as hypothesized, effective theoretically derived rules were identified that affected the gamut of behaviors, perceptions, and outcomes. A more cynical but no less plausible interpretation is that the mere following of any rules reduces uncertainty and leads to trust and liking in virtual groups and that research attempting to identify specific rules or best practices for virtual groups may be misguided. To address that hypothesis, further research should use placebo rules, or counterfunctional rules, which would illuminate whether liking and trust are so strongly linked to conformity in virtual groups that they are immune to factors otherwise likely to deteriorate group performance.

If these rules are not a placebo, they may be a panacea. They may be beneficial because their utility extends beyond virtual groups to groups in general. There is little in the rules themselves that is not good advice for any group. At the same time, the notion that virtual partners know little else about one another besides their online behavior suggests that conformity to behavioral rules may have special potency in the electronic environment, where attributions are significantly more extreme for invisible CMC partners than for those working FtF (see Walther & Parks, 2002).

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