ATTRIBUTIONS FOR GROUP FAILURE: THEIR EFFECTS ON GROUP PROCESSES AND PERFORMANCE IN VIRTUAL GROUPS

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ATTRIBUTIONS FOR GROUP FAILURE: THEIR EFFECTS ON GROUP PROCESSES AND PERFORMANCE IN VIRTUAL GROUPS

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The present work examines group members’ attributions for a previous group failure as a cognitive mechanism underlying subsequent group processes and performance in virtual groups. It offers two theoretical frameworks – a generalized individual approach and a novel socio-structural perspective – that make different predictions about how attributions for a group failure should affect group processes (task effort, changes in individual and group strategies, and positive and negative maintenance communication) and group performance. The hypotheses from the two perspectives were tested in an experiment on virtual groups responding to a group failure. The attributional manipulation directed members’ private attributions for the failure to one of the following causes – self, a group as a whole, other group members, and external constraints of computer-mediated communication. The results support the socio-structural perspective, demonstrating that group-external attributions prompted reviews and revisions of the group’s communication strategies. Furthermore, the findings reveal the effect of attributions on group performance quality and the role of positive maintenance communication as a partial mediator between attributions and group performance.
BIOGRAPHICAL SKETCH

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To the Bazarov-Terpugov Family Support Group
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CHAPTER 1

INTRODUCTION

Causal attributions represent how people explain social events and behaviors by subjectively interpreting their causes. By explaining causes of an event, people not only make sense of the social world, but also adapt to it and shape it (Malle, 1999). In many cases attributions serve as better predictors of how people define and respond to events than the events themselves (see for review, Weiner, 2001, 2004). Abundant empirical evidence demonstrates that causal attributions shape people’s cognitions, emotions, and actions in a variety of contexts, from family and marital relations to organizational and academic achievement-oriented situations (see for review, Bradbury & Fincham, 1990; Martinko, 1995, 2004; Weiner, 2001).

The vast majority of this evidence concerns attributions for individual behaviors and rarely for group actions. Much like for individuals, attributions are presumed to play an important role in shaping group behaviors, and group research has studied the types of attributions and conditions under which they arise in a group (e.g., Forsyth, Zyzniewski, & Giammanco, 2002; Michalisin, Karau, & Tangpong, 2003; Norvell & Forsyth, 1984; Zaccaro, Peterson, & Walker, 1987). The potential link between attributions and group behaviors, however, has received considerably less attention, with research primarily focusing on attribution for a group success (Goncalo, 2004; Goncalo & Duguid, 2008).

Yet groups often face failure. Although this fact is a truism in group research, the title of the book edited by Hackman (1990) provides a striking illustration: *Groups That Work (and Those That Don't)*. As Hackman explains in the introduction, the editor did not approve the original title “Groups That Work” because only 4 out of 33 groups analyzed in the book were “actually effective teams”, while the rest of them
had severe problems. Given the high failure rate in group work, it is essential to understand how groups can change their strategies in order to improve performance.

Contrary to common expectations, a group failure does not automatically result in the group’s reviews or revision of its strategies (Avery, 1996; Gersick & Hackman, 1990; McClelland, 1984). Group strategies tend to reflect well-learned behavioral norms or expectations about how things should be done, which are formed based on previous experiences with similar classes of task (Hackman, Brousseau, & Weiss, 1974; Hackman & Morris, 1975). Even when the group is failing, group members rarely reconsider and change their strategies. Furthermore, a common response to a group failure is to execute existing routines more vigorously, or adopt what can be identified as a “we’re failing, so let’s try harder” strategy (Gersick & Hackman, 1990, p. 85). Under certain conditions, however, a group failure may cause the group to reconsider and change its strategies, and Gersick and Hackman call for future research to identify those conditions.

The present study takes an attributional approach to the problem of a group failure and recovery from it. It proposes a potential link between attributions for a previous group failure and subsequent group processes (task effort, strategy changes, and group communication) and group outcomes (performance quality and group satisfaction). For example, consider a small project team that has members spread out across different locations. In the early stages of the project, the team members struggle with sharing resources, coordinating their workload, and communication breakdowns, which lead to poor results on the pilot project. As the group members reflect on their failure, how do their causal attributions about the failure affect the group’s work on the next project? The present approach to attributions argues that the type of attributions the team members assign for the previous failure — it was my personal fault, it was some other group member’s fault, the project group as a whole was at
fault, or factors outside the group, such as a challenging work environment - should affect the way the group goes about doing their work on the second project.

The problem of how groups change their strategies and adapt to a challenging work environment is relevant to virtual groups, such as the one described in the example above. In virtual groups members are not physically co-present and communicate primarily or entirely via communication technology, such as email, computer conferencing, or chat (Walther & Bunz, 2005). Organizations increasingly promote such forms of work and expect to profit from tapping flexible and diverse workforce, which is not constrained by spatial or temporal boundaries (Hinds & Kiesler, 2002). The potential advantages of virtual groups, however, are offset by challenges of the unique task environment in which such groups find themselves. Gibson and Gibbs (2006) identified four structural characteristics of the virtual environment – members’ location distribution, electronic dependency, a group dynamic structure, and cultural heterogeneity, each of which in a unique way hinders virtual group performance and innovation. These challenges include temporal delays in information exchange, disruptions in shared context and workflow, weak social ties among members of the group, and their contextual and cultural differences.

Despite these challenges, virtual group members tend to import their well-learned expectations about how to work on the task from their past experiences and familiar settings. Indeed, members of short-term virtual groups are seldom intuitively able to adapt to the structural constraints of the virtual environment and tend to approach their work in ways that they are accustomed to in face-to-face groups (e.g., Walther & Bunz, 2005; Walther, Boos, & Jonas, 2001). As a result, virtual groups frequently experience suboptimal performance and lower satisfaction (e.g., Cramton, 2001; Hinds & Bailey, 2003; Mortensen & Hinds, 2001; Walther et al., 2001; Wilson, Straus, & McEvily, 2006). Thus, the question of how groups reconsider and alter their
strategies in order to adapt to the structural constraints of the virtual environment is clearly important for virtual groups.

The present examination of attributional effects on group processes begins with the analysis of the types of attributions to which group members can attribute a group failure. A common reaction after a failure is to disclaim responsibility by attributing it to factors external either to the self (other group members) or the group as a whole (e.g., time pressure, difficult task, limitations of the communication technology). These attributional tendencies are studied as part of a self-serving and group-serving bias, according to which a group failure is shouldered on external causes, either to the self or the group as a whole, respectively (Leary & Forsyth, 1987). Making internal attributions for a group failure is also common. Different studies have shown how group members can accept blame for a negative outcome by making more internal than external attributions (Forsyth et al., 2002; Lau & Russell, 1980; Miller & Ross, 1975; Tindale, Kulik, & Scott, 1991; Zaccaro et al., 1987). This suggests that both internal and external factors have to be considered as potential attributional causes for a group failure.

The group level adds an additional layer to internal/external attributions by setting the boundary on either the individual group member or the group as a whole. Group research has distinguished between attributions that are internal to self only, internal to the whole group, external to self only (other group members), and external to the whole group (e.g., Forsyth et al., 2002; Forsyth & Schlenker, 1977; Leary & Forsyth, 1987; Zaccaro et al., 1987). Although group-level and self-level attributions are not orthogonal (i.e., attributions external to the group are also external to self, and attributions internal to self are also internal to the group), these four types of causes are conceptually distinct (Leary & Forsyth, 1987; Mendelsohn, Robinson, & Spranca, 1996) and may have different consequences for group processes and behaviors. As
Zaccaro et al. (1987) argued, “the delineation of attributions into just two categories, internal and external, precludes our understanding of ... reactions to group outcomes,” the inclusion of all four types of internal-external attributions allows for a more in-depth and fine-grained analysis of attributional effects on group dynamics than the simpler internal/external distinction (p. 262). Therefore, the present investigation of how attributions affect group behaviors includes attributions to self, a group as a whole, other group members, and the group external environment.

While there is no extant theory that predicts a link between attributions for a group failure with subsequent group behaviors, one approach would be to generalize from attributional theory and research concerned with the individual level directly to the group level. Johns (1999), for example, proposed that self-serving patterns are functionally equivalent across individuals and groups, and should have similar consequences for both. Other perspectives, however, challenge the idea that perceptions in groups and their consequences are merely an extension of those in individual settings (e.g., Goncalo & Duguid, 2008; Hinkle & Schopler, 1986; Jourden & Heath, 1996). For example, Goncalo and Duguid (2008) demonstrate that causal factors internal to the group cannot be reduced to the individual level. Their study concludes that “Attributions for group performance are of interest in their own right, and require the development of theoretical models that are distinct from those developed to understand attributions made to explain individual outcomes” (p. 231).

Therefore, this dissertation considers two different theoretical frameworks – a generalized individual approach and a novel socio-structural perspective – that make different predictions about how attributions for a group failure will affect group processes in virtual groups. The generalized individual framework extends predictions from the individual level to the group level, while the socio-structural perspective
emphasizes the importance of situational awareness for affecting task-appropriate group strategies and behaviors to improve performance.

Briefly, the generalized individual perspective is based on Weiner's theory (1985), which is centered on individuals and their causal attributions for personal performance outcomes, especially achievement failures. According to Weiner's theory, different types of attributions for the previous performance predict personal emotions, achievement strivings, and behavior on the next performance. According to this perspective, attributions to external factors are considered detrimental for future performance because an individual eschews personal responsibility. By blaming external factors, individuals deprive themselves of an opportunity to learn and adjust their behaviors accordingly. In contrast, attributions to internal causes that are controllable by group members (e.g., effort) should bring positive behavior changes and improve group performance. Generalizing this perspective to a group situation, attributions to external factors should be considered performance detrimental to the group because they inhibit strategy changes, whereas attributions to internal causes should stimulate behavior changes and performance improvement.

In contrast, the socio-structural perspective suggests that group-external attributions will offer positive benefits to a group by bringing awareness to the structural constraints and affordances of the group external environment. In turn, the awareness of the group's external constraints is considered essential for finding effective task-appropriate group strategies (Hackman, 1999; Hackman & Morris, 1975; Hackman & Wageman, 2005). The socio-structural perspective proposes that attributions to external constraints will stimulate changes in group strategies, whereas self-internal attributions will facilitate individual-level changes (e.g., greater effort).

Consider the predictions of these two perspectives in the example of the project team discussed above. The two perspectives make very different predictions if
the team members attribute the failure on the pilot project to group-external factors, such as members’ disparate locations and mediated technology. The generalized individual perspective would predict that blaming external factors would prevent the project team from making strategy changes that could positively affect performance. In contrast, the socio-structural perspective would predict that attributions to external factors in the environment should prompt changes in the team strategies and behaviors because of a heightened awareness of the situational determinants on their previous failure. According to the socio-structural perspective, the changes prompted by group-external attributions will increase group effectiveness.

Both perspectives agree, however, that if the project team members blame other group members for the failure – by making self-external attributions – it will be detrimental for group processes and performance. Similarly, both perspectives agree that internal attributions should lead to an increase in individual effort. However, in contrast to the generalized individual approach, the socio-structural perspective predicts that self-internal attributions will only bring independent changes in the behavior of individual group members without affecting the group-level performance strategies.

The next two chapters develop the generalized individual and socio-structural perspectives on how attributions for a group failure affect group processes on subsequent tasks. The chapter after that connects the group inputs, processes, and outputs together, laying out how attributions should affect group performance through their effects on group processes. The theory discussion is followed by a set of hypotheses concerned with two dependent sets of variables: 1) group processes, including strategy changes, task effort, and maintenance communication and 2) group outcomes, including group performance and satisfaction. The hypotheses from the two perspectives are tested in an experiment on virtual groups responding to a failure. The
results' broader implications for the potential link between attributions for a group failure and subsequent group behaviors and performance are discussed.
CHAPTER 2

GENERALIZED INDIVIDUAL PERSPECTIVE

The effects of attributions for a personal failure have been studied within the framework of Weiner’s (1985) theory of achievement motivation and emotion. According to this theory, attributional causes assigned to self-related events are key to predicting personal behaviors, such as whether a person will fail again or will be successful in his/her future endeavors. The functional role of attributions in predicting personal outcomes is tied to people’s motives for attribution making. According to attribution theory, people do not make attributions to simply explain past events, but also to attain an effective management of oneself and one’s environment in the future through understanding causal influences for past events (Kelley, 1971). As Weiner (1985) wrote, “If the prior outcome or event was undesired — such as exam failure, social rejection, political loss, or economic decline — then there is a strong possibility that there will an attempt to alter the causes to produce a different (more positive) effect” (p. 549).

Not all causes are malleable, however. Weiner (1985) classified attributions in terms of three underlying properties — locus, stability, and controllability — which define whether a cause can be altered by the attributor. Locus refers to an internal/external origin of a cause; stability is its duration (stable or not), and controllability refers to a volitional control over a cause. Individual behavior changes, according to the theory, occur when the causes for a past failure are internal, controllable, and unstable because only such causes are subject to change by the attributor. For example, by attributing a test failure to poor effort, the individual can anticipate and achieve future success by changing the cause of the previous test failure, that is, by working harder in the future. Therefore, attributions to internal,
controllable, and unstable causes are considered performance facilitating because by increasing achievement motivation they encourage behavior changes that should, in turn, improve performance.

In contrast, external causes (e.g., task difficulty) or internal but stable and/or uncontrollable causes (e.g., aptitude) are considered performance-detrimental because they do not stimulate attempts at changing individual behaviors. Although external factors may be either stable (e.g., task characteristics) or unstable (chance), they are outside of the attributor's volitional control, according to Weiner (1985). According to this view, as long as external factors (e.g., task difficulty or bad teachers/roommates) are expected to remain in the future, the individual failure is to be repeated over and over again because the causes are outside of the individual's capacity to change them. As Weiner (1985) explains, "If conditions (the presence or absence of causes) are expected to remain the same, then the outcomes experienced in the past will be expected to recur" (p. 556).

Attributional research has taken up this idea that it is attributions for a failure, rather than a failure itself, that undermines future successes and has applied Weiner's theory (1985) to various achievement-related situations (see for review, Martinko, Gundlach, & Douglas, 2002; Weiner, 2001, 2004). According to this view, external causes are largely irrelevant to personal failures, regarded as excuses used by the attributor to protect his/her self-esteem (Noel, Forsyth, & Kelley, 1987). As such, external attributions reflect self-serving and ego-defensive biases that "insulate" individuals from negative implications of their performance (Forsyth and McMillan, 1981). This short-term benefit comes, however, at the long-term cost of future performance losses. The result of shoultering responsibility elsewhere is an obstruction in individual learning and task adaptation because by externalizing their fault individuals deprive themselves of an opportunity to learn and adjust behaviors
accordingly. In other words, when a cause of a failure is seen in uncontrollable and external factors, there should be no utility in personal adjustments and behavior changes, according to this view.

Supporting this perspective, attributions to external factors have been linked to reduced task satisfaction, decreases in achievement motivation, and inferior task performance in individual achievement-related contexts (e.g., Andrews & Debus, 1978; Arkin, Kolditz, & Kolditz, 1983; Forsyth & McMillan, 1981; Hall, Hladkyj, Perry, & Ruthig, 2004; Noel et al., 1987; Wilson & Linville, 1985). In contrast, attributional interventions redirecting attributions from external to internal and unstable causes have produced performance improvements among failing performers (Andrew & Debus, 1978; Hall et al., 2004; Noel et al., 1987; Wilson & Linville, 1985).

