# THE MOTIVATIONAL DRIVERS OF LEADERSHIP EMERGENCE IN MULTITEAM SYSTEMS

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# THE MOTIVATIONAL DRIVERS OF LEADERSHIP EMERGENCE IN MULTITEAM SYSTEMS

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# SUMMARY

Many of the most important organizational and societal challenges are beyond the capacity of single teams, working in isolation, and instead, require the collaborative efforts of *Multiteam Systems* (MTSs; Mathieu, Marks, & Zaccaro, 2001). MTSs are networked collections of two or more component teams whose success as a larger collective depends on the degree to which constituent members and teams collaborate effectively toward the accomplishment of shared 'superordinate' goals. Limiting collaborative interactions, however, MTS members are not always *motivated* to achieve superordinate goals. Indeed, MTSs are composed of individuals who have the volition to prioritize and pursue any number of possible objectives. This dissertation emphasizes that MTS members are embedded in distinct team contexts, each of which exerts unique pressures on constituent members to focus on particular pursuits. Thus, MTSs can be comprised of teams with unique, and sometimes competing, *team priorities*.

Given decades of research demonstrating that the goals prioritized by individuals and groups predict interactions in social settings (e.g., Deutsch, 1949; Tajfel & Turner, 1979), team priorities are likely to have important ramifications for interteam collaboration processes. In particular, theories of social interdependence suggest that team priorities are likely to impact the emergence of critical *leadership* processes of influence claiming (i.e., attempting to lead) and granting (i.e., agreeing to follow)—processes that form the "the psychological basis for channeling individual efforts into a coordinated system of action" (Johnson & Johnson, 2006, p. 291).

In a large-scale MTS laboratory study, I consider the impact of team priorities on the networked patterns of leadership that arise across systems. Using a between-team manipulation, I experimentally manipulated the degree to which component teams were induced to prioritize the superordinate goal of the system and evaluated the impact of this

manipulation on the emergence of leadership claiming and granting processes across teams.

The results of this study show that the priorities emphasized *within* component teams in MTSs have significant ramifications for members' participation in critical processes of leadership *between* teams. I show that membership on a team that prioritizes the superordinate MTS goal might confer system-wide influence. Relative to teams that did not prioritize the superordinate goal, members of these teams were more likely to reference the superordinate goal in their interteam communications and more likely to claim and be granted leadership influence by members of other teams. However, my results also suggest that when a system includes teams that prioritize goals which conflict with MTS objectives, MTS members who prioritize superordinate goal might allow those teams to unduly influence the system. In comparison to members of teams that do not prioritize the superordinate goal, members of teams whose team priority is the superordinate goal were more likely to claim followership (i.e., grant leadership)—potentially to others with *incompatible* priorities. Furthermore, this dissertation uncovers patterns of communication related to leadership granting and identifies patterns of leadership granting related to MTS performance. Overall, the findings from this dissertation significantly advance theory surrounding multiteam collaboration and organizational leadership and suggest new directions for both research domains.

# CHAPTER 1

# INTRODUCTION

Many of the most important organizational and societal challenges, including disaster response (DeChurch et al., 2011), military coordination (Lanaj, Hollenbeck, Barnes, & Harmon, 2013), social change (Kania & Kramer, 2011), and interdisciplinary science (DeChurch & Zaccaro, 2013), are beyond the capacity of single individuals or teams, and instead, require the collaborative efforts of *Multiteam Systems* (i.e., 'MTSs'; Mathieu, Marks, & Zaccaro, 2001). MTSs are networked collections of two or more 'component' teams whose success as a larger system depends on the degree to which the teams successfully navigate their interdependencies and work collaboratively toward *shared superordinate goals* (Lanaj, Hollenbeck, Barnes, & Harmon, 2013; Marks, DeChurch, Mathieu, Panzer, & Alonso, 2005). Challenging multiteam collaboration however, MTS members are not always *motivated* to achieve superordinate goals.

MTSs are complex collective entities whose members are independent actors with the volition to act in support of any number of objectives. A variety of forces, including real and/or psychological divides between teams (Luciano, Dechurch & Mathieu, in press), reinforcement strategies that emphasize proximal (i.e., individual, team) as opposed to distal (i.e., superordinate) outcomes (Mathieu, 2012), or ambiguity between members' actions and the achievement of superordinate goals (Kanfer & Kerry, 2012), often focus members' attention and efforts *away* from shared superordinate goals and yield systems comprised of members who prioritize a wide variety of proximal goals. Yet, MTS members are also embedded in specific *team contexts*, each of which can exert unique pressures on constituent members to focus on particular pursuits. Indeed, multilevel theories of organizations (Kozlowski & Klein, 2000) suggest that people's priorities are likely to be more similar within, as opposed to between, component teams.

This dissertation advances the notion that MTSs are often comprised of component teams with unique priorities, some of which may be only tangentially related to and/or in conflict with superordinate goals. I consider the impact of these *'team priorities'* on critical interteam collaboration processes. Specifically, I build on theories of intergroup relations (Tajfel & Turner, 1979) and social interdependence (Deutsch, 1949; Johnson & Johnson, 2006; Lewin, 1935) to suggest that when MTS members are embedded in team contexts that focus their energy and efforts toward *superordinate* goals, they are much more likely to approach interteam interactions *collaboratively.* In contrast, when members are embedded in team contexts that focus their energy and efforts toward more proximal team-level goals—particularly those proximal goals that are only tangentially related to and/or in conflict with superordinate goals—they are likely to approach interteam interactions *competitively.* Critically, social interdependence theory suggests that under collaborative, as opposed to competitive, scenarios, MTS members will be more likely to *attempt to influence* fellow collaborators toward shared goals and more willing to *grant others'* influence attempts—processes that form the "the psychological basis for channeling individual efforts into a coordinated system of action" (Johnson & Johnson, 2006, p. 291).

Contemporary theories of leadership maintain that not only are processes of claiming and granting influence vital to collective action, these processes constitute the fundamental building blocks of *leadership* (e.g., DeRue & Ashford, 2010). Indeed, researchers are increasingly depicting leadership as a relational phenomenon characterized by influence processes that emerges between sets of two or more organizational actors as they operate in social settings (e.g., Carter, DeChurch, Braun, & Contractor, 2015; DeRue & Ashford, 2010; DeRue, 2011; Eberly, Johnson, Hernandez, & Avolio, 2013; Uhl-Bien, 2006; Yammarino, 2013). In light of views of leadership as a relational process, team priorities, which are likely to impact members' collaborative vs. competitive interactions within and across teams, are also a key antecedent of members' participation in leadership in MTS contexts. That is to say, that team priorities predict who will lead and who will follow in multiteam contexts, and ultimately how patterns of leadership influence will arise to impact the success of component teams and larger systems.

In this dissertation, I leverage classic and contemporary social psychological theories to build hypotheses regarding how teams' prioritization of superordinate goals underpin the emergence of patterns of leadership claiming and granting across organizational systems. I test my hypotheses using a large-scale multiteam system laboratory experiment, which was designed for this dissertation. Using a between-team manipulation, I experimentally manipulated the degree to which component teams were induced to prioritize the superordinate MTS goal. This controlled experimental approach afforded: (a) a sufficient sample of MTSs with comparable size, task demands, composition, and tenure; (b) the ability to manipulate team priorities; and (c) the investigation of all members' interactions over their entire lifespan as a MTS. Using inferential models of network emergence and development, I evaluated the effects of members' manipulated team priorities on their leadership claiming and granting with members of other teams, revealing how team priorities give rise to broader networks of leadership relationships across systems.

# CHAPTER 2

# EFFECTS OF TEAM PRIORITIES ON LEADERSHIP EMERGENCE IN MULTITEAM SYSTEMS

MTS success hinges on the degree to which component teams successfully navigate their interteam interdependencies and coordinate their efforts in pursuit of shared superordinate goals (Marks et al., 2005). Yet, a key paradox of multiteam collaboration is that many of the reasons why multiple teams are *needed* to tackle large complex problems, such as their diverse skillsets, resources, and perspectives, can also create real and/or psychological divides between the teams that limit effective interteam interactions and encourage fellow teammates to turn toward one another for social support (Luciano, DeChurch, & Mathieu, in press).

Prior research establishes that *leadership* is a fundamental force in MTS contexts that can encourage component teams to traverse their boundaries and coordinate their interdependent actions toward superordinate goals (Carter & DeChurch, 2014; Davison, Hollenbeck, Barnes, Sleesman, & Ilgen, 2012; DeChurch & Marks, 2006; Lanaj et al., 2013; Murase, Carter, DeChurch, & Marks, 2014). However, as a phenomenon, leadership influence does not necessarily support collective goals. In fact, views of leadership as a relationship that arises through social interactions, stress that *any* organizational member, regardless of his or her priorities and formal position of authority, might attempt to claim leadership influence in support of any number of goals, and in turn, other people may grant those leadership influence attempts (e.g., Carter et al., 2015). Thus, although emergent influence processes *might* focus group members' attention and efforts on goals that are shared by the entire group (e.g., superordinate MTS goals), in some situations, individuals will attempt to influence others to support objectives that are only tangentially related to, or in conflict with, collective goals.

In other words, there is no guarantee that all leaders (i.e., the "influencing agent[s]," Katz & Kahn, 1978, pp. 527) in MTS settings will always exert influence in support of superordinate goals; at times, influence processes might undermine system performance. As such, it would be practically useful to be able to *predict* why, how, and among whom leadership is likely to arise throughout these systems, and potentially take steps to intervene if necessary. However, the extant research on MTS leadership has not yet clarified the antecedents of leadership emergence, focusing instead on understanding how formally-appointed leadership teams impact interteam coordination and performance.

The key purpose of this dissertation is to consider questions of *leadership emergence* in multiteam contexts. In the following sections, I connect theories of interdependence in social settings (e.g., Deutsch, 1949) with relational depictions of leadership emergence (e.g., Carter et al., 2015; DeRue & Ashford, 2010) to develop hypotheses regarding how the goals prioritized *within* component teams predict MTS members' participation in processes of claiming and granting influence *across systems*. I begin by clarifying the nature of the MTS as an organizational form.

## Features of Multiteam Systems

Boundaries of collective entities, such as teams or MTSs, are often fluid and difficult to demarcate (DeChurch & Mathieu, 2009; O'Leary, Mortensen, & Woolley, 2011). Just as teams researchers emphasize interdependence among collections of individuals toward *team goals* as a defining feature of team boundaries (e.g., Campion, Medsker, & Higgs, 1993), MTS researchers emphasize interdependence among collections of teams toward *superordinate goals* as a defining feature of MTS boundaries (Mathieu et al., 2001). At a minimum, MTSs contain at least two distinct component teams, each of which is a recognizable entity whose members experience a sense of entitativity derived from their common fate with regard to proximal team goals

(Campbell, 1958). Additionally, all component teams within a MTS share a common fate with regard to at least one, more distal, shared superordinate goal (Mathieu et al., 2001).

## MTS Attributes

Given this broad definition of the MTS as an organizational form, MTSs can vary widely with regard to their characteristics or attributes. Specifically, Zaccaro and his colleagues (2012) delineate three categories of MTS attributes that vary across systems: *compositional attributes*, *linkage attributes*, and *developmental attributes*.

*Compositional attributes* refer to demographic features of the system as a whole, as well as features of component teams in relation to one another. Compositional attributes include the number of individuals and teams in the system, the geographic dispersion and cultural diversity of members and teams, and the degree to which MTSs are composed of teams from a single organization (i.e., an ‘internal MTS’) or from multiple organizations (i.e., a ‘cross-boundary MTS’). Compositional attributes also include the degree to which teams are expected to contribute certain levels of effort and/or resources toward shared goals, and the compatibility of the goals at lower and higher levels of the MTS goal hierarchy.

*Linkage attributes* refer to the ways in which members and component teams are *connected* to one another (Zaccaro et al., 2012). These connections can include the nature and degree of task interdependence required of component teams in order to achieve team and higher-order goals, the hierarchical arrangements or power distributions within and between teams, and the networked patterns of communication or social relationships among members. Linkage attributes encompass formal linkage structures, such as when a formal leadership team is established to organize interteam interactions, as well as informal linkage structures, such as the informal patterns of social relationships (e.g., friendship, advice, influence) that arise among members over time (Zaccaro et al., 2012).

Lastly, *developmental attributes* include the genesis (i.e., appointed, self-assembled) of a MTS and its evolution over time with regard to compositional and linkage attributes. As examples: new networked patterns of communication might arise as members gain additional insight into one another's expertise and seek out those with specialized knowledge (Mell, van Knippenberg, & van Ginkel, 2014); a component team without formal authority might become more powerful over time by virtue of their functional specialty being highly central to the core mission of the system (Zaccaro et al., 2012); or new members and teams may enter and/or leave the system as task demands shift (Luciano et al., 2015).

As the description of developmental attributes implies, theory surrounding MTSs aligns with "input-process-output" or "input mediator output input" models of *team* effectiveness (e.g., Hackman, 1987; Ilgen, Hollenbeck, Johnson, & Jundt, 2005; Kozlowski & Ilgen, 2006; McGrath, 1984; Steiner, 1972). Compositional, linkage, and developmental attributes are thought to impact the behavioral processes and psychological states (also linkage attributes) that emerge within and across teams over time, as well as the resulting individual and collective outcomes.