Consider now the virtual project team discussed above and how the generalized individual perspective would link the members’ attributions about their previous failure with their work processes and performance on the next task. First, attributions to external factors (other group members or external constraints of the virtual environment) should hurt group performance because they shift responsibility away from the individuals to external factors that are presumably uncontrollable and irrelevant. As a result, the group will not attempt to make strategy changes (either individual- or group-level) and will not try to work harder on the task. In short, self-external and group-external attributions will lead to a repeated group failure on the second task. In addition, if group members make self-external attributions (i.e., direct their blame at other group members), it will negatively affect the other outcome variable – relational satisfaction. This effect is predicted based on Weiner’s theoretical extension (1995), which connects partner blame with negative attitudes, emotions, and antisocial actions towards the target individual.
What if the project team members attribute their problems to self- or group-internal causes that are subject to change by the group members (e.g., lack of effort, lack of motivation, insufficient experience, or poor strategy)? Because the group members internalize their problems and the problem causes are potentially controllable, such attributions should encourage adjustments in work processes and task effort. Therefore, the generalized individual approach predicts that internal attributions should promote strategy changes, effort increase, and performance improvement on the second task.
CHAPTER 3

SOCIO-STRUCTURAL PERSPECTIVE

Much like the generalized individual perspective, the socio-structural framework assumes that attributions for a previous group failure affect subsequent group processes and performance. In contrast to the generalized individual approach, the socio-structural perspective's central tenet is that attributing a group failure to the structural constraints of the external environment will lead groups to review and revise their strategies, which, in turn, will improve group performance. This novel theoretical position on the value of external attributions to group performance is based on several theoretical assumptions derived from group theory and research, some of which contrast with those underlying the generalized individual approach. Specifically, these assumptions deal with a) distinctions among different types of external attributions, b) the group external context and how external constraints are relevant to group performance, c) whether the group has control over the external environment, and d) differences between structural and individual-level strategy changes. In addition to the attributional effects on procedural communication changes, the socio-structural framework also reflects on how attributions affect maintenance communication, which refers to the socio-expressive aspect of communication (Keyton, 1999; Pavitt & Curtis, 1994). Furthermore, embedded in the discussion are predictions about the effects of attributions on individual-level strategy changes and effort that group members put into the task.

Types of External Attributions

Distinctions between group-external and self-external attributions.

Group members can attribute a group outcome to two types of external causes: external to self - other group members and external to the whole group - situational
factors. Recall that because both of these causes are external to the individual group member, the generalized individual approach described above predicts that attributions to either self-external or group-external causes will harm group performance.

In contrast, the socio-structural perspective predicts that attributing a group failure to a challenging work environment will have different consequences for group behaviors and performance than attributing it to other group members. This proposition is consistent with both general attribution research and group research. According to Robins, Mendelsohn, & Spranca (1996), although attributional research usually associates external attributions with all aspects of the external environment, it is important to distinguish between general situational influences and the effect of social partner(s). Similarly, group research distinguishes between the self-serving and group-serving bias, according to which group members can attribute a group failure either to factors external to self only—other group members (self-serving), or to factors external to the group as a whole—the external environment (group-serving) (Forsyth & Schlenker, 1977; Leary & Forsyth, 1987).

Attributing a group failure to external constraints of the virtual environment is expected to prompt the group’s attention to performance strategies and revise them in order to better adapt to the external environment. In contrast, attributions to other group members should lead to maladaptive communication behaviors and negative relational outcomes. The next section lays out how attributing the group failure to other group members may affect communication and social relations in the group.

Effects of attributions to other group members on maintenance communication and relational outcomes.

Blaming others is associated with relational difficulties in various interpersonal contexts, including family, marital, and organizational relations. One mechanism through which other-blame hurts social relations is by eliciting negative emotions in
the attributor, such as anger, frustration, or even aggression (Weiner, 1995). Another
one is by creating expectations for the attributional target’s reactions, which, in turn,
affects the attributor’s communication strategies, such as avoidance or cooperative
communication in conflict situations (Sillars, 1980). The ultimate cost of other-blame
is the relationship itself, which deteriorates because of decreased relationship
satisfaction and trust (e.g., Fletcher, Fincham, Cramer, & Heron, 1987; Seligman,

Because relational dynamics in groups is shaped through members’
communication behaviors, which create “the social fabric of a group” (Keyton, 1999,
p. 192; Walther & Burgoon, 1992), attributional dynamics should be evident in the
group’s interaction. That is, if attributions are to affect social outcomes in the group,
the group interaction process should also be affected. Specifically, attributions are
expected to influence maintenance communication, or socio-expressive aspects of
communication, which refers to messages expressing members’ attitudes towards one
another, the group as a whole, and work (Pavitt & Curtis, 1994). Burgoon and
colleagues (1987) called it an “affective tone” of communication or a “secondary
relational message value” distinguishing it from content message function. Jarboe
(1996) illustrated the socio-expressive aspect of communication with this example:

One can imagine two groups arriving at exactly the same set of consequences,
yet one discussion might be marked by sarcastic tones and rigidity whereas
another group present its ideas supportively and tentatively. … And one group
may disband with relief while the other looks forward to the next meeting. The
sheer presence of an idea is one thing; the way is presented is another; and its
impact on group process is also another (p. 374).

In virtual groups blaming others has also been considered as an underlying
cause of conflict and poor social relations (Cramton, 2002; Hinds & Bailey, 2003;
Mortensen & Hinds, 2001; Walther et al., 2001), although this relationship has not been directly tested. Therefore, attributions to other group members are expected to negatively affect maintenance communication and social relations in virtual groups. The next section focuses on attributions to the external environment and how such attributions may impact group processes and performance.

*External Constraints and Group Performance*

Recall that the generalized individual perspective tends to view external attributions for the group failure as excuses deflecting the fault from the attributor rather than references to the objective causes that may have interfered with the group performance. In contrast, the socio-structural perspective considers how external factors can be relevant to group behaviors and performance, and accounts for a potential influence of external constraints on shaping group processes/performance.

The influence of the external environment as a larger social system, in which the group is embedded, can be analyzed from different perspectives, such as its effects on group membership, structure, resources, functions, goals, and procedure (see for review, Argote & McGrath, 1993). The present discussion of the external environment is limited to its role in affecting group performance. To this end, this section reviews some representative group theories that characterize how external constraints are relevant to group performance.

In 1968, Roby presented a general framework, according to which group performance is the interplay of two complex systems – the group itself and the group’s external environment, which he referred to as the task environment. The task environment consists of objective properties, such as general physical conditions, group culture, task objectives, task instructions, facilities available to group members such as communication devices, and task mechanics. According to Roby, these
properties can be conceived as causes that impose external constraints and affording options for group behavior.

Goodman's (1986) framework also highlights constraints imposed by the external environment on group performance of production teams producing some goods in real-world organizational contexts, such as coal-mining crews. He refers to the external context as technology, which encompasses materials, physical environment, task, and procedures related to the task activities. While group research has mainly focused on the link between the human aspects of the group (e.g., group effort, leadership, or coordination) and group performance, Goodman argued that the external environment creates "the constraints by which other systems (for example, the human or team component) could function" (p. 143). If external constrains directly affect group performance, then studies of group performance must account for factors that are both endogenous and exogenous to the group. Because external constraints vary for different types of groups and their work environments, it is important to identify constraints that are most relevant to a particular group environment, according to Goodman.

In another well-established framework of group effectiveness, Hackman (1978) discussed how the group's external context creates contingencies that mediate between group processes and performance. Specifically, Hackman was concerned with the role of technology with which the group works and how the technology may mediate between group processes and group performance. The constraints imposed by the technology (including task and external context) determine whether group processes – task effort, changes in task strategies, or individual talents/knowledge – can bring improvement to a group performance, and which of them are most relevant in a given performance situation. According to Hackman, to improve group
performance members need to understand external constraints and how they affect group processes and performance.

Most empirical research concerned with the role of external context on shaping group performance has been conducted in the context of groups working with machinery, such as maintenance-road crews (Tesluk & Mathieu, 1999), coal-mining crews (Goodman, 1986), or wood-harvesting crews (Kolodny & Kiggundu, 1980). For example, Tesluk and Mathieu (1999) studied a role of external constraints - "factors in the immediate work environment that can potentially interfere with effective performance" (p. 201) - in affecting performance of maintenance-road crews. The external constraints that the crews encountered included problems with tools and equipment, job-related information, materials and supplies, required services and assistance from others, time availability, scheduling, and the physical work environment. As predicted, Tesluk and Mathieu found that these constraints negatively affected their group performance.

Virtual groups also operate in the environment with inherent structural constraints that affect information exchange, maintenance of shared context and workflow, coordination of resources, and knowledge of others' situation (see for review, Gibson & Gibbs, 2006). Consistent with the theoretical perspectives reviewed above, these constraints impose limiting options on group behaviors that can potentially interfere with group performance. For example, electronic dependence limits informal spontaneous interaction affecting knowledge interpretation (e.g., DeSanctis & Monge, 1999) or slows down the rate of information because group members have to compensate the absence of nonverbal and environmental cues by more verbiage (Walther & Burgoon, 1992). The effects of structural constraints in virtual groups have been extended not only to group performance, but also to social relations. Virtual group research has linked members' location distribution and
electronic dependence with weakened team identity, conflict escalation, discontent, relatively lower affection and cohesion, and frustration directed at other team members (e.g., Cramton, 2001; Hinds & Bailey, 2003; Mortensen & Hinds, 2001; Walther et al., 2001; Wilson et al., 2006).

Recall the example of our project team and its struggles with sharing resources, coordinating their workload, and communication breakdowns. It is reasonable to assume that most of their problems were caused by structural constraints imposed by the virtual environment, such as contextual differences, lack of knowledge about one another’s situations, and a slow rate of information exchange (Gibson & Gibbs, 2006). It is also likely that the project members approached their virtual group work without giving sufficient consideration to the structural characteristics of the group’s virtual environment and how they should adapt to them. As Hackman (1978) argued, “norms about strategy ...are more likely to be present out of ‘habit’ than as a reflection of some basic feature of the group task or the organization environment” (p. 76). As discussed earlier, the habitual ways of how things are done in traditional face-to-face settings do not live well with the virtual environment, however. In order to make virtual collaboration successful group members have to reformulate group norms about performance processes to make them more appropriate to structural constraints they face in the virtual environment (Walther & Bunz, 2005).

As follows from this brief theory and empirical research overview, the external environment imposes constraints on group performance. Although the relative importance of the external environment may vary for different groups and situations (Goodman, 1986), it is clear that “the context is part of the phenomenon of group dynamics” (Hackman, 1999, p. 234). Therefore, in contrast to the generalized individual view on external constraints as largely irrelevant to performance, the socio-
structural perspective assumes that external constraints are potent and relevant factors that can affect group performance in virtual groups.

*Control Over the External Environment*

If external constraints affect group performance, it is essential for group members to realize their influences on group work. As Hackman and Morris (1975) argue, in order to improve group performance “members should achieve the fullest possible awareness and understanding of the factors that affect their own performance activities and their effectiveness as a group” (p. 94). Likewise, Roby (1968) maintained that changes in the group procedures result from group members’ learning the environmental information, that is, “establishing what aspects of the task environment are relevant and how they bear on specific decisions” (p. 17). In their study of external constraints on group effectiveness, Tesluk and Mathieu (1999) came to a similar conclusion that “A careful analysis of the work group’s task and context conditions is a vital first step in identifying the critical context factors that influence effectiveness and understanding how work groups can manage these factors” (p. 214).

The virtual group research has also acknowledged awareness of external constraints as an essential step to improving group adaptation to the external environment and group performance. Walther, Boos, and Jonas (2001) emphasized the importance of “an appreciation of the sociotechnical requirements of distributed work” (p. 9), and that group members have to realize the external constraints of mediated work in order to alter their behavior appropriately. Walther and Bazarova (2007) used a direct attributional intervention to raise group members’ awareness of the situational constraints of the computer-mediated group work. However, the mechanism by which attributions to external factors should improve group adaptation to the external environment and its performance has not been specified.
What can be done once members realize the effects of external constraints on their group behaviors? Recall that the generalized individual approach considers external causes as uncontrollable by the attributor. This is consistent with how most group research views the group external context: a determined system that cannot be influenced by the group (Argote & McGrath, 1993). However, some group theorists proposed that groups are able to gain at least some control over the immediate features of their work environment by using certain strategies that moderate negative effects of external constraints on group performance (Cummings, 1981; Goodman, 1986). According to this view, “Groups not only are influenced by their environment but also are active agents that over time learn to shape their own contexts. Managing performance barriers may be one important way groups can facilitate their own performance” (Tesluk & Mathieu, 1999, p. 203).

Goodman (1986) provided an example to illustrate how the interface between the human and contextual factors may provide an opportunity for intervention that will minimize the negative impact of the external constraints on group performance. Based on his study of coal-mining crews, he discussed how downtime was a major factor affecting group performance for coal-mining crews. Although frequency of downtime was not directly controllable by the crews, they could mitigate its negative impact on the crew effectiveness: “The members’ response to the downtime incident is key to increased productivity” (p. 165).

Tesluk and Mathieu (1999) observed similar reactions to the external constraints in another type of groups – maintenance-road crews. According to their findings, “Through various actions or strategies (e.g., effectively working during down time, prioritizing subtasks, judiciously allocating resources), groups can attempt to manage environmental contingencies” (p. 203). Tesluk and Mathieu identified two types of strategies with which the crews attempted to harness external constraints. The
first strategy was directed at minimizing the presence of external constraints, such as checking the condition of the equipment to avoid equipment breakdowns from happening if the crew anticipated adverse weather conditions, such as an ice or snowstorm. When the crews were unable to take actions to avoid problems from occurring, the other strategy was directed at minimizing negative impacts of external constraints on group performance. For example, to minimize the length of equipment breakdowns, the crew might decide to carry spare parts with them in the field in order to fix the problems faster.

Virtual group members may also use these two strategies to harness the challenges of virtual environment. They can either attempt to minimize the presence of external constraints or their negative impact on group performance. For instance, if the project team above realizes that many of their coordination difficulties resulted from not knowing when the other party received an email message, they might decide to use a synchronous channel, such as phone or chat, for exchanging important information on the next project. When it is impossible to minimize the presence of external constraints, such as not being able to use synchronous communication because of the time zone differences between the members’ locations, the project members can attempt to minimize the impact of those constraints on the group effectiveness. For example, they may decide to install an automatic notification option that notifies the sender once his/her message has been read, or agree to explicitly acknowledge having read one another’s messages by sending email notifications themselves.

Because many of the challenges virtual groups face are caused by the limitations of the electronic channel they use for communication, groups can minimize their interference with performance by restructuring the group’s communication procedures. Communication procedures refer to the order and manner in which communication takes place during a group meeting (Sunwolf & Seibold, 1999).
Virtual group research that has attempted to introduce changes in the group’s communication procedures by giving behavioral guidance through rules suggests that adherence to these rules can improve group performance and the group social climate (Walther & Bunz, 2005). Therefore, when virtual group members are not able to control the external constraints directly, they can minimize their negative impact on group performance by restructuring the group’s communication practices.

There are two ways that restructuring of communication procedures could be linked to group members’ attributions for the previous group failure. One way is through the group’s making group-internal attributions that point to the group’s procedures and strategies directly. For example, if the project members realize that their group failure was caused by their ineffective communication and poor coordination on the pilot project, such group-internal attributions should improve the way the group communicates and coordinates their workload on the next project. Although a promising scenario, it is problematic, however, because group members rarely spontaneously focus on their strategies as a cause of a group failure. According to Hackman (1978), although “norms about strategy should be relatively amenable to change, ...such norms are rarely examined or tested by the group,” and that group members need some kind of “impetus from outside of the group” that would redirect their attention to group strategies (p. 76). Empirical studies examining how groups change their strategies show that a common response after a group failure is to increase effort rather than break out of their performance routines (Avery, 1996; McClelland, 1984). This suggests that groups tend to focus on effort rather than on their group strategies as the underlying group-internal failure cause, which brings an increase in effort without affecting group strategies on the next task.

The socio-structural perspective suggests a different attributional mechanism that can lead the group to realize a necessity of restructuring its communication
procedures. It proposes that realizing external constraints in the virtual environment and their effects on group performance could serve as an impetus that would prompt the group to reflect on and modify its strategy norms. In other words, a look outwards may be what it takes for the group to start looking inwards. Once group members realize that they are in a challenging work environment that interferes with group performance, this awareness should trigger attention to and reconsideration of their approaches to the group task.

There is some support for this proposition from Tesluk and Mathieu’s (1999) study of road-maintenance crews. According to their study, group members could start changing their work strategies only after they “develop an understanding of the types of constraints that affect group performance...by observing the relationship between contextual factors and performance outcomes” (p. 204).

More evidence on how attributions to the external constraints may prompt changes in group strategies comes from a study of social dilemma groups. In social dilemma situations group members find themselves in a conflict between individual interests (keeping the limited resource for oneself) and collective interest (keeping the resource as long as possible for future use). Samuelson (1991) examined how the perceived cause of a previous group failure to use the resource cooperatively affected group strategy changes. Drawing on Messick and Brewer’s work (1983), he defined group-level changes as structural solutions that affect the group’s existing structures, such as changing its decision-making rules, or establishing a leadership role to manage a common resource. The structural changes affect the group endogenous processes, such as members’ level of interdependence, their expectations and perceptions of one another’s behavior, and their communicative patterns. As such, the concept of structural changes is similar to the concept of group norms or expectations that define the rules by which groups operate and modify the existing patterns of group processes.
Samuelson (1991) hypothesized that an appreciation of external constraints, such as a difficult task environment, should stimulate structural changes aimed at improving group cooperation. The external constraint in Samuelson's study was task difficulty, and although it was not directly controllable by group members, they could make structural changes that would minimize its negative effects on group cooperation, such as establishing a formal leadership to the group. Consistent with the prediction, groups induced with group-external attributions to the task difficulty preferred adding a formal leadership to the group more frequently than did groups induced with attributions to group-internal causes.

Extending these findings to virtual groups, the socio-structural perspective predicts that attributions to external constraints of the virtual environment will bring structural changes in the group’s communication procedures. Structural changes can be either directed at minimizing the presence of an external problem cause, such as changing a communication modality when possible, or minimizing its negative impact on group effectiveness by restructuring the group’s communication practices.

*Structural versus Individual Strategy Changes*

The previous section laid out a conceptual framework according to which attributions to external constraints of the virtual environment should stimulate structural changes in virtual groups. In group work, however, there are two types of strategy changes that can be made: individual- and group-level (structural) changes. It is important to consider how individual-level changes are different from structural changes in order to understand the psychological mechanisms that prompt these changes.

The distinction between structural-level and individual-level strategy changes is based on Messick and Brewer's (1983) work on social dilemma groups. According to their conceptualization, individual-level changes are decentralized individual efforts
to improve performance under the existing group structure that do not affect the group norms or expectations about how the group as a whole performs on the task. An example of an individual-level change is when a group member decides to work harder on the task or pay more attention to what the other group members say, and his/her personal efforts to improve group performance occur on an individual and decentralized basis independently from other group members.

Because individual-level changes are tied to the individual locus of control, the socio-structural perspective relates them to self-internal attributions. That is, attributing the group failure to self-internal causes should lead to individual-level changes, such as individual attempts at improving group performance. Importantly, making self-internal attributions is not expected to produce structural changes in the group communication procedures. In other words, the socio-structural perspective predicts that internalization of a group problem by individual group member keeps the solutions at the individual level also, without raising the group members’ cognizance of the necessity and value in changing group-level procedures.

**Summary of the Socio-Structural Perspective**

To summarize, the socio-structural perspective is based on several theoretical principles. First, the effects of attributions to the external environment are considered separately from the effects of attributions to other group members, with the latter being detrimental for group maintenance communication and social relations. Second, external constraints are regarded as potentially important influences on group processes and performance. Third, although the group may not have a full control over the external constraints, group members can make adjustments in their strategies to minimize the presence of the external constraints or their negative impact on group effectiveness. Finally, there are different types of strategy changes that group members can make: individual-level, which involves individual and decentralized changes, and
structural, which involves changes that affect the group’s structural characteristics and strategy norms. Based on these considerations, the socio-structural perspective predicts how different types of attributions – self-internal, group-internal, self-external, and group-external – should affect group processes and performance in virtual groups.

Consider the example of the project group that we have used before to illustrate these predictions. Recall that this group has delivered a poor performance on a pilot project, and the key question is how group members’ attributions will affect how the group will go about doing the task the second time. According to the socio-structural perspective, making attributions to the external environment, such as to temporal delays and slow rate of information exchange, will prompt a review and revision of the group’s communication procedures in order to improve adaptation to external constraints. Blaming other group members for the group failure will harm the group’s maintenance communication and social relations. Finally, attributing the group failure to the group as a whole will increase group effort, and self-focused attributions should stimulate individual-level changes, without affecting group communication procedures.
CHAPTER 4

LINKING ATTRIBUTIONS, GROUP PROCESSES, AND GROUP OUTCOMES

The two perspectives presented above – the generalized individual and sociostructural perspective – make predictions about how attributions for a previous performance outcome affect group processes on the next performance phase. According to the generalized individual approach, attributing a group failure to internal causes (self or group) produces desired behavior changes, such as an increase in effort and strategy changes, whereas attributing a group failure to external causes (other group members or the external environment) produces no such changes in group behaviors. In contrast, the socio-structural position predicts that attributions to external constraints in the environment encourage groups to reconsider and revise their strategies, whereas internal attributions primarily lead to an increase in effort and individual-level changes. Finally, both perspectives agree that blaming other group members for the group failure should negatively affect group communication and its relational climate.

While these two perspectives link attributions and group behaviors differently, they both conceive of attributions as inputs into the group’s subsequent processes and performance. This view is grounded in the input-process-output model (McGrath, 1964), which characterizes group performance in terms of group inputs leading to group interaction processes, which in turn lead to group outcomes. Departing from the input-process-output model that tends to view group performance as a “single-cycle linear path from inputs through outputs” (Ilgen, Hollenbeck, Johnson, & Jundt, 2005, p. 520), the present conceptualization of attributions for the previous task as inputs into the subsequent group work emphasizes a reciprocal relationship between group inputs, processes, and outputs across different tasks. This view is consistent with
recent models of group performance showing that group performance is not limited to
a single accomplishment period, but group inputs, processes, and outcomes are
reciprocal between different performance episodes (e.g., Ilgen et al., 2005; Kozlowski,
Gully, Nason, & Smith, 1999; Marks, Mathieu, & Zaccaro, 2001). An important part
in this recurring exchange between outputs from a previous performance cycle and
inputs into the new cycle is played by emergent cognitive and affective states that are
“products of team experiences and become new inputs to subsequent processes and
outcomes” (Marks et al., 2001, p. 358). The emergent states are dynamic in nature and
represent group members’ attitudes, cognition, values, and motivation. As attributions
are assumed to arise as a consequence of a previous group performance (Forsyth &
Schlenker, 1977, Zaccaro et al., 1987) and can potentially affect subsequent group
processes, they fit into the conceptualization of an emergent cognitive state proposed
by Marks and her colleagues (Marks et al., 2001).

If attributions are inputs that affect group performance through group
processes, in order to complete the input-process-output cycle it is necessary to
consider the effect of group processes (e.g., task effort, changes in communication
procedures, and maintenance communication) on group performance. Although the
generalized individual and socio-structural perspectives draw distinct paths between
different attribution types and the group processes, they share an underlying
assumption about the importance of effort, strategy changes, and group
communication on improved group performance. That is, a group can achieve a better
performance outcome when attributions prompt members to work harder, find a more
appropriate strategy, and communicate in a way that builds up group morale
(Cummings, 1981; Hackman & Morris, 1975; Hirokawa & Keyton, 1995; Weldon &
Weingart, 1993).
At the same time, the impact of effort and strategy changes on group performance hinges on the contingencies built into a task and situation (Hackman & Morris, 1975; Hackman, 1978). For example, although the amount of effort group members put forth on the task is clearly important for group performance, its impact on group effectiveness is moderated by the appropriateness of group strategy.

Similarly, although a group strategy discussion increases chances of finding a more task-effective strategy, it does not guarantee it. However, despite these contingencies, task effort and finding a task-appropriate strategy are important determinants of group performance. Therefore, attributions that positively affect effort and strategy changes are expected to improve group performance.

Another determinant of group effectiveness is the quality of interpersonal relations and maintenance communication in the group (Bales, 1950; Hackman, 1979; Keyton, 1999, 2000). Group’s relational dynamics and communication creates a climate within which group members accomplish their tasks. According to Keyton (1999), “The attitudes we hold about our relationships with others in a group have a strong effect on our task motivation. Group tasks are not accomplished by task knowledge or skill alone” (2000, p. 388). Similarly, Poole and Holmes (1995) argue that social factors account for a large share of the variance in group decision processes.

There are two frameworks that account for the role of maintenance communication in predicting group performance. The first one is based on Bales’ (1953) group equilibrium work suggesting that positive maintenance communication, such as statements releasing tensions or showing satisfaction and solidarity, is important for maintaining an appropriate socio-task balance that facilitates group performance. Whereas negative statements, such as showing tension or antagonism, create “maintenance disturbances” harmful for the group’s goal of maintaining itself,
positive maintenance statements can balance out the negative effects of negative maintenance statements and tensions built up by task-related activity.

The other framework based on Weingart and Weldon’s work (1993) ties maintenance communication with the group’s motivation and effort. They propose that task motivation in groups increases with a morale-building communication that arouses the group’s enthusiasm about the task and expresses confidence in members’ ability to perform well. Such positive maintenance communication, according to Weldon et al. (1991), “builds a sense of efficacy among group members, arouses their emotions, and inspires them to action” (p. 557).

Therefore, attributing the group failure to other group members is expected to hurt group performance because of the negative effects on social relations and maintenance communication. In contrast, the other types of attributions should improve performance because of their positive effects on effort and communication strategy changes.
CHAPTER 5

HYPOTHESES

This chapter outlines the specific hypotheses derived from the two perspectives on the effects of attributions for a group failure on subsequent group processes/performance in the present study. The hypotheses were tested in an experiment that employed three-member groups working on a two-step task consisting of a practice and a performance trial. All groups received a non-contingent negative feedback about the group performance on the practice trial. The failure feedback involved an attributional manipulation to direct responsibility for the group failure to one of four attributional causes: 1) an individual group member (self-internal), 2) a group as a whole (group-internal), 3) other group members (self-external), or 4) external constraints of the environment (group-external). After this feedback and the attributional manipulation, each group was given an opportunity to discuss their strategies for the performance trial. Following the strategy discussion, the group completed the performance trial, and the group performance on the second task was objectively scored.

The hypotheses are organized by the types of variables that attributions are expected to affect: individual and structural-level strategy changes, effort, maintenance communication, relational satisfaction, and group performance. Where applicable, there are contrasting predictions reflecting the generalized-individual and socio-structural theoretical perspectives.

The first variable concerns strategy changes in the group. There are two types of changes that group members could make: individual-level reflecting changes in an individual group member's behaviors and structural changes reflecting a change in the group strategy norms. Both the socio-structural and the generalized individual
approach agree that self-internal attributions lead to more individual-level changes than other types of attributions.

H1: Group members who attribute the group failure to self-internal causes make more individual-level changes than group members who attribute the group failure to other causes.

In addition, the socio-structural perspective predicts that group members who make self-internal attributions will see less value in making group-level changes than group members who make other types of attributions.

H2: Group members who attribute the group failure to self-internal causes see less value in group-level strategy changes than group members who attribute the group failure to other causes.

Next, consider how groups discuss and make structural changes. Structural changes in virtual groups can either minimize the presence of external constraints or the impact of those constraints on group performance through changing the group communication procedures. The evidence for changes in group communication procedures should be seen in both the actual changes that the groups had made between the work sessions and in the content of the strategy discussion that the groups had between the practice and performance sessions.

According to the generalized individual perspective, group members who make attributions to the external environment should review and change their communication procedures less than group members who make internal attributions. In contrast, the socio-structural perspective predicts that awareness of external constraints and their effects on group performance should lead groups to review and change their discussion procedures more than other types of attributions. Therefore,

H3A: According to the generalized-individual framework, group members who attribute the group failure to external constraints make fewer changes in their
communication procedures than group members who attribute the group failure to internal causes.

H3B: According to the socio-structural framework, group members who attribute the group failure to external constraints make more changes in their communication procedures than group members who attribute the group failure to internal causes.

H4A: Group members who attribute the group failure to external constraints discuss their communication procedures less than group members who attribute the group failure to internal causes.

H4B: Group members who attribute the group failure to external constraints discuss their communication procedures more than group members who attribute the group failure to internal causes.

Although group members did not have a control over the communication modality in the study, they were able to express their preference of a communication system for a hypothetical future task. The socio-structural perspective predicts that group members who attribute the group failure to the external constraints will try to minimize the presence of the external constraints – by choosing a different communication system – more than group members who attribute the group failure to other causes. Relatedly, group members who attribute the group failure to the external constraints are expected to be less satisfied with the present communication system than group members who attribute it to other causes.

H5: Group members who attribute the group failure to external constraints prefer to change the group communication system more than group members who attribute the group failure to other causes.
H6: Group members who attribute the group failure to the external constraints are less satisfied with the communication system than group members who attribute the group failure to other causes.

The next hypothesis addresses the effects of attributions on task effort. According to both socio-structural and generalized individual approach, internal attributions should stimulate more effort on the group task. Therefore,

H7: Group members who attribute the group failure to self-internal or group-internal causes increase task effort more than group members who attribute the group failure to other causes.

The next hypothesis predicts the effects of attributions on maintenance communication. Both the socio-structural perspective and the generalized individual perspective suggest that making self-external attributions by blaming other group members should negatively affect maintenance communication. Specifically, a maintenance communication balance is expressed in terms of a ratio of negative to positive statements (Bales, 1953). Therefore, attributing the group failure to self-external causes is expected to lead to more negative and less positive maintenance discussion than attributing the group failure to other causes. Therefore,

H8: Group members who attribute the group failure to other group members have less positive and more negative maintenance communication than group members who attribute the group failure to other causes.

Relatedly, according to both the generalized individual and socio-structural perspectives, self-external attributions blaming other group members are expected to hurt the group's relational climate. Therefore,

H9: Group members who attribute the group failure to other group members experience a) less positive group attitude, b) less trust, c) less group
satisfaction, and d) more negative relational climate than group members who attribute the group failure to other causes.

Now consider the effect of attributions on group performance. As discussed above, increased effort, strategy changes, and positive maintenance communication are potentially positive predictors of improved group performance. In contrast, decreased relational satisfaction and negative maintenance communication should negatively affect group performance. Therefore, attributions that lead to increased effort, strategy changes, and positive maintenance should improve group performance. In contrast, attributions that negatively affect group communication and relational satisfaction should hurt group performance.

H10: Group members who attribute the group failure to other group members have a lower quality performance than group members who attribute the group failure to other causes.

H11: Group processes, including a) effort, b) strategy changes, and c) maintenance communication mediate between attributions and the quality of group performance.
CHAPTER 6

METHODS

Research Design

The study was a completely randomized design consisting of one factor (attribution) with 4 different levels (attribution to self, attribution to the group as a whole, attribution to other group members, and attributions to the external constraints of computer-mediated communication). It was divided into 4 phases. In the first phase, each group completed a practice trial of the group task, which was used as a basis for a non-contingent negative feedback about the group performance. In the second phase, each group member individually received a negative feedback about the group performance on the practice trial. The failure feedback involved the attributional manipulation to direct responsibility for the group failure to one of the four attributional causes: 1) self (self-internal attributions), 2) the group as a whole (group-internal), 3) other group members (self-external), or 4) the external constraints of computer-mediated communication (group-external). After the attributional manipulation and before they received the task materials for the performance trial, groups had a “free discussion” online time, which they could use for discussing their strategies for the performance trial or talking about social events. Finally, in the fourth stage, each group completed the second task trial, which was used to assess a group performance quality. After the task was completed, participants answered questions from a web-administered questionnaire.

Participants

One hundred ninety-two participants were recruited from several classes in communication and psychology for decision-making discussions in online groups. They were offered partial course credit and a candy bar in exchange for their
participation, as well as a chance to be entered in a raffle for the Cornell Store gift certificates. Six groups were removed due to problems with the manipulation or technical difficulties, so the final sample included 58 groups (N=174). Sixty-seven percent of the participants were female. The majority of the students in the sample were from sophomore (36%) and junior (31%) classes; 12% were freshmen and 21% were senior students. Participants were predominantly Caucasian (63%); 14% were Asian, 7% were African, 7% were Hispanic, 3% were European, and the remaining 6% identified themselves as other. The participant mean age was 20 with a mode of 19.

**Group Task**

The task was adapted from a case study “the merit bonus activity” (Hai, 1986), with modifications based on previous studies which had used a similar type of a task (Katz-Navon & Erez, 2005; Saavedra, Earley, & Van Dyne, 1993), as well as results from pilot runs (N=16 groups) testing the task, experimental procedure, and attributional manipulation. The task required groups to recommend merit-based bonuses for fictitious employees based on the employees’ profile descriptions. Participants received the following task instructions:

“For many employees, their annual pay raise is the most important feedback that they receive from their organization. You are one of the three managers in a department that was formed several years ago. Several technical graduates were recently hired to perform a variety of maintenance tasks. You need to make recommendations for a salary percentage increase that will be given as a merit bonus for these employees. Each employee is described using four characteristics: effort, ability, performance, and friendliness. Each characteristic has an equal weight. Based on their profile descriptions, your task is to rank these employees for a merit bonus, from most deserving to least. You have to be in consensus with the two other
managers on the merit bonus assignments. Your communication with them will be done in an online chat.”