## MTS Goal Hierarchies: Key Compositional Attributes

By definition, all MTSs contain multi-level goal hierarchies with at least two levels (i.e., team goals, superordinate goals). However, these systems vary in terms of the "degree of compatibility between team and MTS goals." In some MTS goal hierarchies, the achievement of all proximal goals would support superordinate goal achievement. In other systems, the goal hierarchies contain distal superordinate goals that are "indifferent to, or even partially in conflict with, the core mission and goals of one or more component teams" (Zaccaro et al., 2012, p. 16).

Organizational scientists have established that the *goals* people prioritize and pursue are highly consequential for understanding and predicting individual and collective actions and interactions (e.g., Chen & Kanfer, 2006; Deutsch, 1949; Johnson & Johnson, 2006; Kanfer & Heggestad, 1997; Klein, Wesson, Hollenbeck, Wright, & DeShon, 2001; Lewin, 1935; Locke & Latham, 1990; 2002). Likewise, MTS theory clarifies that the *nature and compatibility* of the goals found across levels of MTS goal hierarchies are particularly important MTS compositional attributes with significant ramifications for the linkage processes and properties that arise within and between teams (Luciano et al., 2015; Zaccaro et al., 2012).

The levels of compatibility between lower and higher level goals are likely to significantly impact team and multiteam functioning. Indeed, Zaccaro et al. (2012) note when goals at lower- and higher-levels of a MTS goal hierarchy are poorly aligned, this can "result in more complex interteam processes than MTSs where the core missions of component teams are more compatible with each other and with the distal goal of the MTS" (p. 17).

### MTS Members Might have Different Priorities

Further complicating MTS collaboration, MTS members may not *prioritize* superordinate goals, especially in systems where one or more lower-level goals is incompatible with superordinate objectives. In social settings with multiple goals, people are not always capable of focusing their attentional resources toward all goals simultaneously. Research suggests that when people encounter social situations with somewhat incompatible goals, feedback directs their attention such that they prioritize *one* goal over another and behave accordingly (DeShon, Kozlowski, Schmidt, Milner, & Wiechmann, 2004).

MTSs are complex collective entities composed of members with the *volition* to act upon their own motivations—people make choices regarding how they will allocate their attention and effort (Kanfer & Ackerman, 1989). For example, Mathieu (2012) acknowledges that members of many MTSs are likely to prioritize and pursue their own proximal goals, even at the expense of achieving superordinate goals, when reinforcement strategies reward individual or team performance rather than multiteam performance. Similarly, Kanfer and Kerry (2012) described how MTS members are likely to experience a high level of ambiguity between their actions and the achievement of superordinate goals that directs their attention and efforts toward proximal goals.

**Team Priorities**

The theoretical work just describes suggests that there can be variability *within* a MTS in terms of members' priorities—each individual MTS member may choose to prioritize and pursue any number of possible objectives. However, multilevel theories of organizations (e.g., Kozlowski & Klein, 2000) also suggest that the amount of variability in members' priorities is likely to be much greater *between* component teams than it is within teams.

This is because fellow teammates are more likely to experience more similar ambient stimuli (e.g., work design; team norms), discretionary stimuli (e.g., personalities, motivational traits), and multidimensional stimuli (e.g., team climate; Chen & Kanfer, 2006) than are members of different components teams (Luciano et al., 2015). Thus, the kinds of informational feedback that direct people's attention toward particular pursuits (e.g., DeShon et al., 2004) are typically more similar within teams than between. Like many other phenomena in teams (e.g., team trust, collective cognition; Kozlowski & Ilgen, 2006), as a variety of top-down (e.g., pay structures, manager behavior) and bottom-up forces (e.g., member interactions, social cues) impinge on a particular team, members' priorities are likely coalesce to characterize a shared property of the team as a whole (Kozlowski & Klein, 2000).

I use the term '*team priority*' to refer to the goal that is emphasized, relatively homogeneously, within a component team at a given moment. A team priority can be thought of as a team property, similar to a team-level norm, which guides the goal-directed efforts of team members toward individual, team, or multiteam pursuits. Team priorities are distinguishable from *team-level goals,* which describe specific outcome states, the achievement of which requires interdependent actions among fellow team members (Courtright Thurgood, Steward, & Pierotti, 2015). In contrast, a team priority describes the dominant objective emphasized within a team and can refer to a goal at *any* level of the MTS goal hierarchy (i.e., individual goals, team goals, MTS goals, etc.).

Effects of Team Priorities

Building on Zaccaro and colleagues' argument that MTS interactions become more complex when superordinate goals are not entirely compatible with one or more goals at lower levels of MTS goal hierarchies, I suggest that the composition of team priorities may further complicate interteam interactions. Specifically, the challenges for interteam collaboration stemming from incompatibility across goals at lower and higher levels of MTS goal hierarchies are likely to be compounded when some or all members *prioritize* proximal goals that detract from superordinate goal achievement.

Achieving superordinate goals requires at least some degree of interteam 'task interdependence' (Courtright et al., 2015) such that members of different component teams share resources, interact with one another, and depend on one another's outputs for their own success (Mathieu et al., 2001). However, when teams prioritize objectives that are only tangentially related to and/or in conflict with shared superordinate goals of the system, they are unlikely to be motivated to engage in the necessary interdependent activities that enable superordinate goal achievement. As Mathieu and colleagues put it, "MTSs will fail if different teams that are linked intensively are pulling in alternate directions" (2001, pp. 307).

For example, Mathieu (2012) described an MTS comprised of an architectural team, a school board, a building committee, and a town council tasked with developing a plan for the design, construction, and funding of a new high school. Completing the superordinate goals of the project necessitated the expertise and buy-in of all teams. Yet, during negotiation, different factions negotiated in favor of relatively incompatible objectives. Whereas one faction pushed to build a costly state-of-the-art facility, another pushed to limit tax increases and potentially put a stop to the project altogether.

## Why Do Team Priorities Impact Interteam Interactions?

Tenets of *Social Interdependence Theory* (Deutsch, 1949; Lewin, 1935) help explain why the members of the different component teams in Mathieu's (2012) example struggled to engage in effective interteam interactions. According to social interdependence theory, *positive interdependence* (i.e., collaboration) exists when individuals perceive that their own goal attainment is positively tied to another person's goal attainment, and/or that the other's efforts might be substitutable for one's own. *Negative interdependence* (competition) exists when individuals perceive that their goal is achievable only if the other individual fails to obtain his or her goals (Deutsch, 1949).

Under conditions of positive interdependence, individuals tend to view collaborators' *effective* actions positively and collaborators' *ineffective* actions negatively. Positive forms of interdependence tend to result in the type of *promotive* teamwork interactions that underpin collective success (e.g., Marks, Mathieu, & Zaccaro, 2001; Kozlowski & Ilgen, 2006) such as "mutual help and assistance, exchange of needed resources, effective communication, mutual influence, trust, and constructive management of conflict" (Johnson & Johnson, 2006, p. 292). In contrast, under conditions of negative interdependence, competitors tend to view one another's *effective* actions *negatively* and *ineffective* actions *positively,* and often work to obstruct each other's effective actions. In Mathieu's (2012) example, members of the component teams that prioritized goals that were somewhat in conflict with superordinate goals likely perceived more negative or competitive forms of interdependence with members of other teams, thus limiting their desire to engage in promotive teamwork behaviors across teams.

Many decades of empirical research on social interdependence have verified that the goals people and groups prioritize and pursue shape their perceptions of interdependence with others and their engagement collaborative vs. competitive interactions. For instance, studies of intergroup relations demonstrate that group members tend to show a strong preference for ingroup, as opposed to outgroup, members, attributable in part, to perceptions of competition between different groups that work toward incompatible goals (e.g., Brewer & Brown, 1998; Tajfel & Turner, 1979; Tajfel, Billig, Bundy, & Flament, 1971). However, when groups are induced to focus their attention toward a desirable shared superordinate goal, perceptions and experiences of positive interdependence, and thus, positive feelings and collaborative interactions, are enhanced (e.g., Sherif, 1958).

More recently, Luciano and colleagues (2014) echoed this classic work by arguing that the degree to which MTSs component teams prioritize highly dissimilar and/or incompatible goals is an important *team boundary-enhancing* force in multiteam contexts. These researchers describe how basic human social motives (Fiske, 2009) to: (a) have strong stable relationships, (b) predict the future, (c) perceive linkages between their behaviors and external outcomes, (d) see the world as a benevolent place, and (e) maintain/improve self-esteem, lead MTS members to seek out opportunities to interact with certain other members who are most likely to help them meet these needs. When teams emphasize incompatible goals, and team boundaries are enhanced, MTS members are likely to orient their need fulfillment (e.g., in terms of seeking out support and/or collaborative interaction) *toward* fellow teammates and *away* from members of other teams, thus limiting effective interteam interactions. Moreover, Luciano et al. posit that dissimilar/incompatible team priorities can significantly widen any rifts and divisions among teams that might have existed due to other boundary-enhancing forces, such as teams with different areas of expertise, norms, processes, or information sharing practices. In contrast, when teams have more similar and compatible team priorities, members are more likely to be motivated to find ways (e.g., openly sharing information) to overcome their differences.

In summary, the composition of team priorities in a MTS is a crucial compositional attribute that can dramatically impact system functioning. Given that teams are increasingly used as the basic unit of work in organizations and teams are increasingly called upon to work interdependently with *other* teams toward important large-scale problems (DeChurch & Zaccaro, 2010), there is a pressing need to understand more about the phenomena, such as *multiteam leadership*, reviewed next, that could help focus teams toward shared superordinate goals.

## The Importance of Leadership in MTSs

Echoing more than a century of research on leadership across the organizational sciences (Yammarino, 2013; Hogan & Kaiser, 2005), MTS researchers have advanced leadership as a key 'solution for the problem' of component team alignment and collaboration in MTS contexts. Building on functional theories of leadership, which consider the role of leadership in meeting group needs (Fleishman, Mumford, Zaccaro, Levin, Korotkin & Hein, 1991; Hackman & Walton, 1986; Lord, 1977; McGrath, 1962), MTS researchers maintain that the degree to which leadership fulfills certain functions (e.g., strategizing, coordinating) within, between, and across MTS component teams positively impacts MTS effectiveness (DeChurch et al., 2011; Zaccaro & DeChurch, 2012). As Mathieu and colleagues' (2001) state in their seminal chapter introducing the concept of MTSs: "the importance of leadership increases as: (1) units operate in increasingly dynamic and fluid conditions; and (2) units within a system are tightly linked in some functional interdependence" (p. 307).

However, multiteam or intergroup collaboration contexts also challenge traditional approaches to conceptualizing and studying leadership which were based on an assumption that leadership stems from a single formal leader toward subordinates who all share a common group membership (Hogg, van Knippenberg, & Rast, 2012). The large size and complexity of MTSs, and the potential for constituent members to belong to multiple organizations and/or functional areas of expertise often precludes any single individual from being able to meet all leadership needs for the entire system. Rather, MTS contexts often necessitate that *multiple people* assume responsibility for various aspects of leadership, simultaneously, or over time (Carter & DeChurch, 2014; Johannessen, McArthur, & Jonassen, 2012; Zaccaro & DeChurch, 2012).

**MTS Leadership Teams**

Under the assumption that the large size and scale of multiteam tasks often invokes multiple leaders, initial research on MTS leadership has considered how members of formally-appointed ‘leadership teams’ enable system success (e.g., Davison et al., 2012; DeChurch & Marks, 2006; de Vries, Hollenbeck, Davison, Walter, & Van der Vegt, 2015; Firth et al., 2015; Lanaj et al., 2013; Murase et al., 2014). For the most part, these prior studies have investigated the effects of top-down leadership interventions in relatively similar MTS samples (i.e., military personnel or participants in military-based games) with relatively similar, action-oriented superordinate goals (e.g., eliminating targets, avoiding enemy hits; Davison et al., 2012).

For example, DeChurch and Marks (2006) experimentally manipulated the functional leadership behaviors of formally-appointed leadership teams in MTSs engaged in an intensively-interdependent military-operations task. Their findings demonstrated that interteam coordination and MTS performance are enhanced when leadership teams are trained to: (a) develop strategic plans focused on synchronizing component team actions; and (b) directly facilitate coordination processes between teams during action phases of task performance. In a re-analysis of the dataset examined by DeChurch and Marks (2006), Murase and colleagues (2014) found that a key intervening psychological mechanism linking leadership teams' functional behaviors to multiteam coordination and performance is the development of an accurate cognitive architecture throughout the system. This study revealed that MTS leaders who possess an accurate understanding of how component teams should interact 'transfer' this understanding to members of component through their communication of strategic plans.

In another investigation of formally-appointed leadership teams, Davison and colleagues (2012) showed that differences between component teams with regard to how central the teams' contributions are to superordinate goals can have important implications for how formal leadership teams should facilitate interteam coordination. In this study, each MTS was composed of military personnel assembled into one of three teams: a *'point team'* whose contributions were more critical to addressing the demands of the MTS goal relative to a second component team (i.e., the *'support team'*), and a *'leadership team'* devoted to integrating the tasks of the two other component teams. Findings indicated that coordination between the leadership team and the point team member who had been assigned to a 'boundary spanner' role on the point team had a much greater positive effect on MTS performance, relative coordination between the leadership team and the boundary spanner on the support team. In other words, the findings from this study suggested an effective pattern of interaction whereby formal leaders should coordinate more with representatives of teams whose inputs are more central to the superordinate goal. Interestingly, the results also showed that direct 'lateral' coordination between members of the two component teams who were not designated boundary-spanners was negatively related to MTS performance, suggesting that too much between-team interaction can be detrimental to the achievement of action-oriented multiteam goals.

Using the same military-operations platform and team configuration as in Davison et al., Lanaj and colleagues (2013) manipulated how responsibility for developing strategic plans was distributed among members. In the *decentralized* planning condition, the boundary spanners for the two component teams worked first with their lower-level staff (i.e., component team members) to generate initial plans; then they presented these plans to the formal leadership team. In the *centralized* planning condition, the boundary spanners worked first with the leadership team to generate an initial plan that they then presented to the component teams. Results showed that although MTSs in the decentralized condition tended to show enhanced proactivity and higher levels of aspiration, the positive effects of these factors on MTS performance were negated by stronger negative effects attributable to excessive risk-seeking and breakdowns in interteam coordination. Thus, this study lends support to the idea argued by Davison et al. that members of formal leadership teams in action-oriented systems may be in a better position to fulfill certain leadership functions (i.e., strategic planning) as compared to members of component teams.

In two follow-up papers, which re-analyzed portions of the datasets used by Davison et al. (2012) and Lanaj et al. (2013), and added additional experimental sessions, Firth et al. (2015) and de Vries et al (2015) provide additional examples of top-down interventions that formal leadership teams might use to facilitate superordinate goal achievement. First, Firth and colleagues state that MTSs may experience "inconsistencies between units regarding how shared problems are conceptualized" (Firth et al., 2015, p. 3). These inconsistencies can limit coordination effectiveness (e.g., Bruns, 2013; DeChurch & Mesmer-Magnus, 2010; Dougherty, 1992). Firth et al., showed that *frame-of-reference training*, which provides component teams with a common language and standardized criteria for judging their own and others' performance (e.g., Athey & McIntyre, 1987; Dierdorff, Surface, & Brown, 2010; Gorman & Rentsch, 2009; Woehr, 1994), facilitates multiteam coordination and performance. These effects were likely due to a reduction in idiosyncrasies, errors, and inefficiencies in between-team processes.

de Vries and colleagues (2015), examined the role of formally-appointed leadership teams (termed ‘integration teams’ in this study) in helping systems reap the benefits of *interpersonal functional diversity* (i.e., the degree to which members are acquainted with multiple functional areas of expertise present in the system). Their results showed that coordination between the leadership team and the component teams can help MTSs reap the potential benefits of interpersonal functional diversity (e.g., improved interteam coordination due to greater shared understanding across teams) while avoiding the potential costs (e.g., decreased aspirational behavior due to low levels of individual specialization; de Vries et al., 2015). Thus, echoing the prior studies of leadership in military MTSs, this study showed that top-down functional leadership behaviors enacted by formally-appointed members of leadership teams toward members of component teams who are all in the same organization (i.e., the military) can facilitate superordinate goal achievement.

## The Importance of *Informal* Leadership in MTSs

The experimental investigations of MTS leadership reviewed in the previous section substantially advanced understanding surrounding the role of formally-appointed leadership teams in enabling multiteam effectiveness. However, these studies relied on a traditional assumption about leadership—that leadership stems only from those individuals who occupy *formal* positions of authority (i.e., members of formally-appointed leadership teams). Certainly, as Davison and colleagues (2012) note, members of formally-appointed leadership teams are sometimes best suited to handle “aspects of coordination that are beyond the scope of component teams” (p. 7). However, *not all MTSs* contain a formally-appointed leadership team with the authority to direct the actions of the entire system, and as Levine and Moreland put it over 25 years ago, “not all leaders are appointed or elected; some “emerge” during the course of group interaction” (Levine & Moreland, 1990, p. 613).

The notion that leadership influence can stem from informal sources is not new, nor is it unique to team or MTS contexts. Leadership researchers have long acknowledged that leadership influence does not necessarily involve formalized authority (Gibb, 1954; Hollander & Julian, 1969; Follet, 1925). Numerous studies have suggested that leaders, followers, and leadership processes can arise due to a variety of factors other than one person’s ‘legitimate power’ (French & Raven, 1959) over others (e.g., personality, social status, social connections, expertise, group membership; Aime, Humphrey, DeRue, & Paul, 2014; Balkundi & Kilduff, 2006; Carter et al., 2015; Hackman & Wageman, 2005; Hogg, 2001; Morgeson, DeRue, & Karam, 2010; Uhl-Bien, 2006; Yukl, 2010). Yet, perhaps because formal leaders are more easily identifiable than informal leaders, the vast majority of empirical studies of leadership have continued to study leadership involving formal authority (e.g., Dinh et al., 2014).

For the most part, leadership research focusing on formal leaders (e.g., managers) has sufficiently met the needs of organizations operating after the industrial revolution (McChrystal, Silverman, Fussell & Collins, 2015). However, the challenges facing organizations and society have grown increasingly complex depending greater levels of interdependence as larger-collectives operate in highly turbulent and competitive environments. In today’s complex organizational settings, leadership is rarely the sole responsibility of a single formal leader or leadership team, and instead, often involves contributions from those who do not occupy formal positions of authority.

In fact, even when formal leaders *are* present in a MTS, complex and dynamically changing task demands may require that additional members assume responsibility for aspects of leadership. For example, in a case study of a MTS that handles the inspection, maintenance, and repair of offshore oil and gas infrastructures, Johannssen et al. (2012) describe how high-risk action work in extreme environments often requires strong, centralized authority structures where the majority of interteam coordination functions are handled by one or a few individuals. However, they clarify that under conditions of extreme stress, the coordinators' resources are severely limited and the effectiveness of the system requires other individuals to assume other aspects of leadership, such as coaching, conflict management, or boundary management.

Furthermore, in many cross-boundary MTSs (i.e., systems spanning multiple organizations; Zaccaro et al., 2012), formal leaders do not possess formal authority over *all* members. For instance, an Organizational Development Consultant described a situation her firm is faced recently:

> *"I'm working on developing a training for people who manage consortia* [i.e., collective entities composed of multiple interdependent groups/teams from different organizations] *and I'm looking for any research into effective management practices... One organization works as the "prime," responsible to the donor and for the overall direction of the project, and has a number of "sub-contractors" as partners. A major challenge faced by the managers is how to effectively manage a project when the individuals assigned to the project don't report to you."* - (Lynette Friedman, Organizational Development Consultant, personal communication, 3/14/15).

As this quote exemplifies, even so-called 'formal leaders' may rely on 'informal' means to influence members of component teams from other organizations.

Similarly, MTS case studies suggest that informal leadership processes are highly relevant to the success of complex, geographically distributed, interdisciplinary systems. As an example, many Americans are aware of the poor decision-making processes that contributed to the tragic *Columbia* space shuttle disaster on February 1, 2003, which led to the deaths of all seven passengers. As Beck and Plowman (2014) point out, less Americans are aware that the emergent *disaster response efforts* after the shuttle explosion were judged a success and enabled our nation to understand what caused the accident. These researchers described the aftermath of the disaster as a situation where "relative strangers, from dissimilar agencies, without a designated leader or existing structure, quickly collaborated across organizational boundaries on an unprecedented and complex undertaking." In this MTS, processes of informal influence and trust among individuals who did not have formal authority *over* one another were key to aligning system efforts (Beck & Plowman, 2014). Likewise, in the high school expansion project described by Mathieu (2012), "back channel compromises and adjustments" are what ultimately "enabled the high school MTS to complete its task" (Mathieu, 2012, p. 518).

Finally, at least two empirical studies of MTS leadership have found positive relationships between patterns of informal leadership processes and multiteam outcomes (Bienfeld & Grote, 2013; Carter et al., 2014). Bienfeld and Grote's (2013) field study examined leadership behaviors enacted by members of cockpit and cabin crews who collaborated as component teams in MTS aircrews. In the more successful MTS aircrews, both formal leaders and component team members engaged in significantly more leadership behaviors relative to less successful MTS aircrews. Carter and colleagues' (2014) quasi-field study examined the structure of members' self-reported perceptions of others' leadership in self-managing interdisciplinary MTSs that were focused on developing an innovative new product. Their study showed that the degree to which members of *different* component teams saw one another as leaders and the degree to which these leadership was distributed more equally across members positively related to the innovative output of the system as a whole.

In summary, in MTS contexts, informal leadership processes are possible and often necessary for system success. Thus, in order to develop a broader understanding of the leadership phenomenon in multiteam settings, MTS researchers may need to rely on broader conceptualizations of leadership and empirical approaches that better account for the informal and emergent nature of leadership in these settings. The following section describes one such approach.

## Re-Conceptualizing Leadership

Over the past few decades, leadership researchers have begun to recast leadership in a way that better incorporates the informal, as well as the formal, nature of leadership. Leadership is increasingly being depicted as a type of *patterned, formal and/or informal relationship,* characterized by *influence processes,* that *emerges* between sets of two or more people, who may or may not possess formal authority, as they operate in social settings (e.g., Carter et al., 2015; Lord & Dinh, 2014; Uhl-Bien, 2006). In large part, this paradigm shift is in response to the need to better understand leadership in the new organizational forms of the 21st century, such as MTSs, characterized by team-based work structures, interdependence, self-organization, empowerment, virtuality, and cross-functional collaboration (Kozlowski & Ilgen, 2006).

### Leadership is Emergent and Relational

Broadly, the concept of *emergence* refers to the arrival of novel and coherent structures, patterns, and properties at higher levels of observation due to the characteristics, actions, and interactions among constituent components at lower levels of observation, as well as feedback loops with the embedding environment (Goldstein, 1999; Prigogine & Stengers, 1984). Emergence is a central concept across numerous disciplines including computer science (Moore & Crutchfield, 2000), artificial intelligence (e.g., Hinton, 1989), physics (Goldstein, 1999), and biology (Camazine, 2003).

In organizational contexts, *emergent collective phenomena* begin to arise as members' actions meet in time and space, creating a discrete interpersonal interaction event. Over time, a series of interpersonal interaction event cycles or "double interacts" (Weick, 1979) among organizational actors combine with their evolving thoughts, feelings, actions, as well as feedback loops with the embedding environment, to give rise to emergent patterns and/or shared properties at the group-level of observation

(Kozlowski & Klein, 2000; Kozlowski, Chao, Grand, Braun, & Kuljanin, 2013; Morgeson & Hofmann, 1999).

Given that leadership, aa phenomenon, requires at least two people, with one leading the other, or both mutually influencing one another (Katz & Kahn, 1978), researchers have argued that leadership is a one type of collective phenomenon that can emerge between sets of two or more people (Carter et al., 2015). Building on theories of emergent collective phenomena (e.g., Morgeson & Hofmann, 1999; Kozlowski & Klein, 2000), the repeated, and often simultaneous, influence claiming/granting processes among people—termed "leading-following double interacts" (DeRue, 2011, p. 129) or "leadership event cycles" (Eberly et al., 2013, p. 1)—constitute the dynamic processes through which leadership relationships come about.

For example, DeRue and Ashford (2010) argue that leadership is a type of relationship, characterized by influence, that develops through dynamic interaction processes whereby at least one person (i.e., the 'leader') *'claims'* influence in relation to another (and 'grants' followership in relation to the other), and at least one other person (i.e., the 'follower') *'grants'* the influence attempt (and 'claims' followership in relation to the other). Similarly, Uhl-Bien and Pillai (2007) reference granting as a process of exhibiting *deference* to a leader in (e.g., "if leadership involves actively influencing others, then followership involves allowing oneself to be influence," p. 196). Eberly and colleagues (2013) argue that leadership arises between at least two 'loci' of leadership due to their affect, behaviors/interactions, and cognitions. Figure 1, depicts a single leadership relationship that has emerged between two people at one moment in time.


*Figure 1.* Leadership relationship between two people at one point in time.

There are a wide variety of behavioral processes that might constitute the leadership relationship in Figure 1. For example, functional theories of leadership (e.g., Fleishman et al., 1991; Hackman & Walton, 1986) might suggest that this relationship exists because Actor B engaged in certain leadership functions such as providing feedback, motivating personnel or communicating plans (Zaccaro, Rittman, & Marks, 2001) toward, or in support of Actor A and/or a set of other people (e.g., other teammates). Some views of leader-member -exchange theory (LMX; Graen & Uhl-Bien, 1995) might suggest that thoughts, feelings, actions, or interactions reflecting the emergence of constructs like 'trust' or 'respect' between Actor A and Actor B constitute the emergence of a 'leadership' relationship between them.

More broadly, DeRue and Ashford (2010) suggest that leadership relationships develop through direct and/or indirect verbal and/or nonverbal actions and interactions that reflect influence claims or grants. For example, Actor B (i.e., the leader) in Figure 1 might have engaged in a *direct verbal influence claim* by making statements that are consistent with a functional leader role such as providing directions for Actor A. Actor B might have engaged in a *direct nonverbal influence claim* by sitting at the head of a conference room table. Actor A might have engaged in a *direct verbal influence grant* by stating that he or she will follow the directions given by Actor B, or a *direct nonverbal influence grant* by following Actor B's requested directions (non-verbally). *Indirect influence claims* could include aligning oneself with other influential individuals by name-dropping (*verbal*) or appearing physically beside other influential individuals (*non-verbal*). *Indirect influence grants* could include acknowledging a potential leader's close connections to important others (*verbal*) or by refraining from speaking unless spoken to (*non-verbal*).