Participants were told that they would be working on two trials, a group practice trial and a group performance trial, which are analogous to each other, and that they have twenty minutes to complete each trial. Participants were notified that the task had a correct answer, and their performance would be evaluated by comparing the group ranking to the correct answer. To increase motivation, participants were also told that groups with the correct ranking on the performance trial would be entered in a raffle for the Cornell Store gift certificates, with each member of the winning group awarded a $100-value gift certificate. The task instructions and employee profiles for both practice and performance trials are listed in Appendix 1.

All the groups in the study received non-contingent negative feedback for their performance on the practice task. The practice task did not have an objectively correct answer because the pilot study testing revealed that with an objectively correct answer participants could guess the accuracy of their performance and whether it was consistent with the negative feedback. In contrast, the pilot testing suggests that without the objectively correct answer participants appeared to believe the negative feedback.

The ranking solution on the second trial had a correct answer. The profiles of the employees were designed in such a way that rating each employee on the four criteria – friendliness, effort, performance, and ability - on a 3-point scheme (low=1, average=2, and high=3) and summing up the total score for each led to a correct ranking order, with the top employee totaling 11 points and the least ranking employee totaling 7 points overall. For example, “Bob has excellent technical skills and seems to have good performance even though he often gets into arguments with the other employees and rarely puts much effort into his job” gets high for ability (3), average
for performance (2), and low for both effort (1) and performance (1), resulting in his total score of 7. A distribution of scores for all the employees on this task is presented in Table 1.

Table 1.

<table>
<thead>
<tr>
<th>Employee</th>
<th>Ability</th>
<th>Effort</th>
<th>Performance</th>
<th>Friendliness</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Susan</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Paul</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Bob</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>John</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Nancy</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>8</td>
</tr>
</tbody>
</table>

The correctness of final group decisions was assessed by an ordering of the five alternatives based on the number of incorrect orders. The correct rank order of ABCDE, where alternative A > alternative B > alternative C > alternative D > alternative E, was assigned a value of 5. An incorrect ordering of one employee resulted in 3 correct and 2 incorrect rank orders and was assigned a value of 4, followed by a value of 3 (2 correct and 3 incorrect), followed by a value of 2 (1 correct and 4 incorrect), and, finally, a value of 1 for all 5 rank orders being incorrect. Thus, the outcome variable of decision correctness had five ordered values from 1 being totally incorrect to 5 being totally correct.

Procedure

*Phase 1: providing the basis for a false performance feedback.*

After group members were seated in individual rooms equipped with the computer and the Internet connection, they were asked to read and sign a letter of informed consent. Then they were given general task instructions and task materials for the group practice trial. The instructions for the practice trial asked participants to
do a personal ranking before they could begin a discussion with the other members of their group:

"Your task is to reach consensus as a group on the ranking of the five employees, from most deserving to least, for the merit bonus assignments. Before you start your group discussion, please do your personal rankings first. You can begin your online discussion when everyone responds that they are ready. You can reach your group responses in any way you wish, but your final ranking should reflect the group’s collective opinion. When your group decides on the final rankings, please type them in your group chat."

Once the group started a discussion in the group chat, the experimenter took the individual rankings away. This was done a) to prevent participants from changing their personal rankings based on the group collective decision and b) to presumably give more time for the experimenter to evaluate personal rankings, which were used as part of the attributional manipulation.

Phase 2: performance feedback and attributional manipulation.

All the groups in the study received non-contingent negative feedback for the practice trial printed on a computer print-out with a group score “2” inserted in pen: “Thank you for your participation in the group practice trial! We have evaluated your group score: You gave correct ranking to 2 out of 5 people.”

Next, dependent on the attributional condition, participants received oral information designed to induce attributions either towards the group as a whole, self, other group members, or the situational constraints of computer-mediated communication. The attributional manipulation was presented privately to each group member. A pilot test of the attributional manipulation tested several ways to manipulate attributions. The first one followed Goncalo’s (2004) procedure asking participants to reflect on various attributional factors, which resulted in an
approximately 50% success rate because many participants failed to follow the instructions (for example, instead of reflecting on the effect of situational factors, they wrote about group activities).

The other type of attributional manipulation relied on a combination of feedback and background information, previously shown to be effective in evoking different types of attribution (Samuelson, 1991; Tindale et al., 1991). Although the success rate for the feedback-type of attributional manipulation was higher than for the reflection method, participants seemed to have trouble distinguishing between group and other-member attributions. Therefore, to strengthen the manipulation, a combination of both reflective method and background/feedback information was used to manipulate attributions. As Noel et al. (1987, p. 160) wrote in their discussion of ways to manipulate attributions, “Individuals, in their search to identify causal forces, rely on both objective as well as subjective sources of causal information.” Therefore, the revised manipulation capitalized on both objective and subjective cues, which proved successful in the pilot studies. After giving participants the feedback according to the manipulation condition, the experimenter asked each group member individually to reflect on factors correspondent to the attributional condition: How their own performance/ the other group members’ performance/working in instant messaging/group’s teamwork has affected the group outcome. The specific wording for each attributional condition is below:

*Group-internal attributions*: “This is your group score. As you can see, your group did not do well on this trial. We have also analyzed the initial personal rankings, and the ENTIRE GROUP made mistakes in their rankings. Now, in order for the experimenter to understand your group better, please consider how the GROUP’S TEAMWORK has influenced your group outcome on the practice trial. Write down your answer here.”
Self-internal attributions: “This is your group score. As you can see, your group did not do well on this trial. We have also analyzed the initial personal rankings, and YOU made mistakes in your personal rankings. Now, in order for the experimenter to understand your group better, please consider how YOUR OWN performance has influenced your group outcome on the practice trial. Write down your answer here.”

Self-external attributions: “This is your group score. As you can see, your group did not do well on this trial. We have also analyzed the initial personal rankings, and the OTHER group members made mistakes in their rankings. Now, in order for the experimenter to understand your group better, please consider how the OTHER MEMBERS’ performance has influenced your group outcome on the practice trial. Write down your answer here.”

Group-external attributions to the external constraints of the electronic medium: “This is your group score. As you can see, your group did not do well on this trial. But this task is much easier to solve face-to-face. In fact, we’ve found that groups WORKING IN INSTANT MESSAGING make a lot more mistakes than groups that interact face-to-face. Now, in order for the experimenter to understand your group better, please think about how WORKING IN INSTANT MESSAGING has influenced your group outcome on the practice trial. Write down your answer here.”

Phase 3: strategy change discussion.

After collecting responses to the attributional manipulation check, the experimenter gave participants a group performance trial sheet that showed the employees’ names with blank profiles. The instructions for the performance trial were exactly the same as for the practice trial, except that there was no instruction to do the initial personal rankings. In addition, the instructions emphasized that only performance on this trial would count towards the final score that would determine the group eligibility for the raffle. The experimenter mentioned that she needed a few
minutes to print the employees’ profiles. While the participants were waiting for the profiles, their task was to have a group discussion, with the following instructions presented in writing:

“Before you start working on the task performance, you have several minutes to discuss how you will go about doing it. Your task on the performance trial will be the same as on the practice trial. You have to rank five employees for a merit bonus. You can reach your group responses in any way you wish, but the final rankings should reflect the group’s collective opinion. You may also use this time to talk about other things with your group members—university events, social activities, etc., but you are not allowed to use your cell phone or browse the Internet during this time. When you are finished with the discussion and ready for the experimenter to bring the employee profiles, please indicate so by typing, “we are ready” in the chat window."

The “free discussion” procedure was adapted from the research on the effects of goals on group performance effectiveness (e.g., Hackman et al., 1976; Saavedra et al., 1993). It gave groups an option to plan and change their strategy if they chose so. Although a discussion of alternative strategies does not guarantee that the group identifies and adopts a more effective task strategy, Hackman et al. (1976) argued, “such discussion should increase the chances that a group will identify and select a strategy that is more task-effective than the “most obvious” way of proceeding” (p. 352).

Phase 4: performance on the group performance trial.

After the group gave a signal “we are ready” in their online discussion board, the experimenter brought the profiles of the employees for the performance trial. Once the group finished the group ranking, group members completed a web-based questionnaire, after which they were thanked for their participation, given a candy bar, and debriefed.
Measures

Strategy change assessment.

The strategy change was assessed in several ways. First, following Weingart & Weldon’s approach (1991), participants were asked if the group had used the same strategy on the group performance trial as they did on the group practice trial. “Did your group use the same strategy on the actual performance trial as you did on the practice trial? Please choose one: Yes ____ No _____. If you answered “No”, please describe what you did differently on the performance trial, compared to the group practice trial.”

Two coders independently unitized the open-ended responses using a thought unit as the unit of analyses. The thought unit is defined as a “single assertion about some subject” (Holsti, 1969, p. 116). Most responses offered only one explanation; multiple explanations were identified in 13 cases. The proportion of consensual answers (agreements divided by the total number of utterances) generated inter-coder agreement of .95. In addition, a composite judgment reliability using Guetzkow’s (1950) composite reliability procedure, which is a common measure for establishing unitizing reliability, yielded a reliability proportion of .98.

As the participants reported both individual and group changes, the responses were content analyzed for the individual-level versus group-level change (kappa=1). An example of the individual-level change, “In the performance trial I tried to rank all of the characteristics equally, whereas I did not in the practice trial.” An example of the group strategy change, “The first time once we agreed we just moved along. The second time we thoroughly discussed and debated each person’s placement.”

To test a prediction that group-external attributions lead to more changes in a group communication procedure, two judges coded independently whether the responses reflected a change in group communication practices and procedures
(kappa = .84). The disagreements were reconciled through a discussion where needed. A change was identified as communication-related if it was “related to the order and manner in which communication occurred during group interaction; concerned with the group communication practices, changes in the discussion format and communication norms.” For example, “In the performance trial we discussed why we choose each employee instead of just agreeing right away as we did on the practice trial” was classified as a communication-related change. Another example of a change in the group communication practice, “We kept our strategy for the performance trial more organized. We spoke in order of group member number and if there was an issue, we discussed one at a time.”

In addition to the open-ended question measuring the group strategy change, two scales were used for measuring strategy-related variables: a) a perceived value of group planning and strategy change (Weldon, Jehn, & Pradhan, 1991) and b) questions about group strategy assessment (Hackman, 1982). The scale reliability coefficients were .93 for perceived value of group strategy change (2 items) and .74 for strategy assessment (8 items).

In addition to changes in task strategies directed at minimizing the impact of external constraints on group performance, structural changes may target minimizing the presence of an external constraint, such as changing a communication modality. The choice of an alternative structure was presented through a question about a preference for a different medium versus different partners on a hypothetical future task: “If you had to do this task again and had a choice between working with a different group of people electronically or working with the same group of people but in a face-to-face meeting, what would you choose? Please select only one: Doing this task with my group in a face-to-face meeting _____ or Doing this task with a different group of people electronically _____.”
Electronic system satisfaction.

System satisfaction was measured using a 3-item scale from Connoly, Jessup, & Valacich (1990). The original items were treated as individual questionnaire items rather than items in a scale. Therefore, they were first subjected to a factor analysis using the principal factor method for a factor extraction followed by a varimax rotation. A scree test suggested two meaningful factors, which were retained for rotation. In interpreting the rotated factor pattern, an item was said to load on a given factor if the factor loading was .60 or greater on a given factor, and was less than .45 for the other. Using these criteria, two items were found to load on the first factor, while one item loaded on the second factor and was therefore dropped from the analysis. The reliability coefficient for the retained items was .80. The two retained items included "How satisfied are you with the electronic system your group used versus Face-to-Face?" and "Was electronic system used for the group task helpful?"

Task effort.

Task effort was measured in three different ways. A self-report measure of perceived individual effort was adapted from Weldon et al. (1991) and Weingart and Weldon (1991), with a slight change of wording to reflect comparisons between the practice and performance trials. The scale reliability was .76.

In addition to the scale items, there were two behavioral measures of task effort. The first measure was the time spent on personal ranking before group members engaged in a group discussion on the second trial. Recall that unlike on the practice trial, which required group members to produce individual rankings before they began a group discussion, instructions for the second trial did not include an individual ranking as part of the procedure for the second trial. It was up to group members to decide how much time they wanted to allocate on the individual rankings or even skip it completely. The measure was taken at the group level as a time interval
between when group members received their ranking profiles and when they actually started a group discussion on the second trial.

The second behavioral measure of task effort was adapted from Goncalo and Duguid (2008) as a count of task-related contributions from each group member during the group discussion. To account for individual differences across group members, this measure was operationalized as a difference between the number of task-related contributions on the second and first trial for each group member. First, two coders independently coded all the contributions on the first and second trials as either task-related or not (\(kappa= .96\)). For example, statements related to the weather, or to an upcoming midterm, were counted as being unrelated to the task. Then the number of task-related contributions on each trial was counted for each group member, and the difference in the number of task-related contributions between the trials yielded a measure of task effort on the second trial, compared to the first trial. This measure reflects group members' task effort on the shared subtasks of the group task.

*Group satisfaction, conflict, climate, and trust.*

There were several scales for measuring relational outcomes, including a group safety climate (adapted from Gibson & Gibbs, 2006, \(alpha = .87\)), trust measure (adapted from Jarvenpaa & Leidner, 1998, \(alpha = .86\)), and the group attitude scale (adapted from Evans & Jarvis, 1986, \(alpha = .93\)). The group satisfaction items were adapted from two different sources (Gouran, 1973; Connoly et al., 1990). Because some of the original items for group satisfaction were previously used as individual items rather than a scale, they were subjected to a factor analysis with the principal factor method for extracting the factors, followed by a varimax rotation. According to the loading criteria described above, three items loaded on one factor, which was subsequently called a group process satisfaction (e.g., “How satisfied are you with the
ideas your group proposed to solve problems?"). The other two items had high loadings on both factors and were, therefore, dropped from the analysis. The reliability coefficient for the new group satisfaction scale was .88. In addition to the group-level measures for relational outcomes, there were individual level scales for task attraction ($\alpha = .87$) and social attraction ($\alpha = .88$). Finally, there was a group identity measure adapted from Spears, Lea, & Lee (1990), with a reliability coefficient equal to .62.

*Coding of the strategy discussion.*

First, two coders separated a strategy discussion part from the rest of a group discussion for each group. The separation was straightforward because of the procedural comments separating a strategy discussion from the practice and performance trials (e.g., participants were instructed to type in “we are ready” when they were done with the strategy discussion and were ready to move to the performance trial).

Next, four coders unitized the strategy discussions using a thought unit as the unit of analysis. Two coders working independently of each other unitized each transcript. The unitization procedure yielded 1891 units overall. A composite judgment reliability using Guetzkow’s (1950) method yielded a unitization reliability proportion in the range of .95-.96. Where necessary, the author reconciled the unitization differences between the judges.

The coding scheme for analyzing the group discussion was adapted from Pavitt, Zingerman, Towey, & McFeeters’s (2006) work on resource dilemma situations. This choice was based on several factors. First, Pavitt et al.’s coding scheme was well fit to capture a discussion relevant to the different stages of the group work in the present study – the practice trial, the strategy discussion stage, or the performance trial. For instance, it has topical focus categories that relate to task
understanding, practice round, or a strategy discussion. Second, this scheme captures a relatively molar level of analysis. In order to analyze the mediating role of a group interaction between the group inputs and the group outputs, it is essential for the coding scheme to address at a relatively molar level those aspects of interaction that are important in determining group effectiveness for a specific task (Hackman & Morris, 1976).

Pavitt et al.'s (2006) coding scheme has two types of codes that were applied to each discussion unit in the present study: topical and functional. The topical focus codes were insightful for understanding the types of discussion topics that were affected by attributions but had less relevance to the hypotheses tested in the study. Three pairs of judges coded the discussion transcripts for the topical codes, with each transcript coded by two judges. The intercoder reliability for the topical coding averaged .88 between the three pairs of coders. The coding instructions for the topical focus coding with the examples of statements from the group discussions are listed in the Appendix 2.