**Leadership is a Configural Emergent Property of Groups**

Further clarifying the nature of leadership in collective contexts, researchers have suggested that leadership is better conceptualized as a *configural* (i.e., patterned Kozlowski & Klein, 2000) emergent property of dyads and larger groups as opposed to a property that is experienced identically by all group members (e.g., Carter et al., 2015; Carson et al., 2007; DeRue, 2011). The configural view of leadership is clear in DeRue and Ashford's (2010) and Eberly and colleagues (2013) portrayals of leadership emergence. Their theoretical work posits that leadership might arise between some, but not necessarily all, individuals in a social setting. As leadership arises among certain sets of group members, aggregate patterns of leadership relationships come to characterize larger collectives (DeRue, 2011; Carter et al., 2015).

Again, views of leadership as patterned are not new, nor unique to team/MTS contexts. Studies stemming from dyadic theories of leadership (e.g., leader-member-exchange; Gerstner & Day, 1997; Graen & Uhl-Bien, 1995; Sparrowe & Liden, 1997) have long established that even formal supervisors can develop differential (i.e., patterned) influence relationships with different subordinates. Similarly, the literature on followership and implicit theories of leadership suggests that people differ in terms of their followership styles and react to leaders in different ways (Oc & Bashshur, 2013; Uhl-Bien, Riggio, Lowe, & Carsten, 2014).

Contemporary researchers, particularly within teams research, have integrated views of leadership as patterned with an understanding that leadership does not necessarily involve formal authority. For example, studies based on shared leadership theory (e.g., Pearce & Conger, 2003) have shown that a pattern of leadership in which all team members share in leadership responsibilities can positively impact certain collective outcomes (e.g., Carson et al., 2007; D'Innocenzo, Mathieu, & Kukenberger, 2014; Dust & Ziegart, 2015; Klein, Lim, Saltz, & Mayer, 2004; Nicolaides et al., 2014; Wang, Waldman, & Zhang, 2014). Recent elaborations of theories of shared or collective leadership clarify that groups or teams can vary with regard to leadership patterning such that different people, each of whom may be internal or external to a team, and may or may not possess formal authority, might engage in different leadership processes with different people, simultaneously, or over time (Contractor, DeChurch, Carson, Carter, & Keegan, 2012; Morgeson et al., 2010). Lending empirical support to the notion that leadership is a configural as opposed to shared property of groups, meta-analytic evidence suggests that the explanatory power of shared leadership in teams increases when researchers operationalize shared leadership using a configural measurement approach as opposed to a measurement approach that assumes all members perceive team leadership in the same way (D'Innocenzo et al., 2015).

As an example of this patterned conceptualization in small groups, Figure 2 provides a visual depiction of a possible pattern of leadership relationships that might emerge among members of a five person team.

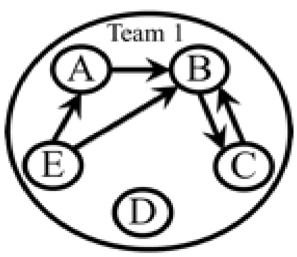



*Figure 2.* Pattern of leadership relationships among members of a five-person team.

Carter and DeChurch (2014) extended views of leadership as an emergent configural phenomenon to the MTS context by clarifying that leadership is an important type of emergent process or linkage attribute (Zaccaro et al., 2012) in MTS settings. Like other MTS linkage attributes (e.g., patterns of communication or interdependence), MTSs can vary with regard to their leadership patterning—different sets of members, who may or may not occupy formal positions of authority, might participate in influence processes with one another within or across component team boundaries. Additionally, like other MTS linkage attributes, other compositional, linkage, or developmental attributes of the system are likely to shape the patterns of leadership linkages that emerge among members. Figure 3 depicts a possible pattern of leadership relationships that might emerge among members of a two-team MTS.

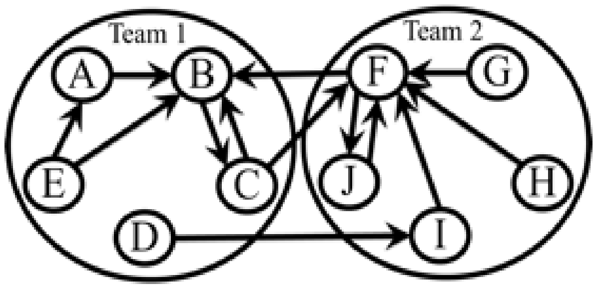



*Figure 3.* Pattern of leadership relationships among members of two five-person teams assembled into a two-team multiteam system.

**Implications of Emergent Leadership Patterning for MTSs**

Although the conceptualization of leadership as emergent/relational, patterned and formal/informal may more accurately *describe* the phenomenon of leadership in collectives, this view of leadership also presents a challenge for MTS researchers. If, as discussed above, leadership is an emergent relational process of influence, then *any* MTS member, regardless of his or her formal authority, may exert influence. Furthermore, as noted previously, MTS members do not always prioritize superordinate goals. Therefore, leadership influence may not always be attempted in *support* of superordinate goals and leadership grants may not always be directed toward individuals who prioritize superordinate goals. In other words, given that leadership can emerge through social processes and MTS members can act of their own volition, leadership might be claimed and granted in support of goals that undermine MTS performance.

As an example, in 2004, Sgt. Joe Darby, of the 372nd Military Police Company stationed at Iraq's Abu Ghraib prison, reported the torture that his colleagues were inflicting on Iraqi prisoners by showing his supervisors a now-infamous set of photographs documenting the prisoners' ordeal. In subsequent interviews, Sgt. Darby noted that Specialist Charles Graner emerged as an informal leader for some members of the unit, and these influence relationships had escalated certain soldiers' participation in the abuse. As the Abu Ghraib example illustrates, even in organizations like the United States military, which has a strict hierarchical leadership structure, members of complex collectives may successfully influence others informally, and sometimes tragically, toward their own ends (http://people.wku.edu/sam.mcfarland/).

The Abu Graib example illustrates that leadership can arise informally and *adversely* impact individual and collective outcomes. This suggests that *practically*, it may be very important to be able to predict how, why, and *among whom* leadership relationships are likely to emerge. Yet, the extant research on MTS leadership has not yet provided guidance regarding leadership emergence, focusing instead on the effects of leadership on multiteam outcomes. This leaves a crucial gap in our understanding of the phenomenon. In the next section, I develop a broader understanding of the reasons why *systems* of patterned leadership relationships might arise by considering how a highly salient attribute of MTS members social contexts—their team priorities—are likely to impact their participation in leadership claiming and granting between teams.

## How Team Priorities Underpin Leadership Emergence in MTSs

All MTSs have at least one superordinate goal and at least two component teams whose team boundaries are defined by team-level goals that are not shared by members of other teams (Mathieu et al., 2001). However, the goals across levels of MTS goal hierarchies are not necessarily compatible (Zaccaro et al., 2012), and component teams often pursue unique, and sometimes competing, team priorities. Research on *social interdependence theory* (e.g., Lewin, 1935; Deutsch, 1949), intergroup relations (e.g., Tajfel & Turner, 1979), and MTSs (Luciano et al., 2015), all suggest that the goals prioritized locally, within teams, are likely to impact members interteam interactions.

Given the view of leadership as an emergent relationship that arises through people's interactions in social settings, I argue that team priorities will therefore impact people's participation in the types of relational processes (i.e., leadership claiming and granting) that reflect the emergence of leadership. In fact, a critical aspect of social interdependence theory is the notion that positive interdependence, and the accompanying positive feelings and perceptions of others, positively predicts *inducibility*—people's openness to being influenced by others and/or to influencing others (Deutsch, 1949). Specifically, people's perceptions of positive/negative interdependence with others predicts: (a) the likelihood that people will attempt to influence others (i.e., leadership claiming); and (b) people's willingness to be influenced by others (i.e., leadership granting). In the following, I develop hypotheses regarding how the alignment between a MTS member's team priority and the superordinate goal(s) predicts his or her participation in leadership claiming and granting.

### Effects of Team Priorities on Leadership Claiming

Under conditions of positive, rather than negative, forms of interdependence, collaborators are more likely to attempt to influence one another to achieve shared goals and avoid actions that hinder goal achievement (Deutsch, 1949; Johnson & Johnson, 2006). Moreover, meta-analytic evidence suggests that people who are in cooperative situations tend to outperform those who are embedded in competitive or individualistic situations, in part because they are more motivated to take on and persist in more difficult tasks—including attempting to influence others toward complex, distal goals (Johnson & Johnson, 1989). As described above, in the section delineating the MTS compositional attribute of team priorities, teams who prioritize superordinate goals are likely to view themselves as linked to other component teams through positive as opposed to negative forms of independence. As such, my first hypothesis is:

*Hypothesis 1: Members of component teams that prioritize the superordinate goal are more likely to claim leadership in relation to members of other component teams than are members of component teams that do not prioritize the superordinate goal.*

Moreover, MTS members' priorities are likely to manifest in the *language* that they use when attempting to influence members of other teams. Linguistic researchers have long held that language is an instrument for goal attainment (Austin, 1962; Wittgenstein, 1953). For example, the goals-plan-action (GPA) model of persuasion (Dillard, 1990) and Berger's (1995) plan-based model of strategic interaction maintain that individuals pursue goals by developing (conscious or nonconscious) goal-directed plans and then, by interacting (e.g., communicating) with others. Indeed, goals are "at the heart of the social negotiation of meaning, a point that is especially evident when actors disagree about what goal defines (or should define) their current reality" (Wilson & Feng, 2007, p. 91). Working backwards, the content of people's communications in social contexts is often an indicator of their underlying goals and plans (Delia, O'Keefe & O'Keefe, 1982). In other words, people's goal focus appears (consciously or non-consciously) in the language that they use.

Given that MTS members whose team priorities are aligned with superordinate goals are likely to devote greater attentional resources toward those superordinate goals and perceive a shared identity with other teams as compared to teams that do not prioritize the superordinate goals, members of superordinate goal-focused teams are also more likely to *communicate* these priorities. Specifically, a MTS member whose team priority aligns with the superordinate goal(s) is likely to use verbiage that references the shared superordinate goal.

*Hypothesis 2: Members of component teams that prioritize the superordinate goal reference the superordinate goal in their communication with others more often than do members of teams that do not prioritize the superordinate goal.*

In contrast, MTS members whose teams do *not* prioritize superordinate goals are relatively more likely to perceive and/or experience *negative* forms of interdependence with members of other component teams. Thus, they are more likely to engage in obstructive behaviors and patterns of interactions that limit the ability of other component teams to achieve their own priorities (Johnson & Johnson, 2006). This attentional focus on their team-level objectives, as opposed to superordinate, goals is also likely to manifest in the language that they use when interacting with other teams.

*Hypothesis 3: Members of component teams that prioritize a team-level goal at the expense of the superordinate goal reference their own team-level goal in their communication with others more often than do members of component teams that do not prioritize a team-level goal.*

**Effects of Team Priorities on Leadership Granting**

Team priorities also have implications for the granting side of leadership (i.e., followership) across component team boundaries. First, theories of interdependence suggest that members of teams who prioritize and pursue superordinate goals may be more likely to *be granted* leadership by members of other component teams.

For example, Deutsch's (1985) 'crude law of social relations' maintains that the interaction processes brought forth by positive/negative forms of interdependence tend to elicit that form of social interdependence in others. In other words, cooperative interactions tend to beget cooperative interactions (e.g., inducibility) and competitive interactions tend to beget competitive interactions. Given this 'crude law,' I expect that a MTS member whose team prioritizes and pursues the superordinate goal—and who is therefore likely to approach interteam interactions collaboratively—is also more likely, relative to MTS members who approach interteam interactions competitively, to be perceived by members of other teams as a fellow collaborator. Thus, MTS members in teams that prioritize superordinate goals may be more likely to be granted influence (in general) by members of other teams.

*Hypothesis 4: Members of component teams that prioritize the superordinate goal are more likely to be granted leadership by members of other component teams than are members of component teams that do not prioritize the superordinate goal.*

However, given that under conditions of positive, rather than negative, interdependence, collaborators are more likely to grant (i.e., follow) fellow collaborators' influence attempts (Johnson & Johnson, 2006), teams who prioritize superordinate goals may also be the most likely to grant influence attempts made by members of *other* teams. This conjecture is supported by the social identify theory of leadership (Hogg, 2001).

Broadly, social identity theory clarifies that people tend to develop cognitive schemas or 'prototypes' containing information about the defining attributes (e.g., beliefs, attitudes, behaviors) of their ingroups, and tend to perceive other individuals who embody salient attributes of their ingroup as more attractive than 'less-prototypical' individuals (Hogg & Terry, 2000). Hogg (2001) posits that, over and above the effects of stable, de-contextualized individual attributes or behaviors, individuals are more likely to grant influence to those who appears to be highly 'prototypical' of their own group, and are less likely to grant influence to 'less-prototypical' individuals (Hogg, 2001; van Knippenberg & Hogg, 2003).

Likewise, a MTS member's team priority can be thought of as a feature of his or her social context that predicts which other MTS members he or she will perceive to be 'prototypical' of his or her own ingroup, and thus, which other members he or she will grant influence toward. Whereas members of teams that prioritize superordinate goals are more likely to perceive members of other teams as prototypical ingroup members, members whose team priorities lead them to prioritize team goals at the expense of superordinate goals are more likely to perceive members of other teams as 'outgroup' members. Thus, I hypothesize:

*Hypothesis 5: Members of component teams that prioritize the superordinate goal are more likely to claim followership in relation to members of other component teams (i.e., grant leadership) than are members of component teams that do not prioritize the superordinate goal.*

**Interactive Effects of Potential Followers' Team Priorities and Potential Leaders' Language on Interteam Leadership Granting**

Finally, just as MTS members' team priorities are likely to impact the type of language they use when interacting with members of other component teams, team priorities are also likely to impact the type of language they *respond to* by granting others' influence attempts. Although prior research suggests that individuals who use group-entity focused language are more likely to be influential in group settings (Kazecwicz et al., 2013), this influence may depend on the degree to which potential followers perceive themselves to be linked to other group members through positive forms of interdependence.

De Cremer and Van Vugt's (2002) experimental study suggests that influence granting does, in fact, depend on the interplay between leaders' language and followers' level of identification. Their study manipulated the degree to which members of experimental groups were focused on their own individual identity vs. the shared identity of the group. Additionally, the study manipulated the degree to which formal leaders communicated an ability to meet the group's instrumental needs (e.g., help the group solve a problem) or communicated a commitment to maintaining the group identity (e.g., by emphasizing fairness). Results showed an interaction effect whereby leaders who communicated an ability to meet members' instrumental needs were more influential when followers' individual identities were salient; however, when the group identity was made salient, leaders who communicated a commitment to maintaining the group were more influential.

I expect this pattern of results will be somewhat isomorphic in multiteam settings. Specifically, within a MTS composed of teams with different priorities, members of different teams will respond differently to messages that emphasize the multiteam identity as opposed to their own team-level goals. Whereas MTS members whose team priorities make the superordinate identity salient may be more susceptible to influence attempts referencing the superordinate goal, a MTS member whose team priority is less aligned with the superordinate goal may be relatively more susceptible to influence attempts that reference his or her own team-level goal.

*Hypothesis 6: MTS members' team priorities interact with their leadership granting such that:*

> *H6a: Members of component teams that prioritize the superordinate goal have a greater probability of granting leadership to members of other component teams who use superordinate-entity referencing language than do members of component teams that do not prioritize the superordinate goal.*
>
> *H6b: Members of component teams that prioritize a team-level goal have a greater probability of granting leadership to members of other component teams who reference the focal member's team-level goal than do members of component teams that do not prioritize a team-level goal.*

## Effects of Leadership Granting Networks on Multiteam System Performance

These six hypotheses consider *why* leadership claims and grants are likely to arise among members of MTSs and what communication patterns relate to these processes—questions of 'leadership emergence.' Although not the main focus of this dissertation, a key implication of the view of leadership as an emergent phenomenon is that *any* group member, regardless of their objectives, might claim and be granted leadership influence, and thus, sway the direction of the collective as a whole.

Arguably, given the powerful effect of goals on individuals' behaviors and interactions in social settings, MTS members are likely to attempt to influence others toward the objective(s) they prioritize. Whereas a MTS member who prioritizes a superordinate goal will be more motivated to attempt to influence others to achieve the superordinate goal, a MTS member who prioritizes his or her own team-level goal over that of the MTS will be more motivated to attempt to influence others to behave in ways that facilitate the achievement of their own team-level goal.

Therefore, the degree to which leadership is *granted* to individuals that prioritize these different goals is likely to have implications for the overall effectiveness of the system as a whole. Potentially, if members of teams that prioritize the superordinate goal become highly influential across the system (i.e., they are granted leadership by many other members), they may encourage superordinate goal achievement. On the other hand, pursuit of the superordinate goal may be less likely if MTS members who prioritize a proximal goal at the expense of superordinate goals become highly influential. To evaluate these two possibilities, I conducted supplemental analyses testing the following two research questions:

*Research Question 1: How does granting leadership to members of teams that prioritize their own team-level goal affect MTS performance?*

*Research Question 2: How does granting leadership to members of teams that prioritize the superordinate goal affect MTS performance?*

# CHAPTER 3

# METHOD

I tested my hypotheses in a sample of undergraduate student participants engaged in a MTS laboratory task called “Project BLUE,” which was designed for this dissertation. In each of 22, 4-hour experimental sessions, 12 undergraduate student participants were randomly assigned to one of 12 unique roles in a 4-team MTS ($n$ = 264 individuals). Table 1 summarizes the demographic characteristics of the sample. As shown in this table, the majority of participants were female (67%), Caucasian (74.42%), and in their freshman (34%) or sophomore (24%) year in college. In each experimental session, a *between-team* manipulation established a different team priority within each of the four teams.

Analyses evaluated the degree to which a participant’s team priority predicted his or her participation in leadership processes of claiming and granting and his or her use of, and responses to, particular semantic markers (i.e., goal-referencing language) during interteam interaction. The dependent variables of interest for *Hypotheses 1, 4, 5, 6a,* and *6b* were at the relational level of observation (i.e., leadership claims; leadership grants). Thus, the sample size of 264 individuals assembled into 22, 12-person, 3-member teams, resulted in a total of 2,904 possible leadership ties (i.e., the dependent variable for *Hypotheses 1, 4, 5, 6*).

Table 1.

*Gender, Class Year, and Race Proportions for Full Sample; Gender and Class Year Proportions for Sample Teams.*

| | % Female | Class Year<br>Fresh. | Soph. | Jr | Sr. | Grad. |
|---|---|---|---|---|---|---|
| Full Sample | 67% | 34% | 24% | 21% | 15% | 5% |
| Construction Teams | 62% | 33% | 27% | 13% | 23% | 4% |
| Engineering Teams | 69% | 30% | 23% | 25% | 13% | 8% |
| Village Council Teams | 67% | 38% | 26% | 24% | 12% | 5% |
| Geology Teams | 67% | 37% | 25% | 21% | 12% | 5% |
| Race | | | | | | |
| Full Sample | Caucasian | Afr. Amer. | Hispanic | Indian | Chinese | Other |
| | 73.42% | 9.68% | 4.50% | 5.06% | 3.09% | 4.65% |

Note. $n$ = 264 individuals assembled into 22, 4-team MTSs.

## Multiteam System Task

In each experimental session, 12 participants were assembled into four, 3-member teams within the Project BLUE simulation: a *Geology Team*, an *Engineering Team*, a *Construction Team*, and a *Village Council Team.* Each participant had a unique role on their component team. Figure 4 depicts the MTS structure and lists the names of the 12 roles. Each team was located in a separate room. During each four-hour experimental session, participants began by learning information and skills relevant to their unique role on the MTS. Then, the participants applied their knowledge and skills during a 30-minute team decision-making activity. Lastly, the participants engaged in a 1-hour multiteam decision-making activity involving all 12 MTS members.

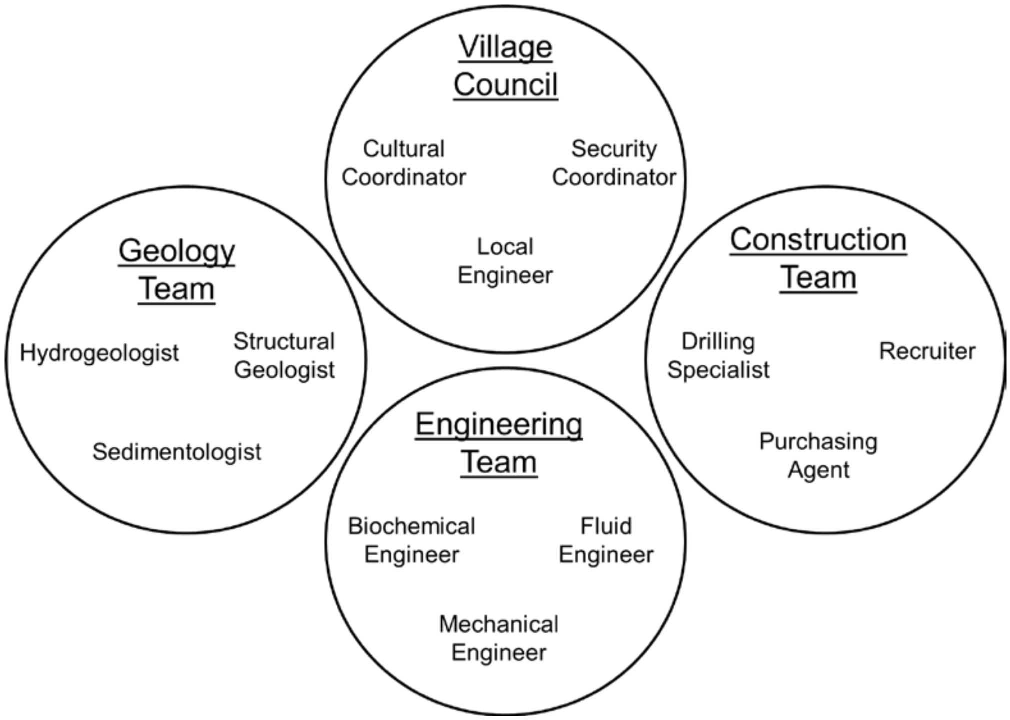



*Figure 4.* MTS structure and unique disciplinary roles in Project BLUE simulation.

The multiteam decision-making activity in the Project BLUE simulation provided the teams with information and tools that *could* enable them to collectively develop a plan for a new water well in a fictitious region of Western Africa, referred to as the '*Maji region,*' that would yield a very high clean water output for the local population (i.e., the superordinate goal). The Geology Teams had information about water source and depth in the region; the Engineering Teams had information necessary to design water wells that pump a high amount of clean water; the Construction Teams had information necessary to build wells in different areas of the region; and the Village Council Teams had information about which geographic locations are near to local population centers as well as information about other factors that might be of concern to the local population. To optimize the shared superordinate goal of providing a high amount of clean water output to as many people in the Maji region as possible, all four teams would need to integrate their knowledge and allocate their efforts appropriately. However, the experimental manipulation used in this study focused each team toward a different goal in the hierarchy, and some team priorities were less compatible with the superordinate goal than others.

### Task Timeline and Participant Materials

Each 4-hour experimental session commenced as follows. First, researchers randomly assigned participants to teams and roles. After the participants were seated in one of the four the experimental rooms, the task progressed in three phases: (1) an *individual training phase* lasting approximately 1.5 hours; (2) a *team training phase* lasting approximately 1 hour; and (3) a *multiteam collaboration performance phase* lasting approximately 1.5 hours.

#### Project BLUE Computer Interface

All participants were provided with a laptop computer that was pre-loaded with a computer interface designed for this study. Each participant's interface was equipped with similar capabilities. However, each participant's interface contained some information that was unique to his or her role on the MTS, and some information that was contained within other participant's interfaces. Fellow team members were exposed to a greater amount of overlapping information (e.g., information about geology for the geology team) as compared to members of different component teams. Figures 5-13 provide screenshots of different aspects of the computer interface. Figure 5 provides a screenshot of a computer interface for one participant (i.e., the Hydrogeologist). As this figure shows, the participants interfaces had several components—a text-based chat component, a notetaking component, a map of the Maji region, an information database, a decision calculator, and portals for saving grid cells from the map and saved calculators from the decision calculator. The interface allowed participants to open the information database and access different HTML links containing a variety of information related to their task. Figure 6 shows a screenshot of an information database.

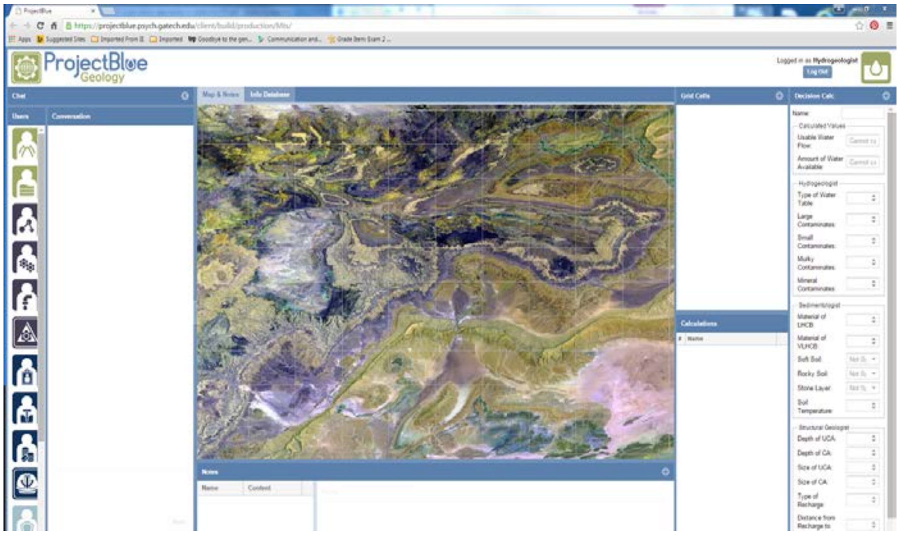



*Figure 5.* Project BLUE computer interface.

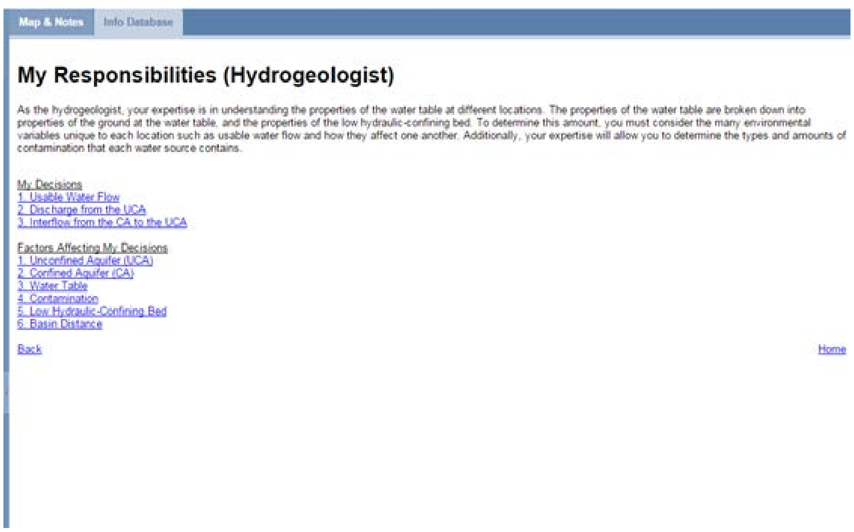



*Figure 6.* Information database in computer interface.