The second coding scheme captured the specific function played by a discussion unit. It included three general categories: substantive, maintenance, and procedural. The substantive code was assigned if the unit was concerned with the ranking decision, such as a discussion about the task instructions, the practice trial, or ranking decisions for the performance trial.¹

The maintenance function is concerned with a socio-expressive aspect of communication, such as maintaining (or damaging) individual or group morale.

¹ The original coding scheme further separated the substantive units into five subcategories according to the original scheme: information – descriptive statements about the task, suggestion (introducing or asking for a proposal), elaboration (non-evaluative statements about previously offered proposals), evaluation (acceptance or rejection of the proposal under consideration), confirmation (explicit group acceptance of a proposal). However, because there were no theoretical predictions concerning the substantive microlevel units and the categorizing reliability was low for them (kappa below .50), all the substantive microlevel units were grouped into the one – substantive – category.
Positive maintenance units were assigned to statements that showed pleasure, joking, or positive responses to expression of pleasure and jokes. Positive maintenance units also included positive responses to episodes of tension and antagonism, praise for group, or showing social support for other group members. For example, “Go team”, “haha”, “Okay ... thanks everyone! I hope the next round is half as fun 😄”, “Its ok guys lol”, “Let’s do better this time”, “Awesome!” Negative maintenance units, in contrast, showed disapproval or criticism for the group or other group members. Negative maintenance statements could also show displeasure, frustration, disinterest, and acknowledgements of incompetence. For instance, “I’m indifferent”, “This task is the most random thing ever”, “DON’T GET HASTY, NUMBER 2”, “DON’T GET DEFENSIVE, NUMBER 2.”

The procedural code for a discussion unit was concerned with the group communication procedures, including attempts to “guide” the discussion. Some of the procedural discussion that occurred during the strategy discussion stage referred to the strategy discussion stage itself (e.g., “are we supposed to discuss our methods now”) and some referred to the future performance trial (e.g., “I think this time we should answer in order of group name 1 2 3 ... group member 1 says who and why, then group member 2, then group member 3”). Although it was not part of the original coding scheme (Pavitt et al., 2006), in order to distinguish between the procedural units for the current and future trials the procedural discussion codes were further separated into the current and future procedural codes. The future procedural codes reflected the group’s discussion of communication strategies for the performance trial. For example, “Maybe we need a little more debate because we all kind of just accepted it last time.” Another example of a future procedural statement is “We should do it like over the radio, when you’ve finished saying what you want to say, add a— “
Two judges independently separated all the coding units into the six functional categories (substantive, positive maintenance, negative maintenance, current procedure, future procedure, and off-topic). The categorizing reliability was good \((kappa=.86)\), and the differences were reconciled by the author where necessary. The detailed coding instructions with the examples from the group discussions are listed in the Appendix 3.

In addition, there was an attempt to code communication content of the strategy discussion by applying the coding scheme from the summary of marital interaction coding scheme (Weiss & Summers, 1983), which was originally developed for coding marital interactions. This scheme targeted microlevel processes, with a purpose of examining how attributional blame is expressed in the conversation. For example, it includes codes to capture verbal statements that criticize, put down or threat the partner, deny responsibility, excuse the partner, or accept responsibility. The close read of the discussion showed that the explicit blame directed at the partners was rare. Because other codes in the marital interaction scheme were either redundant to the codes in the first scheme or irrelevant to the hypotheses, it was not used for further analyses.
CHAPTER 7

RESULTS

Several considerations informed the statistical analyses. The first was potential non-independence of observations coming from members of the same group. Non-independence in a nested design refers to correlation between scores of members belonging to the same interacting unit, making them more similar or dissimilar (in case of negative correlation) than scores of members from other groups (Kenny, 1995; Singer, 1998). The data with correlated residuals requires multilevel modeling that accounts for variability at each level of hierarchically structured data, including estimation of random effects residuals for the effects of subjects nested within groups (Littell, Milliken, Stroup, & Wolfinger, 1996).

The second consideration was with a distribution of the response variable because nominally coded and count data deviated from normality and required using generalized linear models that fit variables with discrete probability distributions (Allison, 1999). In addition to normally distributed data, there were three types of response variables: a binary response (e.g., whether groups made changes in their communication procedures or not), a multinomial response with ordered categories (a quality of the group decision that had five ordered categories), and count data that is typically highly skewed and follows a Poisson distribution (e.g., a count of task-related statements for effort or a count of discussion units related to communication changes for a strategy discussion variable). Therefore, the choice of a statistical model for each response variable was governed by these two considerations: a) whether residuals were correlated or not, and b) the distribution of a response variable. A binary response was fitted with a binary logit model; a multinomial response with ordered categories was fitted with a cumulative logit model, and count data was
modeled with a negative binomial distribution, which is appropriate for Poisson-distributed data with overdispersion (a greater variability than what is allowed for by a Poisson model, which is usually the case when predicted values are small) (Allison, 1999; Stokes, Davis, & Koch, 2000). The negative binomial model estimates a relative frequency of the discussion units (rate) across the attributional conditions. The discussion length variability across the groups was adjusted by an offset term in the negative binomial model, which represented the log of the total number of discussion statements for each group.

The data that had a discrete probability but did not have correlated residuals were fitted with SAS GENMOD procedures (SAS Publishing, 2009). The data that had both correlated residuals and a discrete probability distribution were fitted with SAS GLIMMIX Procedure, which fits generalized linear models with random effects to correlated data with any distribution (SAS Institute, 2006). The focused comparisons were carried out using contrast analyses on the data scale, that is, the logit scale for binomial and multinomial models, and the log scale for the negative binomial model.

*Manipulation Check*

Following the procedure in Goncalo (2004), the effectiveness of the attribution manipulation was tested by coding attributional responses. The author and a research assistant who was blind to the hypotheses of the study independently rated each group member’s attributions for the group failure on the practice task according to an attributional focus that reflected one of the attributional conditions: self, situational factors, group as a whole, or other group members. The responses were presented in a random order, so that the coding would be done independently for members of the same group. The coders were instructed to choose only one factor for each statement that reflected a main focus of the explanation. The inter-coder reliability was good
<table>
<thead>
<tr>
<th>Type of Attribution</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-focused</td>
<td>My personal performance may have affected the group outcome because I was not assertive enough. I kind of went with the group and our final result was poor. I think group member 3 was driving a significant part of the discussion. However, he/she was not interested in discussing our choices, she only wanted to get a quick consensus rather than an accurate one. I think I was the only one to actively contest group member 3’s decisions. Group member 2 didn’t add that much or challenge any decisions. On this trial, we did not challenge each other enough. We were too agreeable, and thus our responses were more arbitrary than</td>
</tr>
<tr>
<td>Other members-focused</td>
<td>accurate/scientific. We would perhaps have been more successful if we had ranked each person with a score based on the four criteria, &amp; then discussed how we came to that score. Instead, we seemed to just quickly agree on the choices of the other members. We had to be more objective and more willing to challenge each other. Online it is hard to keep track of what people are saying when there are more than 2 people involved in a chat. In person, only one person can talk at a time. Online everyone can talk at once as people type at the same time and then send in their comments. Also, difficult to stress your points over the internet which makes it hard for others to see or understand how strongly you feel about something.</td>
</tr>
<tr>
<td>Group-focused</td>
<td></td>
</tr>
<tr>
<td>Situation-focused</td>
<td></td>
</tr>
</tbody>
</table>
(kappa = .83), and the disagreements were reconciled through a discussion. The examples of different types of attributions are listed in Table 2.

According to the results of the manipulation check, 3 groups were removed from the analyses because two or more members of those groups failed the manipulation check. For example, instead of making self-external attributions correspondent to the attributional condition, a group member made group-internal attributions: "Perhaps, we were too eager to agree with each other instead of looking for and trying to understand if indeed we made correct choices. For example, we all quickly agreed that Jim should get the largest pay raise, but should he? I think the group members were too quick to agree, especially in our controversial rankings." Three other groups were removed from the analyses because they exchanged information relevant to the manipulation and/or questioned the validity of a negative feedback.

In addition, there were 8 individuals who failed the manipulation check, but they were part of groups in which two other members passed the manipulation check. Because the results were not significantly different when the analyses were run with or without the individual scores of those 8 individuals, their scores were kept for the final analyses. The final number of groups was 58 groups, with the following breakdown by attributional condition: self-internal – 14 groups, self-external – 13 groups, group-internal – 13 groups, and group-external – 18 groups.

*Individual-Level Changes*

The first hypothesis predicts that self-internal attributions prompt more individual-level changes than attributions to other causes. This hypothesis was tested based on the participants' open-ended reports about what had changed between the trials. First, the majority of the participants (70%) reported strategy changes between the practice and performance trials. Their explanations of strategy changes were
content-analyzed to determine whether the change was made on the individual-level or the group-level. Consistent with the prediction, self-internal attributions led to more individual-level changes than the other types of attributions, \( F(3, 62) = 3.47, p = .02 \). Specifically, the odds of individual-level changes for group members in the self-internal condition are 13.7 times the odds for group members in all the other attributional conditions. Table 3 shows the least squares means mapped onto the probability scale, standard error means, confidence intervals for the means, and the odds for each attributional condition. These results suggest that consistent with the prediction attributions for a previous group failure affect subsequent changes in the individual group members' behaviors, with self-focused attributions for the group failure prompting more individual-level changes than attributions to other causes.

Table 3.

<table>
<thead>
<tr>
<th>Attribution Type</th>
<th>Attribution mapped onto the probability scale</th>
<th>Lower Mean</th>
<th>Upper Mean</th>
<th>Odds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>.05</td>
<td>.009</td>
<td>.25</td>
<td>.05</td>
</tr>
<tr>
<td>Other Members</td>
<td>.10</td>
<td>.02</td>
<td>.38</td>
<td>.12</td>
</tr>
<tr>
<td>Self</td>
<td>.50</td>
<td>.21</td>
<td>.80</td>
<td>1.01</td>
</tr>
<tr>
<td>Situation</td>
<td>.06</td>
<td>.01</td>
<td>.23</td>
<td>.06</td>
</tr>
</tbody>
</table>

The second hypothesis was related to the first predicting that group members who make self-internal attributions see less value in making group-level changes than group members who make other types of attributions. This measure was based on self-report items measuring a perceived value of group strategy change. Consistent with the prediction, group members in the self-internal condition saw less value in group strategy changes than did group members in all the other attributional conditions, \( t \)
(52)=1.74, t = .04 (one-tailed p-value for a planned contrast comparing self-internal attributional condition with all the other conditions). Table 4 shows least squares means, standard error means, and confidence intervals for the means. This result suggests that attributions for a previous group failure affect a perceived value of group strategy changes on the subsequent task. Group members who made self-focused attributions saw less value in group-level strategy changes than group members who attributed the group failure to other causes².

Table 4.

<table>
<thead>
<tr>
<th>Attribution Type</th>
<th>LS-Mean</th>
<th>SE</th>
<th>Lower Mean</th>
<th>Upper Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>5.14</td>
<td>.33</td>
<td>4.47</td>
<td>5.81</td>
</tr>
<tr>
<td>Other Members</td>
<td>4.78</td>
<td>.35</td>
<td>4.08</td>
<td>5.48</td>
</tr>
<tr>
<td>Self</td>
<td>4.36</td>
<td>.33</td>
<td>3.71</td>
<td>5.01</td>
</tr>
<tr>
<td>Situation</td>
<td>5.13</td>
<td>.30</td>
<td>4.52</td>
<td>5.73</td>
</tr>
</tbody>
</table>

Changes in Group Communication Procedures

The next set of analyses tested how attributions for a group failure had affected restructuring of the group’s communication procedures and practices for the subsequent group task. Two measures captured changes in the group’s communication procedures. The first one was based on the group members’ open-ended reports, which were coded for changes in the group’s communication practices and procedures. The second measure was a behavior analysis of the group interaction during the strategy discussion session.

² An additional analysis was done on group strategy assessment adapted from Hackman (1982). No significant difference emerged between the conditions, F(3, 51)= .73, p=. 54. However, any difference in group strategy assessment between the conditions may have been obscured by the way the questions were posed because the strategy assessment items did not distinguish between the practice and the performance trials. That is, the questions referred to a group strategy assessment in general (e.g., “Our group developed a good strategy for doing the task”), and were open for interpretation as either referring to the practice trial, performance trial, or both.
These analyses tested the competing hypotheses about the effect of group-external attributions on restructuring of the group’s communication procedures. According to the generalized individual perspective, attributions to the external constraints of the computer-mediated communication for the previous group failure should hinder the group’s review of and changes in the group’s communication procedures. Alternatively, the socio-structural perspective predicts that attributions to the external constraints should prompt the group’s attention to its communication procedures and the need to revise them in order to improve the group’s adaptation to the environment.

The results were consistent with the socio-structural perspective. According to the members’ open-ended reports, groups with attributions to the external constraints of the computer-mediated environment made more changes in the group’s communication procedures than did groups with attributions to self or the group as a whole, t(53)=1.80, p=.04 (one-tailed p for a planned contrast comparing the estimates on the logit scale). Specifically, the odds of making structural changes in communication procedures for group members who made attributions to the external constraints are 2.80 times the odds for group members who made internal attributions (to self or group as a whole). More generally, attributions to external constraints prompted more changes in the group’s communication procedures than all the other types of attributions combined, including attributions to other group members, t(49)=1.83, p=.04 (one-tailed p for a t-test comparing the estimates on the logit scale).

The biggest contrast turned out to be between attributions to external constraints and self-internal attributions: The odds of structural changes in the communication procedures for groups whose members attributed the group failure to external constraints are about 5 times the odds for groups whose members made self-internal attributions. Table 5 shows least squares means mapped onto the probability
scale, standard error means, confidence intervals for the means, and odds for each type of attribution. This result suggests that attributions for a previous group failure affect how groups change their communication strategies for the next task.

Table 5.

Changes in Communication Procedures by Attributional Condition

<table>
<thead>
<tr>
<th>Attribution Type</th>
<th>(mapped onto the probability scale)</th>
<th>Lower Mean SE</th>
<th>Upper Mean</th>
<th>Odds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>.22</td>
<td>.10</td>
<td>.43</td>
<td>.29</td>
</tr>
<tr>
<td>Other Members</td>
<td>.17</td>
<td>.07</td>
<td>.36</td>
<td>.20</td>
</tr>
<tr>
<td>Self</td>
<td>.08</td>
<td>.03</td>
<td>.23</td>
<td>.09</td>
</tr>
<tr>
<td>Situation</td>
<td>.31</td>
<td>.16</td>
<td>.51</td>
<td>.45</td>
</tr>
</tbody>
</table>

The majority of the reported changes in communication procedures concerned changes undertaken by the whole group rather than the individual alone, $\chi^2(1)=5.63$, $p=.02$, with 38 communication changes coded as group-related and only 2 changes coded as an individual change. For example, "I took a more active, vocal role in ranking for the actual trial" was coded as a communication-related change, which occurred on the individual-level. In contrast, a communication-related change, such as "In the performance trial we discussed why we chose each employee, instead of just agreeing right away", was coded as a group-related change because the individual reports it as a change concerning the whole group rather than only his or her own behavior. These patterns appear to suggest that communication changes were perceived as affecting the whole group rather than the individual alone, although not all members of the group consistently reported group-related communication changes. That is, in some groups only two or even one member reported that the group had changed its communication procedures between the trials, while the other group
member(s) did not. However, taken as a whole, these results appear to suggest that attributing the previous group failure to external constraints prompted groups to restructure their communication procedures more than attributing a group failure to other causes.

Relatedly, the next analysis was concerned with how attributions for a previous group failure affect the group’s reviews and revisions of its communication procedures, based on the analysis of the group’s interaction during the strategy discussion session. The generalized individual perspective predicted that attributions to the external environment should hinder a group’s review of its communication practices because the attributional focus is directed outside the group rather than inwards. In contrast, the socio-structural perspective predicted that a heightened awareness of external constraints and their influence on the group failure should prompt a group’s attention to its communication procedures in order to improve its adaptation to external constraints.