To complete the MTS simulation, participants choose a location in the Maji region to build the well. To choose a location, the participants selected an X-Y coordinate on the map and imported the map-based information regarding this location into their decision calculator. Figure 7 shows an example of the type of information a participant would see when selecting a location (i.e., 23, 37) on the interface. Figure 8 depicts an example of how a participant could have used the note-taking function of the interface (e.g., to record information about the well plan that pertains to their role on the MTS).

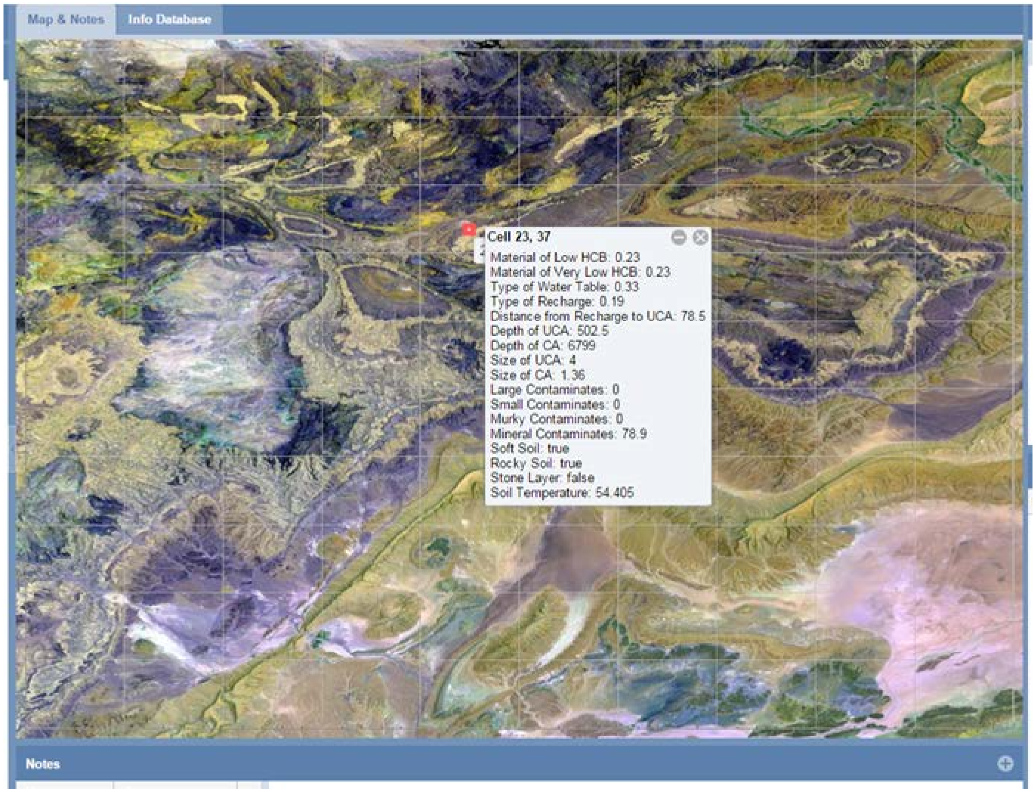



*Figure 7.* Map functionality in computer interface.

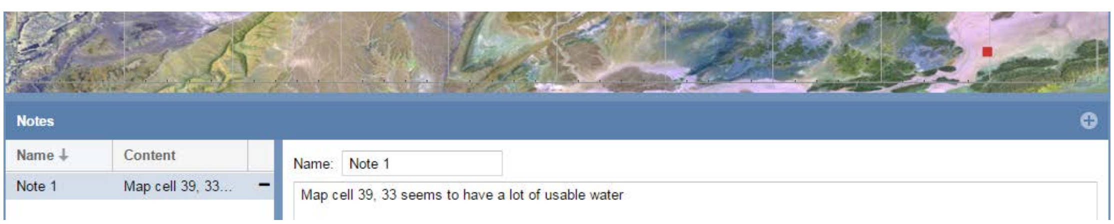
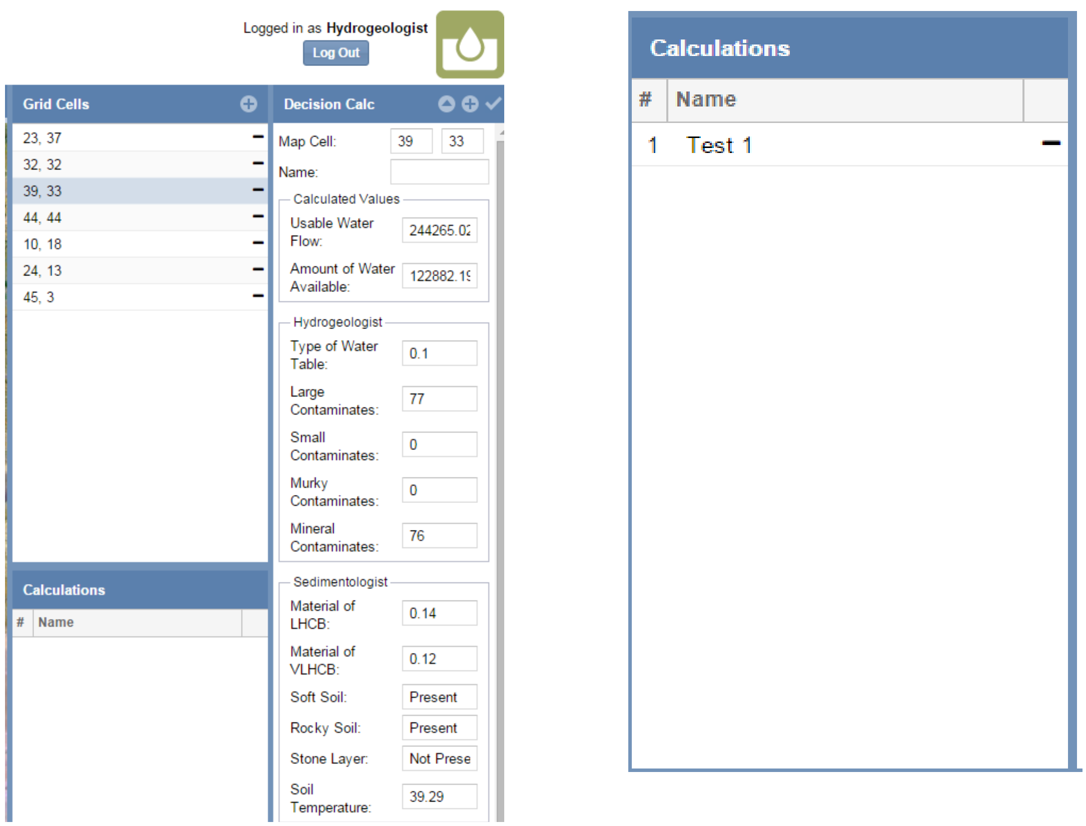



*Figure 8.* Note-taking functionality in computer interface.

Figures 9a and 9b are screenshots of the decision-calculator and the saved calculation list, respectively. The decision-calculator allowed the participants to optimize their decision-making in order to achieve their individual, team, or multiteam goal. To use the decision-calculator, a participant would first choose a location and add this location to his or her “saved grid cells” list. Then, the participant would add the saved grid cell to his or her decision-calculator, thus importing all map-based information to the calculator that is relevant to this map cell. Finally, the participant could complete the calculation by making his or her own decisions about various aspects of the well design plan (e.g., whether to hire local employees to build the well or use international volunteers), and by seeking out information from other MTS members (e.g., he or she might ask members of the engineering team about which pump or filter types the well will use). Lastly, the participant could save prior calculations for future use (e.g., for future discussions with other teams) by naming the calculation and adding it to the saved calculation list.




*Panel A* *Panel B*

*Figure 9.* 'Decision-calculator' (Panel A) and 'saved calculations' (Panel B) components in computer interface.

Individual Training Phase

During the individual training phase, participants began by watching a 15-minute video that acquainted them with their team, their role on their team, and the computer interface. Training videos shown during the individual training phase explained the participant's expertise and the computer interface in detail. After watching the videos, the participants completed a guided training packet lasting approximately 1 hour. The training consisted of a set of interactive questions that led the participants through the use of the information interface, the decision calculator, and the map. The interactive training questionnaire provided participants with feedback clarifying whether their responses were correct or incorrect and provided additional explanation regarding the correct response. Participants' scores on their training questionnaires provided an indicator of their initial comprehension of the task.

Team Training Phase

At the beginning of the team training phase, teams viewed a second set of videos which provided additional information about their team and instructions for completing a team-based decision-making activity. Then, the teams completed the 30-minute team decision-making activity. The decision-making activity provided an opportunity for the participants to practice working together as members of a team to integrate their unique knowledge, skills, and resources and make decisions about aspects of the well.

The team decision-making activity was slightly different for each team, requiring the teams to consider different aspects of the overall well design plan that aligned with their team expertise. Geology Teams searched for a geographic location in the Maji region that had the highest potential to yield maximal water output. Engineering Teams attempted to design a well with high potential to yield water. Construction Teams made a plan to construct a well with the goal of keeping construction costs to a minimum (e.g., equipment costs, recruitment costs, etc.). Lastly, the Village Council Teams made a series of decisions about the well plan with the goal of limiting the potentially negative impact of the well on the region’s financial stability.

Throughout the team activity phase, participants used their information interface and hypothetical calculators to generate decisions. At the end of the activity, team members ‘signed off’ on their final choices using a team sign-off portal on their computer interfaces. Figure 10 shows an example of a sign-off portal that would appear in the center of the participant’s computer interfaces. Researchers activated this sign-off portal on participants’ computers at the beginning of the 30-minute activity, and participants were allowed to use the portal throughout the activity.

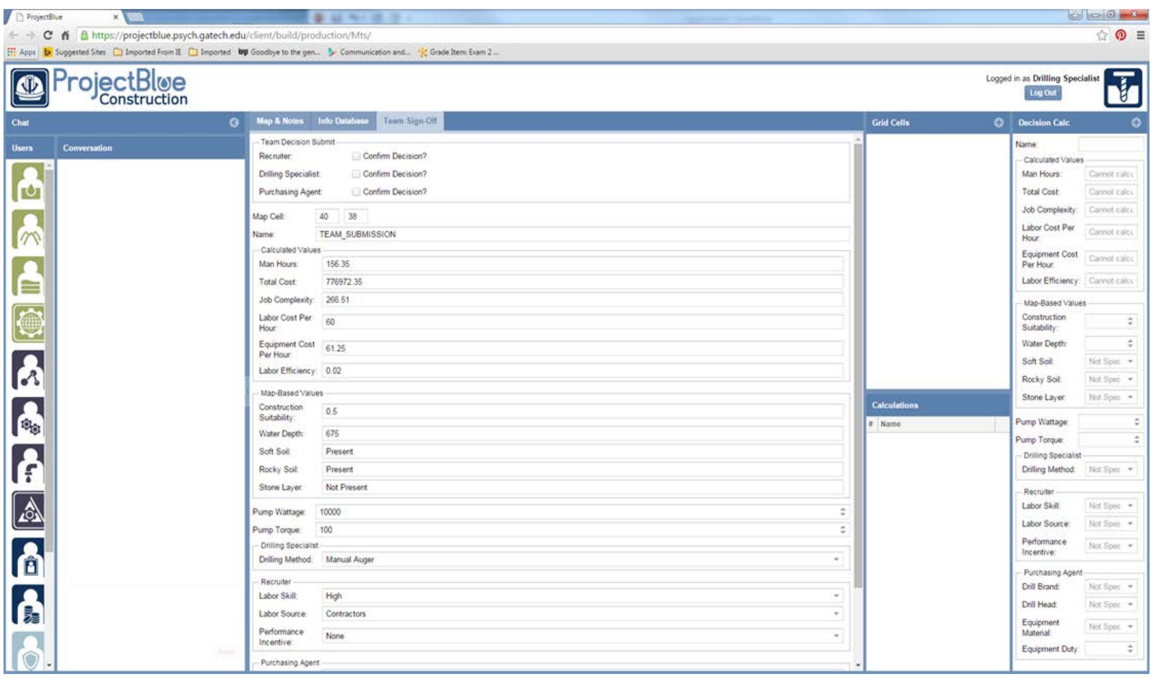



*Figure 10.* ‘Team-sign-off portal’ in computer interface.

After the team members came to an agreement, the members used the sign-off portal to “confirm” their team decisions. Figure 11 provides a screenshot example of this confirmation process.