The procedural discussion code reflecting a discussion of communication procedures for the subsequent performance trial was part of the coding scheme adapted from Pavitt et al. (2006). It was assigned to discussion units concerned with communication procedures by which the decision should be made on the performance trial, including attempts to “guide” the discussion. According to the descriptive analysis, all three members made procedural statements in 19 groups; two members made procedural statements in 7 groups; finally, there was 1 group in which only one member made a procedural statement. These data appear to suggest that when procedural changes were suggested, there was a majority consensus in all but one group. Table 6 shows a frequency of procedural units by the number of contributors in the group.
Table 6.

**Frequency of Procedural Units by the Number of Contributors in the Group**

<table>
<thead>
<tr>
<th>Number of Procedural Units</th>
<th>Number of Contributors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 Members</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
</tr>
</tbody>
</table>

Supporting the socio-structural prediction, attributions to the external constraints of computer-mediated communication prompted a greater discussion of the group’s communication strategies for the performance trial than all the other attributions combined, $\chi^2 (1)=3.34, p=.03$ (one-tailed $p$-value for a focused contrast comparing the estimates on the log scale). Results indicate that groups whose members attribute the group failure to the external factors discuss communication procedures nearly 2.7 times more as those groups whose members attribute the group failure to other causes. The comparison of attributions to external constraints with internal attributions (self and group) was also marginally significant, $\chi^2 (1)=2.67, p=.051$ (one-tailed $p$-value for a focused contrast comparing the estimates on the log scale).
scale). Compared to group members who made group-external attributions, the expected count of discussion units for communication strategies on the performance trial is 53% lower for group members who made group-internal attributions, 65% lower for group members who made self-external attributions, and 69% lower for group members who made self-internal attributions. Refer to Table 7 for the log estimates of least squares means, standard error means, their confidence limits, and exponentiated means reflecting expected counts of communication strategy discussion units controlling for the total number of discussion units for each group.

Table 7.

Discussion of Communication Procedures for the Performance Trial by Attributional Condition

<table>
<thead>
<tr>
<th>Attribution</th>
<th>LS-Mean (expressed in log estimates)</th>
<th>Lower Mean</th>
<th>Upper Mean</th>
<th>Exponentiated Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>-2.19</td>
<td>-3.29</td>
<td>-1.08</td>
<td>.11</td>
</tr>
<tr>
<td>Other Members</td>
<td>-2.50</td>
<td>-3.55</td>
<td>-1.45</td>
<td>.08</td>
</tr>
<tr>
<td>Self</td>
<td>-2.63</td>
<td>-3.67</td>
<td>-1.58</td>
<td>.07</td>
</tr>
<tr>
<td>Situation</td>
<td>-1.44</td>
<td>-2.31</td>
<td>-0.57</td>
<td>.24</td>
</tr>
</tbody>
</table>

This analysis suggests that members’ attributions for a group failure affect the group’s discussion of the communication procedures for the next task. Attributing a previous group failure to external constraints stimulates greater discussion of the group’s communication procedures for the next task than attributing a group failure to other causes.

Choice of an Alternative Communication Modality and Communication System Satisfaction
Whereas the previous two hypotheses dealt with how groups could minimize the impact of external constraints by making structural changes in their communication procedures, groups can also attempt to minimize the presence of external constraints by changing the communication modality that is perceived as interfering with group effectiveness. The following are the analysis of self-report items for a) the group members' preference of a communication modality for a future hypothetical task, and b) group members' satisfaction with the communication system used for the group discussion.

Hypothesis 5 predicts that group members who attribute the group failure to external constraints prefer to change the group communication system more than group members who attribute the group failure to other causes. Although the trend appears to be in the predicted direction, the difference for a statistical test comparing the group-external with all the other attributional conditions was not statistically significant at .05-value, $t (109)=1.40, p=.08$ (one-tailed $p$-value for a planned contrast analysis comparing the parameter estimates on the logit scale). Group members across all conditions overwhelmingly preferred face-to-face over the computer-mediated discussion, but the results may have been confounded by the way the question was posed. In addition to proposing a choice of a communication modality, it also forced a choice of group members: “Doing this task with my group in a face-to-face meeting or Doing this task with a different group of people electronically.” Unfortunately, it is not clear how a choice of medium versus a choice of group members has contributed to the responses on this question.

The next analysis examined communication system satisfaction by attributional condition. As predicted, group members who made attributions to the external constraints of computer-mediated communication reported less satisfaction with the electronic communication system than groups in all the other attributional
conditions, \( t(159)^3 = 1.88, p = .03 \) (one-tailed \( p \)-value for a planned contrast). Refer to Table 8 for the least squares means, standard error means, and confidence intervals for the means.

Table 8.

**Electronic Discussion System Satisfaction by Attributional Condition**

<table>
<thead>
<tr>
<th>Attribution Type</th>
<th>LS-Mean</th>
<th>SE</th>
<th>Lower Mean</th>
<th>Upper Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>4.00</td>
<td>.20</td>
<td>3.61</td>
<td>4.39</td>
</tr>
<tr>
<td>Other Members</td>
<td>4.15</td>
<td>.21</td>
<td>3.74</td>
<td>4.56</td>
</tr>
<tr>
<td>Self</td>
<td>4.07</td>
<td>.19</td>
<td>3.69</td>
<td>4.46</td>
</tr>
<tr>
<td>Situation</td>
<td>3.67</td>
<td>.18</td>
<td>3.31</td>
<td>4.03</td>
</tr>
</tbody>
</table>

**Task Effort**

The next set of analyses looked at individual effort to test the prediction that attributing the group failure to internal causes prompts an increase in task effort. The analyses were done on two behavioral measures of task effort – the time spent on the individual ranking before the performance trial and the change in individual members' number of task-related contributions between the practice and performance trials. In addition to the behavioral measures of effort, there were self-report items for perceived self-effort.

As predicted, groups whose members made internal attributions to self or the group spent more time on the individual rankings than groups with attributions to other group members or situational factors, \( t(51) = 3.29, p = .002 \). The least squares means, standard error means, and confidence intervals for the means are presented in Table 9. Group members who made self-internal attributions spent more time on the

---

\(^3\text{The } -2 \text{ restricted log likelihood test comparing models with a random factor of group and without it failed to reject the null hypothesis of no variance due to a random factor of group, } \chi^2(1) = 3.2, p = .07. Therefore, the model was run without a random factor of group, explaining the higher degrees of freedom for estimating a significance of the test value.\)
individual rankings compared to group members who made attributions to situational factors ($p=.009$) or other group members ($p=.005$) causes.

Table 9.

*Individual Ranking Time on the Performance Trial by Attributional Condition*

<table>
<thead>
<tr>
<th>Attribution Type</th>
<th>LS-Mean (in minutes)</th>
<th>SE</th>
<th>Lower Mean</th>
<th>Upper Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>3.31</td>
<td>.52</td>
<td>2.26</td>
<td>4.35</td>
</tr>
<tr>
<td>Other Members</td>
<td>1.83</td>
<td>.54</td>
<td>.74</td>
<td>2.92</td>
</tr>
<tr>
<td>Self</td>
<td>4.00</td>
<td>.50</td>
<td>2.99</td>
<td>5.01</td>
</tr>
<tr>
<td>Situation</td>
<td>2.13</td>
<td>.47</td>
<td>1.18</td>
<td>3.07</td>
</tr>
</tbody>
</table>

The next analysis examined a change in the number of group members’ task-related contributions between the practice and performance trials, with a positive number indicating an increase and, vice versa, a negative number indicating a decrease in the number of contributions on the performance trial relative to the practice trial. Although the estimated least squares means appeared to be different across the conditions, due to a large variation across the groups, neither the overall omnibus test, $F (3, 54)=.82, p=.49$, nor a focused analysis comparing internal to external attributions, $t(54)=.27, p=.79$, or group-internal to all other types of attributions, $t(54)=1.31, p=.19$, emerged as significant. Refer to Table 10 for the least squares means, standard error means, and confidence intervals for the means.

The final analysis of effort was based on self-reports of a perceived task effort reported by the participants at the end of the study. The difference between the conditions was significant, $F (3, 159)=4.54, p=.004$. According to the results, group members in the self-internal attribution condition reported less perceived individual effort than group members in the other attributional condition. Refer to Table 11 for the least squares means, standard error means, and their confidence limits.
Table 10.

*Change in the Individual Number of Task-Related Contributions Between the Practice and Performance Trials by Attributional Condition*

<table>
<thead>
<tr>
<th>Attribution Type</th>
<th>LS-Mean</th>
<th>SE</th>
<th>Lower Mean</th>
<th>Upper Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>5.28</td>
<td>4.57</td>
<td>-3.89</td>
<td>14.45</td>
</tr>
<tr>
<td>Other Members</td>
<td>1.31</td>
<td>4.57</td>
<td>-7.86</td>
<td>10.48</td>
</tr>
<tr>
<td>Self</td>
<td>-3.82</td>
<td>4.42</td>
<td>-12.67</td>
<td>5.04</td>
</tr>
<tr>
<td>Situation</td>
<td>-2.17</td>
<td>3.89</td>
<td>-9.96</td>
<td>5.63</td>
</tr>
</tbody>
</table>

Table 11.

*Perceived Self-Effort by Attributional Condition*

<table>
<thead>
<tr>
<th>Attribution Type</th>
<th>LS-Mean</th>
<th>SE</th>
<th>Lower Mean</th>
<th>Upper Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>5.34</td>
<td>.16</td>
<td>5.03</td>
<td>5.66</td>
</tr>
<tr>
<td>Other Members</td>
<td>5.39</td>
<td>.16</td>
<td>5.06</td>
<td>5.71</td>
</tr>
<tr>
<td>Self</td>
<td>4.66</td>
<td>.16</td>
<td>4.35</td>
<td>4.97</td>
</tr>
<tr>
<td>Situation</td>
<td>5.22</td>
<td>.14</td>
<td>4.94</td>
<td>5.50</td>
</tr>
</tbody>
</table>

Summarizing the results on effort, the behavioral measure of time spent on the individual rankings before the performance trial indicated an increase in effort by groups whose members attributed the group failure to internal causes. While group members with self-internal attributions exerted more effort on individual rankings than group members in the other attributional conditions, they reported lower perceived effort than group members in the other attributional conditions. One explanation that can account for this discrepancy is that individuals have difficulty estimating their own effort, and, as Weingart (1997) suggests, more weight should be placed on behavioral than self-report data. If this is the case, then the data suggest that attributing a group failure to internal causes prompts more task effort than attributing a group failure to external causes. It is also possible that in anticipation of a failure on the
performance trial group members with self-internal attributions have perceptually reduced effort to blame their effort rather than abilities for the anticipated group failure.

Positive/Negative Maintenance Communication and Relational Outcomes

The next set of analyses addressed the predictions about the effects of attributions for a previous group failure on the group’s negative/positive maintenance communication and the group’s relational climate. Recall that maintenance communication refers to the socio-expressive aspect of communication, with positive statements increasing group morale (e.g., “Go team”) and negative statements damaging it (e.g., “I’m indifferent”). Group members who attribute the group failure to other group members are expected to have a larger ratio of negative to positive maintenance communication than group members who attribute the group failure to other causes.

As predicted, groups whose members blamed other group members had a larger ratio of negative to positive maintenance communication, compared to groups in the other attributional conditions, $\chi^2 (1)=3.02, p=.04$ (one-tailed $p$-value for a contrast analysis comparing the logs of expected counts). The expected ratio of negative to positive maintenance communication was about 7 times higher in groups whose members had attributed the group failure to other group members than in the other attributional conditions. Refer to Table 12 for the least squares means, standard error means, confidence intervals, and estimated ratios.

When comparing positive and negative maintenance communication separately across the attribution conditions, the biggest contrast for negative maintenance comments was between those who blamed others and those who made attributions to the whole group, $\chi^2 (1)=3.02, p=.04$ (one-tailed $p$-value for a contrast analysis comparing the logs of expected counts). The expected count of negative maintenance
units for members who attributed the group failure to group-internal causes was about 92% lower than for members who attributed the group failure to self-external causes. The biggest contrast for positive maintenance communication was between those who made attributions to others and those who made self-focused attributions, \( \chi^2 (1) = 3.00, p = .04 \) (one-tailed \( p \)-value for a contrast analysis comparing the logs of expected counts), with the expected count of positive maintenance comments being about 68% lower for group members who made self-external than those who made self-focused attributions.

Table 12.

<table>
<thead>
<tr>
<th>Attribution Type</th>
<th>LS-Mean</th>
<th>SE</th>
<th>Lower Mean</th>
<th>Upper Mean</th>
<th>Estimated Negative/Positive Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>-1.10</td>
<td>1.41</td>
<td>-3.86</td>
<td>1.67</td>
<td>.33</td>
</tr>
<tr>
<td>Other Members</td>
<td>1.01</td>
<td>.91</td>
<td>-.78</td>
<td>2.80</td>
<td>2.75</td>
</tr>
<tr>
<td>Self</td>
<td>-.20</td>
<td>.77</td>
<td>-1.71</td>
<td>1.32</td>
<td>.82</td>
</tr>
<tr>
<td>Situation</td>
<td>-1.50</td>
<td>1.12</td>
<td>-3.69</td>
<td>.68</td>
<td>.22</td>
</tr>
</tbody>
</table>

Note. Lower negative/positive ratios represent a more positive maintenance ratio.

Taken together, the analysis on negative/positive communication maintenance shows that groups whose members attributed the group failure to other members had the most unfavorable ratio of negative to positive maintenance communication, producing more negative and fewer positive maintenance comments than group members who had attributed the group failure to other causes.\(^4\)

\(^4\) Additional analyses of the interaction data were made using the codes from Pavitt et al.'s (2006) interaction coding scheme. Attributions affected how much group discussed the task and its instructions aimed at improving understanding of how the task should be done, \( \tilde{\chi} (1) = 4.53, p = .03 \) (two-tailed \( p \)-value for a focused contrast comparing the self-external attributional condition to all the other ones). This result suggests that groups in the self-external attributional condition paid less attention to the task.
The next set of analyses examined self-report measures of relational outcomes, including a) group attitude, b) trust, c) group satisfaction, and d) a psychological climate. No significant differences were found for any of the relational outcomes: for group attitude, $F(3, 51)=.28, p=.84$; for trust, $F(3, 50)=.02, p=.49$; for group satisfaction, $F(3, 51)=.19, p=.90$; and for climate, $F(3, 51)=.80, p=.50$. Similarly, attributions did not affect group identity, $F(3, 160)=.35, p=.79$. Finally, the null effect was replicated at the individual level with social and task attraction scales, which measured social and task attraction for individual group members as opposed to the group as a whole: for task attraction, $F(3, 329)=.39, p=.76$, and for social attraction, $F(3, 52)=.02, p=.98$.

Contrary to the prediction of hypothesis 9, the self-report data suggest no effects of attributions on the relational outcomes. These results contrast with the analysis of the group interaction data, which suggest that the group members' attributions for the previous group failure affect the exchange of positive and negative maintenance communication during a group strategy discussion.

**Decision-Making Quality**

The analysis of the group decision quality was done with an ordinal logit regression model estimating the probability of higher quality to lower quality decisions by attributional condition. As predicted, groups whose members attributed
the group failure to other group members produced lower quality decisions than
groups in the other attributional conditions, $\chi^2(1)=4.57$, $p=.02$ (a one-tailed $p$-value
for a contrast analysis comparing the logit estimates). The predicted odds of groups in
the self-external condition producing higher quality decisions are about 25% the odds
of groups in the other attributional conditions. Breaking up the comparison by each
attributional condition, compared to groups in the self-external attributional condition,
the predicted odds of higher quality decisions are 5.3 times for groups whose members
attributed the group failure to group-internal causes; about 5 times for groups whose
members attributed the group failure to self-internal causes; and about 2.5 times for
groups whose members attributed the group failure to group-external causes.

Because there were few groups with absolutely correct (correctness level=5)
and absolutely incorrect (correctness level=1) rank orders, the above result was
replicated with a logistic regression analysis that had a binary outcome (high versus
low quality decisions) created by a median-level split ($Median=2$) of the group
decision quality. The contrast analysis based on the binary logit model was consistent
with the result obtained from the cumulative logit model analysis. Groups whose
members attributed the group failure to other group members reached a lower quality
decision than groups whose members attributed the group failure to other causes, $\chi^2
(1)=3.63$, $p=.028$ (one-tailed $p$-value comparing the estimates on the logit scale). As
before, the predicted odds of making a high quality decision for groups in the self-
external attributional condition was about 25% the predicted odds for groups in the
other attributional conditions. Refer to Table 13 for the least squares means of logit
estimates, standard error means, upper and lower means, and odds for each
attributional condition based on the binary logit analysis.
Table 13.

**Group Decision Quality by Attributional Condition**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Mean (on the logit scale)</th>
<th>SE</th>
<th>Lower Mean</th>
<th>Upper Mean</th>
<th>Odds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>.47</td>
<td>.57</td>
<td>-.65</td>
<td>1.59</td>
<td>1.6</td>
</tr>
<tr>
<td>Other Members</td>
<td>-1.20</td>
<td>.66</td>
<td>-2.49</td>
<td>.09</td>
<td>.30</td>
</tr>
<tr>
<td>Self</td>
<td>.29</td>
<td>.54</td>
<td>-.77</td>
<td>1.35</td>
<td>1.33</td>
</tr>
<tr>
<td>Situation</td>
<td>-.22</td>
<td>.47</td>
<td>-1.15</td>
<td>.71</td>
<td>.80</td>
</tr>
</tbody>
</table>

**Mediation Analyses**

The final set of analyses examined the potential mediational effect of behavioral processes affected by attributions on the group performance quality. According to models of group performance (e.g., Hackman & Morris, 1975), group inputs (attributions) may affect group performance through group interaction processes.

According to Baron and Kenny (1986), a test of the mediation relationship includes three conditions. First, attribution (IV) must affect the potential mediator. As the previous analyses have established, attributions affected the following group-level processes: task effort (individual ranking time before the group discussion on the performance trial), positive/negative maintenance communication, a discussion of the task instructions⁵, and a revision of communication procedures for the performance trial. Second, attribution (IV) has to affect group decision quality (DV). The final condition requires the mediator to affect group decision quality (DV) after controlling for attribution (IV).

⁵ Although there was no a priori hypothesis about attributions affecting a discussion of task instructions, it is still important to consider this variable as a potential mediator between attribution and group decision quality.
Table 14.

**Predictors of Decision Quality**

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Parameter Estimate</th>
<th>SE</th>
<th>Wald Chi-Square</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task effort on the individual rankings</td>
<td>.02</td>
<td>.13</td>
<td>.02</td>
<td>.89</td>
</tr>
<tr>
<td>Negative/positive maintenance ratio</td>
<td>.62</td>
<td>.79</td>
<td>.61</td>
<td>.44</td>
</tr>
<tr>
<td>Positive maintenance communication</td>
<td>.55</td>
<td>.26</td>
<td>4.39</td>
<td>.04</td>
</tr>
<tr>
<td>Negative maintenance communication</td>
<td>.04</td>
<td>.12</td>
<td>.11</td>
<td>.74</td>
</tr>
<tr>
<td>Task understanding and instructions</td>
<td>-.15</td>
<td>.10</td>
<td>2.23</td>
<td>.14</td>
</tr>
<tr>
<td>Procedure for the strategy discussion</td>
<td>.05</td>
<td>.07</td>
<td>.38</td>
<td>.54</td>
</tr>
</tbody>
</table>

Prior to regressing group decision quality both on a potential mediator and attribution (i.e., testing the third condition of mediation), the analyses were run to examine a unique effect of each of the potential mediators on group decision quality (higher versus lower quality decisions). A series of the binary logit regression were run on a binary variable of group decision quality (higher versus low) using the potential mediators as the predictors\(^6\). Refer to Table 14 for parameter estimates, standard errors, Wald chi-square, and probabilities for each of the predictors. These analyses lend strong support to positive maintenance communication as an important predictor of the group decision quality: A one-unit increase of positive maintenance discussion was associated with 73% increase in the odds of the group making a more correct decision.

Having established the unique effect of positive maintenance communication on the group decision quality, the next analysis tested whether positive maintenance

\(^6\) A similar set of analyses were run on decision-making quality with 5 levels of correctness using a cumulative logit analysis. Because the results were similar between the binary logit and cumulative logit anlayes, only the results for binary logit analyses are reported.
discussion can account for the relation between attributions and group decision quality (i.e., establish its mediational effect). Satisfying the third condition laid out by Baron and Kenny (1986), positive maintenance communication remained significant after controlling for attribution (IV): $\chi^2 (1)=7.15, p=.008^7$.

If positive maintenance communication mediates the effect between attribution and group decision quality, then the effect of attribution on the decision quality should be reduced when both attribution and positive decision quality are entered as the predictors. Consistent with the mediational prediction, the effect of the attributional condition on group performance quality reduced when controlling for positive maintenance communication, $\chi^2 (1)=3.07, p=.08$ (from $\chi^2 (1)=4.57, p=.033$, without controlling for positive maintenance communication). This suggests a partial mediational effect of positive maintenance communication between attribution and group decision quality. When the total number of the discussion units for each group was added to the model to control for the varying discussion length across the groups, the effect of attribution was no longer significant, $\chi^2 (1)=1.80, p=.18$, for a contrast analysis comparing the self-external attributional conditions with all the other ones, which provides further support for the mediational relationship.

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7 The other predictors were no longer considered as potential mediators between attributions and group decision quality for the absence of their unique effect on group decision quality (See Table 14).
CHAPTER 8

DISCUSSION

The present work advanced an approach to attribution as a cognitive mechanism shaping group communication behaviors, changes in individual and group strategies, task effort, and, ultimately, group performance on a subsequent task. It presented two different perspectives: the generalized individual perspective extending attributional research from the individual to the group level and the socio-structural perspective proposing a novel way of thinking about group-external attributions and their effects on group processes. The predicted effects of attributions on group processes/performance were tested in an empirical study that lends support to the socio-structural perspective as external attributions prompted groups to review and restructure their communication procedures.

Summary of the Main Findings

While the generalized individual and socio-structural perspective made different predictions with respect to group-external attributions, their predictions overlapped on several dimensions. For instance, as predicted by both perspectives, self-internal attributions stimulated individual-level changes (H1) and increased task effort on individual rankings (H7). Similarly, as predicted by both perspectives, attributing the group failure to other members had a negative impact on maintenance communication, leading to more negative and less positive communication among group members (H8). Thus, both the generalized individual and socio-structural perspectives received support for the effects of attributions on task effort, individual-level changes, and maintenance communication.

With respect to the predictions on which the generalized individual and socio-structural perspectives diverged, the findings suggest support to the socio-structural
perspective. Attributing the group-failure to the constraints of the electronic medium led to more review and revision of communication procedures than attributing the group failure to other causes (H3B and H4B). In addition, the findings supported the other predictions of the socio-structural perspective. For instance, attributions to the external constraints of computer-mediated communication reduced members’ satisfaction with the communication system (H6), and self-internal attributions decreased a perceived value of structural changes for the performance trial (H2).

Finally, as predicted by both the generalized individual and socio-structural perspectives, attributions affected performance outcomes: Attributing the group failure to other members reduced the quality of group performance compared to attributing the group failure to other causes (H10). This is the first time that this effect has been tested and observed in a group context. While task effort, changes in structural strategies, and maintenance communication were expected to mediate between attributions and group performance, the data suggested that only positive maintenance communication mediated the effect of attributions on performance outcome, providing partial support to the mediational prediction (H11).

Research Implications

Effects of attributions on communication procedures and behaviors.

The socio-structural perspective presents a novel approach to situational attributions for a group failure and their effects on group processes and performance. As the results demonstrate, attributing the group failure to the external constraints of computer-mediated communication prompted greater review and revision of communication procedures than attributing the group failure to other causes. This finding challenges the accepted view on external attributions for a failure as merely distorted and ego-defensive perceptions that deflect blame to uncontrollable causes of little relevance to the group (see for review, Johns, 1999). Although external causes
may indeed be misused in attributional explanations, the present research shows that it is unwise to throw the baby out with the bath water by failing to consider how attributions to external causes may account for objective external influences on group performance. As Hackman and Morris (1976) argued in order to improve, groups must realize the determinants of their performance, and this can include group-external causes.

The socio-structural perspective draws on group theory and research showing that the group has a dynamic and reciprocal relationship with its external environment, and that external constraints are objective forces that can interfere with its performance (Cummings, 1981; Goodman, 1986; Tesluk & Mathieu, 1999). But the group is not powerless in the face of external constraints. Group members can learn how to manage external constraints by implementing structural changes aimed at minimizing either the presence of external constraints or their negative impact on group performance activities. A prerequisite to managing environmental contingencies, however, is the group members’ awareness of them and their influences on group behaviors, which is reflected in attributions to external constraints.

The present research suggests a theoretical explanation and provides an empirical support to previously untested claims about the value of attributions to situational factors for virtual groups (Walther et al., 2001; Walther & Bazarova, 2007). Although previous research employed interventions to refocus group members’ attributions on situational characteristics of virtual work (Walther & Bazarova, 2007), the mechanism by which group-external attributions should facilitate adaptation to virtual environments has not been explicated. Like physical constraints for face-to-face groups, virtual constraints can be managed through structural changes once group members realize their interference with group performance activities. In support of this view, group members in the present study who had attributed the group failure to
the electronic channel limitations discussed and revised their communication strategies more than group members who had attributed the group failure to other causes.

Furthermore, whereas other studies have emphasized individual-level changes through group members’ internalizing their adaptation need and realizing their “own need for improvement or corrective action” (Walther et al., 2001, p. 3), the present framework distinguishes between individual-level and structural changes. The present findings suggest that attributions to external causes prompt structural changes affecting group-level processes, including group norms, communication structures, and discussion procedures. In contrast, self-focused attributions lead to independent changes in the behavior of individual group members that occur on a decentralized basis.

The distinction between individual-level and group-level changes is important for virtual groups because previous research suggests that the most beneficial changes are in group-level structural procedures. For instance, Walther and Bunz’s (2005) findings demonstrate that changing the group’s interaction strategies through the use of externally imposed rules improved group effectiveness. These rules aimed at changing group-level communication procedures and strategy norms, such as starting early with the production phase of the work, frequent communication, explicit verbal feedback, and observance of deadlines (Walther & Bunz, 2005). Individual-level adjustments and efforts to improve the quality of virtual group work can be beneficial, but when other members of the group do not reciprocate them, they may backfire because of perceptions of unevenness in the quality of performance (e.g., uneven participation or contributions to group efforts). Indeed, one of the main causes of frustration and other member blame in virtual groups is perceptions of unequal contributions (e.g., Cramton, 2001).
The issue of individual-versus group-level adaptation also needs to be considered with respect to the temporal aspects of virtual group work. Long-term virtual groups are able to improve relational dynamics and performance over time, but the mechanism underlying their improvement has been primarily examined at the level of individual group members, such as how individual group members adapt to the electronic medium limitations and affordances (Walther, 1996). Yet the temporal aspect is just as important for group-level adaptation as it is for individual-level adaptation. Group research studying group adaptation to the external environment has indicated the importance of time for groups to develop and refine their strategies. According to Tesluk and Mathieu (1999), groups learn to take control of their external environment by improving their strategies over time. Similarly, Weldon et al.’s (1991) research suggests that groups need time to develop adequate procedures that would improve their performance: Whereas changes in group strategies did not affect group performance on the second trial, they improved it on the third trial in their study. These findings suggest that groups can amend their structural strategies, including strategy norms, communication practices, and operation procedures, over time. Importantly, the present research demonstrates that the type of attributions group members make as they build on previous failures is critical to the types of improvements they attempt to make on the group’s next trial. For groups to undertake reviews and revisions of their structural strategies, they need to realize external constraints they face in the environment. Through understanding external influences on group performance, the group can take necessary actions in order to minimize the presence of the external constraints or their negative impact on group effectiveness.

Another contribution of the present study is in strengthening connections between attributions and communication. Communication scholars have long recognized the importance of attributions for communication. Berger and Bradac
(1982) noted that attributions, if they are “reasonably correct”, facilitate a choice of a more effective communication strategy and interaction goal achievement by making other people and situations more predictable and understandable for the attributor. However, a recent review of attribution research in communication concluded that “the causal ties between attributions and many communication behaviors are still relatively unknown” (Manusov, 2007, p. 29). Consistent with the Berger and Bradac’s proposition, the present research demonstrates how increased situational understanding via group-external attributions prompts group members to review and revise their communication strategies in order to improve the group adaptation to the virtual environment.

In addition to shaping communication strategies, attributions for the previous group failure affected communication behaviors directly in the present study. Consistent with the predictions, groups in which members had attributed the group problems to other members of the group had more negative and less positive maintenance communication than groups who had attributed the group failure to other causes. The established causal link between attributions and communication behaviors provides new insight into the cognitive basis of group interaction processes.

*Effects of attributions on group relations and performance.*

Attributions had an important effect on communication behaviors and style. However, they did not affect the relational outcomes on the self-report relational measures. There was no difference on partners’ task attraction (McCroskey & McCain, 1974), which is closely related to positive/negative maintenance statements in the present research. The discrepancy between interaction and self-report data suggests that respondents’ judgments about relational communication do not always accurately reflect the actual communication performances in the group, which may be
particularly true for experimental groups used in the laboratory settings (see Keyton, 1999).

Although attributions did not affect relational outcomes, attribution types did affect group performance on the subsequent task, with group members who attributed the group failure to other group members performing worse than group members who attributed the group failure to other causes. This finding demonstrates that blaming other group members leads to suboptimal performance in virtual groups, giving empirical support to previously untested claims that other-member blame underlies performance problems in virtual groups (e.g., Cramton, 2001; Hinds & Bailey, 2003; Walther et al., 2001).

*Linking attributions, group processes, and group performance.*

The analysis of decision quality and its predictors revealed that positive maintenance communication was a key factor in predicting decision quality, and that it mediated between attributions and group performance. This finding speaks to the importance of maintenance communication in creating and shaping the context within which the decision is made. Why was maintenance communication so important for decision-making? According to Bales' (1953) framework presented above, positive maintenance statements balance out the negative effects of negative maintenance statements and tensions built up by task-related activity. In the present study, these tensions may have been particularly high after the groups received negative feedback for their performance on the practice task, and positive maintenance communication played a critical role in restoring the appropriate socio-task balance that facilitated group performance. Consistent with the concept of maintenance equilibrium, groups that had most negative maintenance communication, which was not compensated for by positive maintenance statements, did worse on the performance trial than groups with a more appropriate maintenance balance. As maintenance communication was
affected by attributions for a previous group failure, groups whose members had attributed the group failure to self-external causes (other group members) performed worse than groups whose members had attributed the group failure to other causes.

An alternative explanation is that positive maintenance communication should improve group performance by increasing members' task motivation and effort. According to Weldon and Weingart's (1993), positive maintenance communication builds up task motivation and group confidence by arousing members' enthusiasm about the task and inspiring them to work more energetically (i.e., increase their task effort). Statements, such as "let's go for it!" or "it's ok guys lol" may have been especially important in the context of the present study for building the group's confidence and motivation after the initial setback on the practice trial. In the present study, however, positive maintenance communication did not correlate with the number of task-related contributions for the performance trial, r(57)=.02, p=.87, or individual ranking time, r(56)= .20, p=.14, both of which were used as measures of task effort. Thus, the findings give stronger support to the maintenance equilibrium explanation. However, these data do not rule out a possibility that positive maintenance communication increased task motivation in a way that was not captured by the quantity-oriented measures of effort (e.g., quality of thinking, their attentiveness, cognitive effort, or thoughtfulness of information processing).

The fact that neither changes in communication strategies nor task effort affected group performance, although surprising, is not inconsistent with group performance and communication theory. Hackman and Morris (1975) defined group effort and appropriateness of task strategies among the "summary variables" that determine group performance. At the same time, they acknowledged that "different summary variables are operative for different type of group tasks" (p. 63). Likewise, communication scholars studying the relationship between communication and group
performance from a functional perspective came to a similar conclusion. The impact of communication behaviors, including a discussion of communication procedures, depends on characteristics of the task situation that the group faces (Hirokawa, Erbert, & Hurst, 1996; Hirokawa & Rost, 1992). Hirokawa et al. (1996) noted that “a relationship between group communication and group decision-making performance is more likely to emerge as the ‘unfavorableness’ of the task situation increases” (p. 290). The task situation characteristics that increase its “unfavorableness” include unequal information distribution among group members, a task problem complexity, an ambiguity of task evaluation criteria, and information-processing demands (Hirokawa et al., 1996). For instance, if task information is equally distributed among group members, communication behaviors and procedures have limited impact on group performance. Similarly, when the problem and solution are evident to all group members, communication does not bear on group decision, because, “group performance is largely dependent on the ability of individual members to recognize the problem or goal(s) to be achieved, and to apply the appropriate criteria systematically in selecting an available choice” (Hirokawa et al., 1996, p. 290).