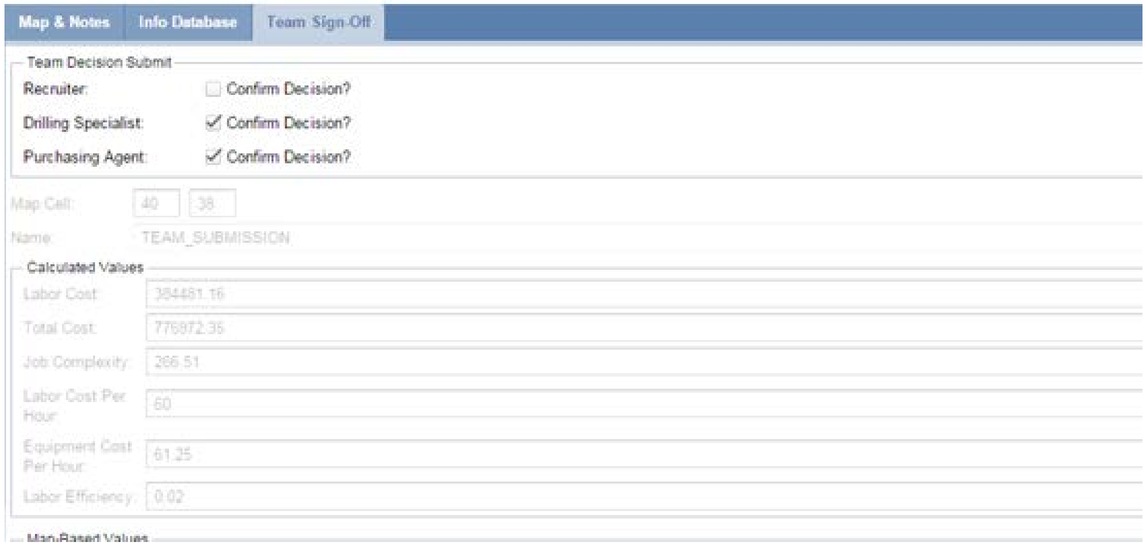



*Figure 11*. Team decision confirmation' component of computer interface.

Multiteam Collaboration (MTS Performance Phase)

The multiteam collaboration phase was the final phase of the laboratory task. At the beginning of this phase, all four teams watched training videos that provided them with information about the MTS and described how they would communicate with members of the other three teams (i.e., via the text-based chat function on the interface) during the task. Then, all four teams were told they would have *one hour* to work together to develop and submit a final comprehensive plan for the well in the Maji region. The teams were told that although they were to work with the other teams, they also needed to ensure that they maximized their own "primary goal" (i.e., the manipulated team priority).

Face-to-face verbal communication was permitted among members of the same team, but all communication between-teams was limited to text-based chat. Figure 12 provides a screenshot of the chat portal participants will use to communicate with other teams. Researchers activated the chat function on the interfaces at the beginning of the hour-long MTS activity. The chat window allowed participants to send chat messages to any other *individual* on the MTS (see Figure 12, Panel A). Additionally, the chat window allowed participants to send chat messages to an entire team (e.g., all three members of the Geology Team; see Figure 12, Panel B). Participants were not able to open a group-chat with all 12 MTS members simultaneously. This functionality was implemented by the research team so that communication messages between specific pairs of MTS members were more readily identifiable and participants could not 'broadcast' a message to all other MTS members in one chat message.


| *Panel A* | *Panel B* |
|---|---|

*Figure 12.* Person-to-person (panel A) and person-to-team (Panel B) chat in computer interface.

As in the team activity, the participants used their computer interfaces and hypothetical decision calculators to enhance their performance during the multiteam discussion. The participants used a "multiteam sign-off portal" to submit their final decision as a MTS. Figure 13 displays an example of a multiteam sign-off portal. Researchers activated this sign-off portal on participants' computers at the beginning of the 60-minute activity, and participants were allowed to use the portal throughout their MTS decision-making activity.

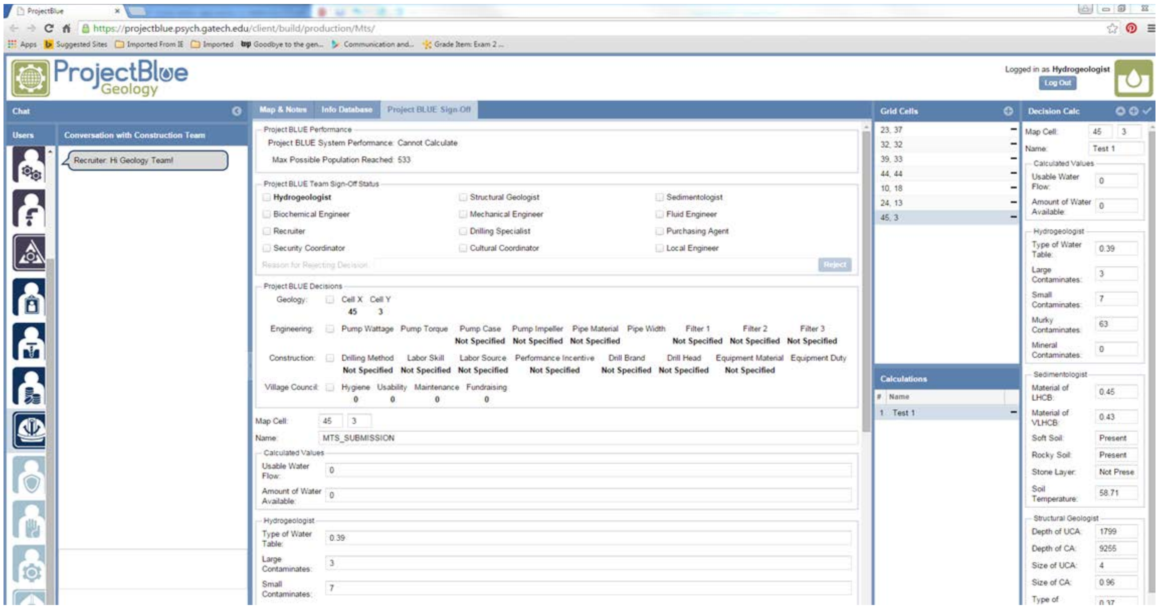



*Figure 13.* ‘MTS-sign-off-portal’ in computer interface.

## Team Priority Manipulation

Overall, the MTS boundary in the Project BLUE MTS simulation was defined by virtue of the interdependencies of all four component teams toward the shared superordinate goal of planning the design and construction of a well in a specific location in the Maji region that provides as much clean water output as possible to as many people as possible. This overall goal had at least four components (a) identifying a location; (b) designing a well; (c) generating a construction plan; and (d) identifying the degree to which the Maji population will be able to reach the well. Additionally, each component team had at least one ‘team-level’ goal. The geology team-level goal was to use geological expertise to survey the land and identify locations that have a high potential to yield water. The engineering team-level goal was to design a well that pumps a high amount of water. The construction team-level goal was to design a construction plan that reduces the costs incurred to the construction company. The village council team-level goal was to ensure that the well plan does not bankrupt the village. These goals are summarized in Figure 14.

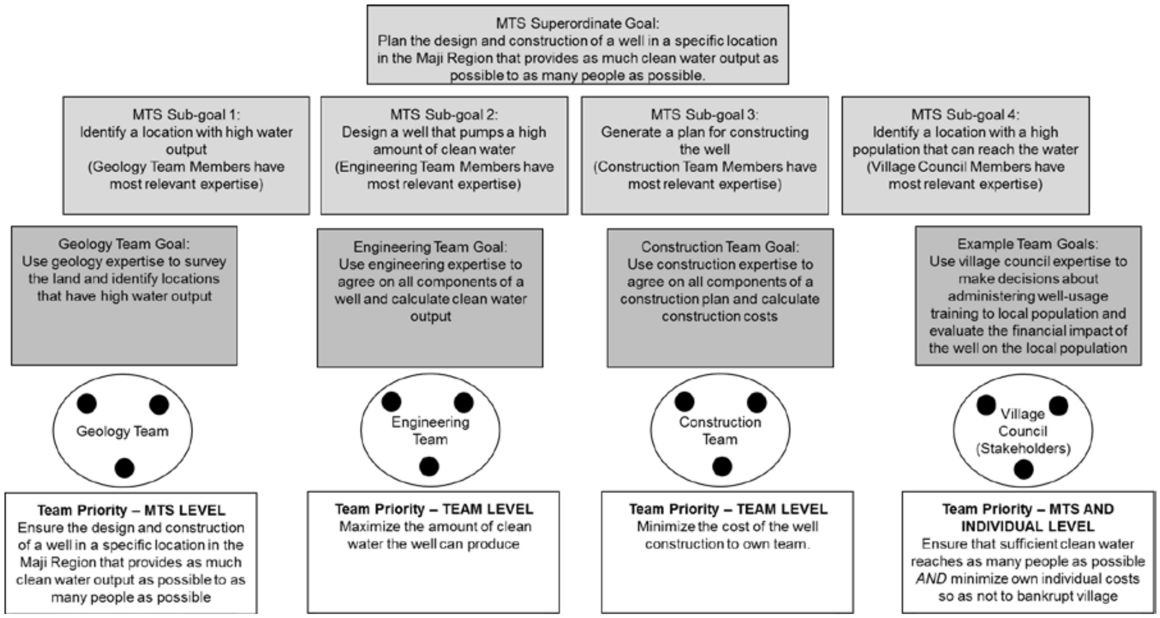



*Figure 14.* Team and superordinate goals and team priorities in Project BLUE.

Figure 14 also clarifies the between-team "team priority manipulation." Although superordinate goal of the MTS requires the expertise and buy-in of all 12 members of the system, a unique team priority was induced within each team on the MTS. These team priorities were clarified and reinforced through all training materials and instructions the participants were exposed to (i.e., videos, training questionnaires, experimenter instructions).

The Geology team's priority was identical to the superordinate goal. Rather than merely surveying the land to identify locations with a high potential to yield water (i.e., their team-goal), this team was induced to focus on ensuring that an overarching well plan was developed that provides as much clean water to the Maji people as possible. The Engineers' team priority was their team-goal (i.e., design a highly effective well, regardless of the local population). The Construction Team's priority was also their team-level goal (i.e., reduce the costs incurred to their construction company). However, the Construction Team's priority is less compatible with achieving the superordinate goal as compared to the Engineering Team's priority. Lastly, the Village Council's team priority was two-fold: as the stakeholders in the ultimate plan, this team was told to focus on (a) achieving the superordinate goal; and (b) ensuring that the achievement of the superordinate goal did not bankrupt their constituencies.

## Measures

Participants completed perceptual self-report measures of leadership claiming and granting, goal interdependence, manipulation checks, and controls at multiple points throughout the study. Additionally, all participants' intrateam and interteam communication was audio and video recorded and all participants' interteam communication occurred through the chat-portal in the computer interfaces. The content of the interteam communication is a key variable in *Hypotheses 2, 3, 6a,* and *6b*.

### Manipulation Checks

Participants completed two sets of manipulation check items after the team decision-making practice activity, responded to the second manipulation check item again at the midpoint of the multiteam decision-making activity, and responded to measures of team and multiteam task and goal interdependence (a third manipulation check) at the midpoint and final time points of the multiteam decision-making activity.

#### Manipulation Check 1: Selecting Primary Goal

After their team decision-making activity,  participants responded to the following prompt: "What is your primary goal?" by selecting one of four options for their primary goal. All participants' response options were specific to their unique role in the MTS, but included a response option to correspond with (a) the participant's individual goal, (b) the participant's team goal, (c) the MTS goal, and (d) an option reflecting both the individual and the MTS goal.

Based on the manipulated team priority structure depicted in Figure 14, Construction and Engineering team members would be expected to select their team-level goal as their primary goal, Village Council team members would be expected to select the ‘mixed’ option (i.e., a combination of both their individual and the MTS goal) and Geology team members would be expected to select the MTS goal as their primary goal.

Table 2 reports the number of participants in each condition who selected a goal residing at various levels of the MTS goal hierarchy as their primary goal. As the values in this table suggest, participants tended to select their manipulated team priority as their primary goal. For example, 52 out of 66 of the Construction team members (i.e., 78.79%) and 64 out of 66 the Engineering team members (96.97%) selected their team-level goal as their primary objective, 49 out of 66 Village Council team members (74.24%) selected the ‘mixed’ option, and 65 out of 66 Geology team members (98.48%) selected the MTS-level goal as their primary objective. A $\chi^2$ analysis of the differences in reported priorities between teams suggest that the differences between the teams in self-reported primary goals were significant; $\chi^2$ (9, 264) = 473.18, $p < .01$, Cramer's V (effect size; ranges from 0 to 1) = .77.

Table 2.

*Manipulation Check: Number of Participants Selecting Each Goal Priority Option by Team.*

| | Number of Participants Reporting Individual, Team, MTS, or Multiple (Individual & MTS) as 'Primary Goal' | | | | |
|---|---|---|---|---|---|
| | Ind. | Team | MTS | Multiple | Sample Size |
| Construction Teams: *(Team goal-focused; team-goal can detract from MTS goal)* | 12 | **52** | 1 | 1 | 66 |
| Engineering Teams *(Team goal-focused; team-goal generally supports MTS goal)* | 2 | **64** | 0 | 0 | 66 |
| Village Council Teams *(Stakeholders focused on both individual goals and MTS goal; individual goals can detract from MTS goal)* | 17 | 0 | 0 | **49** | 66 |
| Geology Teams *(MTS goal-focused)* | 0 | 1 | **65** | 0 | 66 |
| Totals | 31 | 117 | 66 | 50 | $\chi^2$ (9, 264) = 473.18** |

Note. ** *p* <.01; *n* = 264 individuals assembled into 22 MTSs composed of 4, 3-member teams.