Extending Hirokawa et al.’s arguments to the present study, the task situation with equal information distribution among group members and transparent evaluation criteria may not have been challenging enough for changes in communication procedures to make a difference on group performance. Consider, for example, a comment by a group member who had attributed the group failure on the practice task to external constraints of virtual communication: “I would say, just because I hate working in groups online, we should do it like over the radio, when you're finished saying what you want to say, add a ----. That way we don't lose as many loose thoughts.” Although group-external attributions have definitely cued this member’s ideas about external constraints and how to accommodate to them, such a suggestion
may be of little value in a situation in which communication plays a limited role because of the task-situation contingencies discussed above. In contrast, when coordination demands are high and information is unequally distributed among group members, this type of a communication procedural change is likely to benefit group performance (see Hancock & Dunham, 2001). Therefore, a virtual group in a more “unfavorable” real-world situation due to increased external constraints and demanding tasks should benefit more from structural changes in communication procedures than the groups in the current study that had a relatively straightforward task situation and equally distributed information among the group members.

*Research Limitations*

There are several limitations to this study. First, the use of ad-hoc student groups with a limited history of working together and no anticipated future interaction raises a potential generalizability issue for extending these results to groups operating in real-world situations. Although virtual groups may operate on ad-hoc basis for solving short-range tasks in the real world (Hinds & Kiesler, 2002), it is important to examine whether the effects of attributions found in the present study extend to other types of virtual groups. As noted above, the structural characteristics of virtual groups — electronic dependence, members’ distribution, cultural heterogeneity, and a group dynamic structure — are orthogonal to each other and exert independent effects on group processes and relations (Gibson & Gibbs, 2006). Each of these factors may represent a unique situational constraint to which group members have to adapt in order to successfully accomplish their tasks. Future research needs to examine whether attributing the group failure to salient characteristics in the environment other than the electronic channel produces similar effects on group processes and performance as the ones found in the present study.
The second obvious limitation is that the present study instilled the members' attributions in a controlled fashion, which may not have necessarily reflected the actual causes of the group performance on the practice trial. That is, the operationalization of these controlled attributions may have differed from motivated attributions arising from the actual context. Relatedly, although the manipulation check suggests that group members internalized external cues presented in the attributional manipulations, there is always a possibility that participants followed the experimenter's leads without fully internalizing them. However, there are two arguments against this criticism. First, the attributional manipulation in the present study was modeled after the attributional theory and research suggesting that attributional patterns are malleable. According to Kelley (1971, p. 170), "inferences can be externally manipulated by cues and reminders as to the possible relation to the effect of certain plausible causes ... they lead the attributor to consider as he interprets the observed cause-effect evidence." Second, the findings in the present study demonstrate that members' attributions affected their behaviors and group performance as predicted here, which presents further evidence to the participants' internalization of the attributional cues. Future research may also consider other types of attributional interventions, such as by using external prompts via inferential goals (Krull, 1993), instilling shared attributions through a group discussion (Goncalo & Duguid, 2008), raising participants' anticipated accountability (Webster, 1993), or creating certain future expectations that draw attention to either situational or dispositional causes of behavior (Lee & Hallahan, 2001).

Whereas the previous group research was mainly concerned with how different group processes affect attributions, the present study focused on the effects of attributions on group processes/performance, which required isolation of attributional perceptions from the actual causes of the group performance in order to establish
causal links between attributions and group processes/performance. Future research effort should be directed at integrating attributions as both a cause and an effect that would provide a dynamic and interactive view on attributions in groups. Factors, such as team duration (short-term versus long-term), a shared social identity, cultural heterogeneity, members’ dispersion, may all affect attributional patterns. Therefore, the consummate model of attribution in a group requires understanding of the conditions that account for attributions in a group in conjunction with how attributions change group processes and performance.

Conclusion

This research contributes to understanding of how attributions for a previous group performance shape subsequent group processes and outcomes in virtual groups. By drawing on group theory and research from miscellaneous group contexts, this work advances the novel socio-structural perspective grounded in the dynamic and reciprocal relationship between the group and its external environment. The study was designed as a testbed for the socio-structural versus the generalized individual perspective. The findings lend support to the socio-structural perspective, showing that group-external attributions cue groups to review and restructure their communication procedures following the initial failure. Furthermore, the findings demonstrate how attributions affect group performance, with self-external attributions deteriorating group performance quality, and positive maintenance communication mediating the effects of attributions on group performance. Previous research has suggested that attributions, dependent on their type, may be a cause of problems in virtual groups and possibly present a solution to those problems (see for review, Bazarova & Walther, 2009). The present study provides a theoretical framework and empirical findings that suggest the type of problems and the type of solutions that members’ attributions for the initial group failure can lead to in subsequent virtual group work.
APPENDIX 1

TASK DESCRIPTION AND INSTRUCTIONS

Task Description

For many employees, their annual pay raise is the most important feedback that they receive from their organizations. You are one of the three managers in a department that was formed several years ago. Several technical graduates were recently hired to perform a variety of maintenance tasks. You need to make recommendations for a salary percentage increase that will be given as a merit bonus for these employees. Each employee is described using four characteristics: effort, ability, performance, and friendliness. Each characteristic has an equal weight in the merit bonus assignments. Based on their profile descriptions, your task is to rank these employees for a merit bonus, from most deserving to least. You have to be in consensus with the two other managers on the merit bonus assignments. Your communication with them will be done in an online chat.

Task Procedure

The task has 2 parts: a group practice trial and a group performance trial, which are analogous to each other. You have twenty minutes to complete each trial. The task has a correct answer, and we will evaluate your group performance by comparing your group ranking to the correct answer. You will start with a practice trial ranking the first five people. After you receive your group score for the practice trial, you will do a group performance trial. Groups with the correct ranking for the performance trial will be entered in a raffle for the Cornell Store gift certificates, with each member of the winning group awarded a $100-value gift certificate.
Group Practice Trial

Your task is to reach consensus as a group on the ranking of the five employees, from most deserving to least, for the merit bonus assignments. Before you start your group discussion, please do your personal rankings first. You can begin your online discussion when everyone responds that they are ready. You can reach your group responses in any way you wish, but your group’s final rankings should reflect the group’s collective opinion. When your group decides on the final rankings, please type them in your group chat.

ANN DONALDS - Ann is comfortable with nearly all kinds of people. She is bright and hard working but gets bogged down in details, which brings down her productivity.

MARY JOHNS - Mary is skillful and generally does what is assigned to her but she waits to be told what to do rather than initiate activity herself. Her coworkers like her because she is cordial and offers sympathetic help on personal problems to them.

HARRY HALL – Harry is not very good at his job but puts in more time than anyone else, and often works through breaks and lunch to meet his project deadlines. He gets along well with others both on and off the job.

JIM KELLER – Jim is a valuable team player and is respected by his co-workers. He works hard to produce satisfactory results and has recently signed up for an online course to improve his technical skills.

FRAN FOX – Fran has been an important member of the work group. She understands the technical details and often tries to help others. She might be called the informal group leader, but she seems bored with her present job and doesn’t work very hard. As a result, her performance seems to have been below average.
Personal Rankings for the Group Practice Trial

Group Member

1.

2.

3.

4.

5.
Group Performance Trial

Your task is to reach consensus as a group on the ranking of the following employees, from most deserving to least, for the merit bonus assignments. You can begin your online discussion when everyone responds that they are ready. You can reach your group responses in any way you wish, but your final ranking should reflect the group’s collective opinion. Your group performance on this trial will determine your group’s eligibility for the raffle.

SUSAN DAVIS – Susan is skillful at data analyses and preparing technical reports. She gets along well with the others and is quite happy in her job. She often lends a hand to get a job done, but gets so involved that she ends up doing much of the work herself, which brings down her productivity.

PAUL MITCHELL - Paul is a competent and diligent employee who takes his work seriously and often exceeds performance expectations. His relations with his fellow project members are friendly, but he does not go out of his way to have informal conversations during or after working hours. His colleagues sometimes complain about his “know-it-all attitude”.

BOB NILSEN – Bob has excellent technical skills and seems to have good performance even though he often gets into arguments with the other employees and rarely puts much effort into his job.

JOHN ROBERTS – John has a lot of influence with the other members of the group and is well liked. You think his performance is good because he works hard at whatever tasks he is assigned to do and makes the most of his limited skills.

NANCY WILLIAMS - Nancy is bright and very friendly, but has trouble keeping up with the details of her job. She is constantly behind schedule, often because work orders have been misplaced.
APPENDIX 2

TOPICAL CODING FOR THE STRATEGY DISCUSSION

The topical code represents the topical focus of the discussion during which the utterance occurs:

a) Task understanding: Discussion relevant to the ranking task, ranking task instructions, with the general intent of increasing group members’ understanding of how the task is done.
   - Well, according to the task description, the criteria are all weighted equally.
   - …the only issue I have with these tasks is that it’s hard to quantify what each number should represent.
   - Does this task have an objective solution?

b) Practice round: Discussion relevant to what occurred during the practice round.
   - I wonder if the equal weighting of all 4 criteria had any factor on our poor results…
   - I think we probably had jim and fran right and missed the middle three.
   - Ok so we didn’t do so hot…I’m trying to figure out what we did wrong last time.

c) General strategy: Discussion relevant to the general strategy to be used in the performance round. They do not include discussion relevant to specific proposed strategies.
   - So how are we going to go about ranking the next set?
   - What should our plan of attack be?
   - Want to come up with some sort of strategy or whatever?
- We need a new strategy for this task

d) Specific strategy: Discussion relevant to specific proposed strategies.
- So this time around, should we focus more on the actual work performed instead of effort?
- May be we need a little more debate because we all kind of just accepted it last time
- This time I think we should concentrate on those 4 characteristics
- I think we should give all of the criteria more equal consideration

e) Off-topic tangents
- What year is everyone?
- Are you guys here for class credit?
- Nice weather. Are you all comm majors?
- I don't know what we are supposed to do now.
APPENDIX 3

FUNCTIONAL CODING FOR THE STRATEGY DISCUSSION

The functional code represents the specific function played by the unit. There are 3
general categories: substantive, maintenance, and procedural.

1. Substantive: assigned if the unit is concerned with the substance of the
discussion; in other words, if it is relevant to the decision. This would discussion of
the task, practice round, and possible strategies for subsequent rounds.
   - the task instructions say that all criteria should be weighted equally
   - may be on the next round we should consider +++’s and ----’s?
   - let’s think more about what is most important for getting a promotion
   - well, maybe we should rank the metrics
   - I think it’s the last three maybe that are the wrong ones u?
   - I like the new scale
   - Who do you think were the two “correct” people?

2. Maintenance: assigned if the unit is concerned with maintaining (or
damaging) group cohesiveness or individual morale.

   a) Positive: statements showing pleasure, joking, or positive response to
expression of pleasure and jokes. Positive maintenance units can also indicate
affiliation or social support for other group members, or identification with or
praise for a group as a whole. Finally, positive maintenance units may consist
of positive responses to episodes of tension and antagonism.
   - Go team
   - haha
   - Okay…thanks everyone! I hope the next round is half as fun. 😊
   - Its ok guys lol
   - Let’s do better this time.
- Awesome!

b) Negative: statements of disapproval or criticism for the group or other group members, along with direct responses to these statements. Negative maintenance units can also show displeasure, frustration or disinterest, and acknowledgments of incompetence.

- I’m indifferent
- This task is the most random thing ever.
- DON’T GET HASTY, NUMBER 2
- I’m not hasty
- DON’T GET DEFENSIVE, NUMBER 2

3) Procedural units: Assigned if the unit is concerned with the process by which the decision is made. It has do with the establishment of operating procedure of how the group will go about doing the task on the performance round. Procedural categories include attempts to “guide” the discussion.

a) Current procedure: if the unit is concerned with the procedure during the strategy discussion session

- I think should we type we are ready?
- Ok ready then.
- Do you think we’re ready to start working on the next one?

b) Procedure on the performance round: if the unit is concerned with the communication process/procedure during the performance round

- maybe we need a little more debate because we all kind of just accepted it last time
- when we get the profiles, do we want to read through and rank them individually, or discuss it all the way through?
- I think this time we should answer in order of group name 1 2
3...when we ask who we want ranked first group member 1 says who
and why, then group member 2, then group member 3.
- I would say, just because I hate working in groups online, we should
do it like over the radio, when you’ve finished saying what you want to
say, add a--.
APPENDIX 4

SCALE MEASURES

Perceived individual effort (adapted from Weldon et al., 1991)

1) I worked harder to help the group perform well on the performance trial than on the practice trial.

2) I put forth more effort during the performance trial than during the practice trial.

3) I tried as hard as I could to work on the performance trial.

4) I did not exert much effort during the performance trial.

Perceived value of strategy change (adapted from Weldon & Weigart, 1988)

1) In this experiment, a change in group strategy during the group performance trial was necessary for improved performance.

2) In this experiment, a change in group strategy during the group performance trial was important for goal attainment.

Group strategy assessment (adapted from Hackman, 1982)

1) Our group was highly imaginative in thinking about new or better ways we might perform our task.

2) Our group almost never experimented with alternative ways we might carry out our task.

3) When a nonroutine matter came up in our group, we were quite adept at inventing new ways to handle the situation.

4) The way we proceeded with our work was fully appropriate for the tasks we had to do.

5) At times it seemed as if our group was headed in the wrong direction—that is, our approach for the task was not quite what was needed.

6) In this group, we planned our work effectively.
7) The methods and procedures we used in working together were just right for the tasks we had to perform.

8) Our group developed a good strategy for doing the task.

Trust (adapted from Jarvenpaa and Leidner, 1998)

1) Overall, the people in my group were very trustworthy.

2) We were usually considerate of one another’s feelings on this team.

3) The people in my group were friendly.

4) I could rely on those with whom I worked in my group.

Task Attraction Measure (adapted from McCroskey & McCain, 1974)

1) If I was taking part in another project like this, I would like to do it with him/her.

2) If I wanted to get things done, I could probably depend on him/her.

3) I would enjoy working on any task with him/her.

4) He/she is lazy when it comes to working on a task.

5) He/she is an unreliable work partner.

6) I enjoyed working with him/her.

Social Attraction Measure (adapted from McCroskey & McCain, 1974)

1) I think he/she could be a friend of mine.

2) I would like to have a friendly chat with him/her.

3) He/she was sociable with me.

4) He/she is not very friendly.

5) I would like to spend time socializing with him/her.

Group Identity Measure (adapted from Spears, Lea, & Lee, 1990)

1) To what extent do the students in this group differ from each other?

2) To what extend is this group unique, unlike other groups?

3) How similar to each other are the students in this group?
4) I see myself as a member of this group.

5) I regard this group as important.

System Satisfaction (adapted from Connoly, Jessup, & Valacich, 1990)

1) How satisfied are you with the system your group used to discuss problems?

2) How satisfied are you with the electronic system your group used versus Face-to-Face?

3) Was electronic system used for the group task helpful?

Group Satisfaction (adapted from Connoly et al, 1990 and Gouran, 1973)

1) How satisfied are you with the process by which your group generated and evaluated ideas?

2) How satisfied are you with the ideas your group proposed to solve problems?

3) How satisfied are you with the other members’ evaluations of ideas?

4) All in all, how satisfied are you with being a member of this group?

5) How satisfied are you with the group’s overall performance?

Communication climate (adapted from Gibson & Gibbs, 2006)

1) Group members were able to say what they thought.

2) When there was a problem, group members talked about it.

3) Group members used words that were considerate of others’ feelings.

4) Group members were free to be assertive about what they thought and felt.

Group attitude scale (adapted from Evans & Jarvis, 1986)

1) I wanted to remain a member of this group.

2) I liked this group.

3) I looked forward to interacting with this group.

4) I didn’t care what happened in this group.
5) I felt involved in what was happening in this group.
6) If I could have dropped out of this group, I would.
7) I am dissatisfied with this group.
8) If it were possible to move to another group, I would have.
9) I felt included in this group.
10) A feeling of unity existed in my group.
11) I did not feel a part of the group’s activities.
12) I felt distant from the group.
13) It makes a difference to me how this group turned out.
14) I felt my absence would not matter to the group.
REFERENCES