Manipulation Check 2: Allocation of Attention

Additionally, after the team activity and at the midpoint of the MTS activity, participants read the following prompt: "*In many situations, people have multiple goals or objectives and they have to decide how they will divide their attention among these different tasks. Often, people give most of their attention to the goal that they prioritize the most, and some of their attention to other goals. Assuming you had up to 100% of your attention to give to different goals, how much attention did you give to the following goal in the past 30 minutes?*" Participants were provided with a list of 19 activities that they could have allocated their attention toward during the previous discussion. These activities encompassed all 12 individual-level goals, all 4 team-level goals, the MTS goal, and additional choices for “something else” and “I was not attempting to do anything related to this task.” Using sliding scales, participants reported the amount of attention they had allocated to each of these activities during the previous discussion. The questionnaire software required that the amount of attention each participant reported allocating to the activities totaled 100%. A total of 156 individuals assembled into 13 MTSs completed this manipulation check item.

Table 3 summarizes participants’ responses to this item at the end of the team decision-making practice activity and at the midpoint of the MTS decision-making activity. The rows in Table 3 represent the response options for the different activities participants could have allocated effort toward, and the columns represent the four manipulated team priorities. If the manipulation had the intended effect, I would expect that participants would report allocating the majority of their attention toward their team priority. Table 3 shows a pattern of results consistent with that expectation. On average, Construction team members—whose team priority was a team-level goal that was somewhat in competition with the MTS goal—reported allocating a majority of their efforts toward achieving the construction team team-level goal (i.e., $M$ = 62.72% at T1; $M$ = 51.44% at T2). Engineering team members, whose manipulated team priority was a team-level goal that was supportive of MTS goal achievement, also reported allocating a majority of their efforts toward the engineering team team-level goal (i.e., $M$ = 50.77% at T1; $M$ = 47.58% at T2). Also consistent with the manipulation, on average, Village Council team members reported allocating the majority of their efforts toward the MTS-level goal ($M$ = 21.82% at T1; $M$ = 23.11%) as well as toward the members’ three individual-level goals (i.e., $M$ = 19.05, 17.05, and 20.49% at T1; $M$ = 15.66, 14.83, and 23.11% at T2, respectively). Finally, again consistent with the manipulation, Geology team members whose manipulation team priority was the MTS-level goal, reported allocating the majority of their efforts toward the MTS-level goal at both time points (i.e., *M* = 47.41 at T1 and 53.64% at T2).

Table 4 presents the results of further investigations into participants' responses to the allocation-of-attention manipulation check item. This table reports the average amount of attention participants reporting allocating at the midpoint of MTS discussion—after they had worked with members of other teams for 30 minutes—toward eight different categories of goals (e.g., their own individual goals, other teams' individual goals, etc.). This table also reports the results of one-way ANOVA analyses of the differences between teams with regard to participants' allocation of attention toward these goal categories.

As shown in Table 4, there were significant differences between teams with regard to participants' allocation of attention toward: their own individual goals, their teammates' individual goals, their own team's goal, the individual and team goals within their own team, and the MTS-level goal; *F-values* (3, 139) = 6.27, 15.27, 22.99, 27.56, and 49.02, respectively, $p$ <.01. The differences between teams with regard to participants' allocation of attention toward other teams' individual-level goals and other teams' team-level goals were non-significant. The pattern of means reported in Table 4 suggest that, on average, participants whose team priority included the MTS-level goal (i.e., members of the Geology and Village Council teams) allocated *less* attention toward their own individual goals relative to participants whose team priority was their own team-level goal (i.e., members of the Engineering and Construction teams) but *more* attention toward the individual goals of their teammates relative to those team-goal focused teams. Construction and Engineering teams allocated *more* attention toward their own team-level goals relative to Geology and Village Council teams. Lastly, Geology and Village Council Teams allocated *more* attention toward the MTS-level goal relative to Construction and Engineering Teams.

Table 3.

*Manipulation Check: Average Percentage of Attention Allocated to Each Possible Goal by Team.*

| | Const. Teams: (Team Goal-Focused, Competitive) *n* =39 participants | | Eng. Teams: (Team Goal-Focused, Cooperative) *n* =39 participants | | V.C. Teams: (Individual/ MTS Goal-Focused) *n* =39 participants | | Geo. Teams: (MTS Goal-Focused) *n* =39 participants | |
|---|---|---|---|---|---|---|---|---|
| *Possible Goals:* | T1 | T2 | T1 | T2 | T1 | T2 | T1 | T2 |
| Construction Team Goal | **62.72%** | **51.44%** | 0.18% | 0.81% | 0.72% | 1.80% | 0.21% | 3.17% |
| Const. Team Member 1 Goal | 8.15% | 5.56% | 0.13% | 0.19% | 0.08% | 0.31% | 0.18% | 1.06% |
| Const. Team Member 2 Goal | 11.13% | 10.78% | 0.21% | 0.44% | 0.23% | 0.37% | 0.13% | 0.97% |
| Const. Team Member 3 Goal | 12.44% | 8.58% | 0.18% | 1.17% | 0.77% | 0.34% | 0.15% | 0.64% |
| Engineering Team Goal | 0.00% | 1.69% | **50.77%** | **47.58%** | 2.69% | 2.63% | 1.38% | 2.17% |
| Eng. Team Member 1 Goal | 0.00% | 1.06% | 13.10% | 11.42% | 0.44% | 0.49% | 0.44% | 0.61% |
| Eng. Team Member 2 Goal | 0.18% | 0.11% | 8.46% | 7.08% | 0.15% | 0.34% | 0.26% | 0.64% |
| Eng. Team Member 3 Goal | 0.18% | 0.14% | 12.36% | 8.75% | 0.18% | 0.49% | 0.18% | 0.50% |
| Village Council Team Goal | 0.90% | 4.42% | 0.59% | 1.00% | 11.03% | 19.49% | 0.54% | 1.14% |
| VC. Team Member 1 Goal | 0.15% | 0.39% | 0.26% | 0.22% | **19.05%** | **15.66%** | 0.18% | 0.36% |
| VC. Team Member 2 Goal | 0.00% | 0.14% | 0.31% | 0.17% | **17.05%** | **14.83%** | 0.26% | 0.36% |
| VC. Team Member 3 Goal | 0.10% | 0.50% | 0.62% | 0.19% | **20.49%** | **8.31%** | 0.26% | 0.50% |
| Geology Team Goal | 0.10% | 3.47% | 2.13% | 6.00% | 3.15% | 6.94% | 23.59% | 17.14% |
| Geo. Team Member 1 Goal | 0.03% | 3.89% | 0.54% | 2.44% | 1.18% | 2.80% | 13.33% | 9.19% |
| Geo. Team Member 2 Goal | 0.03% | 3.36% | 0.31% | 1.64% | 0.38% | 0.94% | 4.82% | 4.53% |
| Geo. Team Member 3 Goal | 0.03% | 0.39% | 0.13% | 0.53% | 0.33% | 0.54% | 6.49% | 3.03% |
| MTS Goal | 3.87% | 3.36% | 9.31% | 10.31% | **21.82%** | **23.11%** | **47.41%** | **53.64%** |
| Something Else Related to Task | 0.00% | 0.67% | 0.28% | 0.06% | 0.26% | 0.60% | 0.10% | 0.28% |
| Nothing Related to Task | 0.00% | 0.06% | 0.15% | 0.00% | 0.00% | 0.00% | 0.10% | 0.08% |

Note. $n$ = 156 individuals assembled into 52 teams and 13 MTSs (T1), and $n$ = 144 individuals assembled into 36 teams and 12 MTSs (T2). T1 = pre-measure after team decision-making activity; T2 = midpoint of MTS collaboration; Const. = Construction; Eng. = Engineering; V.C. = Village Council; Geo. = Geology.

Table 4.

*Manipulation Checks: Results of ANOVA Analyses Comparing Mean Levels of Attention Allocation (out of 100%) to Own and Others' Individual, Team, and Multiteam Goals at Midpoint in MTS Collaboration by Team.*

| | Const. Teams $_a$ | Eng. Teams $_b$ | V.C. Teams $_c$ | Geo. Teams $_d$ | |
|---|---|---|---|---|---|
| | *M % (SD)* | *M % (SD)* | *M % (SD))* | *M % (SD)* | *F*(3,139) |
| Own Ind. Goal | $11.44_{c,d}$ (15.31) | $18.91_{c,d}$ (19.15) | $7.14_{a,b}$(7.99) | $7.99_{a,b}$ (6.67) | 6.27** |
| Teammates Ind. Goals | $6.74_{c,d}$ (8.18) | $4.64_{c,d}$ (6.77) | $15.83_{a,b,d}$(10.63) | $10.63_{a,b,c}$ (4.93) | 15.27** |
| Own Team's Goal | $52.33_{c,d}$ (27.99) | $48.97_{c,d}$ (6.77) | $19.49_{a,b}$(17.33) | $17.33_{a,b}$ (17.14) | 22.99** |
| Other Teams' Ind. Goals | 1.03(1.71) | .78(1.26) | .74(1.34) | 1.34(.63) | .49 |
| Other Teams' Team Goals | 2.81(4.86) | 2.60(3.31) | 3.79(4.53) | 4.53(1.79) | 1.47 |
| MTS Goal | $4.36_{c,d}$ (11.52) | $7.97_{c,d}$ (10.24) | $23.11_{a,b,d}$(17.43) | $54.97_{a,b,c}$ (31.90) | 49.02** |

Note. $^{\dagger}$ $p$ < .10; * $p$ < .05; ** $p$ <.01; $n$ = 156 individuals assembled into 52 teams and 13 MTSs. T1 = pre-measure after team decision-making activity; T2 = midpoint of MTS collaboration; Const. = Construction; Eng. = Engineering; V.C. = Village Council; Geo. = Geology; ; Subscript indicates mean is significantly different from (a) Construction team mean, (b) Engineering team mean, (c) Village Council team mean, or (d) Geology team mean.

Manipulation Check 3: Team and Multiteam Task and Goal Interdependence

A key psychological mechanism through which team priorities are expected to impact leadership claiming and granting is MTS members' perceptions of positive vs. negative *outcome interdependence* or *goal interdependence* with members of other teams. Goal interdependence refers to the extent to which an individual believes that his or her benefits and costs depend on the goal attainment by other teams (Kelley & Thibaut, 1978; Deutsch, 1949; van der Vegt, Emans, & van de Vliert 1998).

As a third manipulation check, at both the midpoint and final time point of multiteam collaboration, participants completed a 3-item perceptual measure of goal interdependence in relation to the members of their own team (i.e., team goal interdependence) and a 3-item measure of goal interdependence in relation to members of other teams (i.e., multiteam goal interdependence). These measures were adapted from van der Vegt and colleagues (1998). Given the manipulated team priorities, perceptions of *multiteam goal interdependence* were expected to vary between teams such that teams who prioritized the superordinate goal would be more likely to perceive higher levels of multiteam interdependence. Levels of team goal interdependence were not expected to vary between teams.

In addition to measures of goal interdependence, participants completed two 4-item measures of team and multiteam *task interdependence* (i.e., "interconnections between tasks such that the performance of one definite piece of work depends on the completion of other definite pieces of work"; van der Vegt et al., 1998, p. 127) adapted from van der Vegt et al al. (1998). Participants also completed a 4-item measure of goal difficultity (adapted from Hollenbeck, Klein, O'Leary, & Wright, 1989) and their performance on a training questionnaire was used to operationalize task comprehension . Participants levels of perceived team and multiteam task interdependence, task difficulty, and task comprehension were not the focus of the manipulation and thus, were not expected to vary between teams.

Tables 5 reports the results of manipulation checks investigations into the effects of the manipulated team priorities on task difficulty, task comprehension, and team/multiteam task and goal interdependence. The results of one-way ANOVA tests of between team differences presented in this table indicate that mean levels of task difficulty, task comprehension, team task interdependence, team goal interdependence, and multiteam task interdependence were not significantly different between teams. However there were significant differences between teams with regard to the multiteam goal interdependence, $F(3,256) = 3.29$, $p < .05$. Consistent with the manipulated team priorities, Geology and Village Council team members tended to report experiencing higher levels of task and goal interdependence with members of other teams as compared to Construction or Engineering team members.

Table 5.

*Manipulation Checks: Mean Levels of Training Performance, Task Difficulty Perceptions (after Team Activity), and Intrateam and Interteam Task and Goal Interdependence by Team (after MTS Activity) and Results of One-way Analysis of Variance Tests of Between-Team Differences.*

| | α | *ICC*(1) | *rwg* | Const. Teams $_a$ *M(SD)* | Eng. Teams $_b$ *M(SD)* | V.C. Teams $_c$ *M(SD)* | Geo.Teams $_d$ *M(SD)* | *F(df)* |
|---|---|---|---|---|---|---|---|---|
| Task Comprehension | | .00 | .99 | 93%(.06) | 94%(.05) | 96%(.05) | 95%(.06) | 2.12(3,260) |
| Task Difficulty | .62 | .004 | .94 | 2.88(.33) | 2.87(.31) | 2.98(.36) | 2.99(.33) | 1.71(3,187) |
| *Team Interdependence* | | | | | | | | |
| Team Task Interdependence | .95 | .07 | .80 | 5.89(.91) | 5.95(1.04) | 5.98(.91) | 5.95(1.02) | 0.08 (3,253) |
| Team Goal Interdependence | .96 | .07 | .79 | 6.06(.87) | 6.11(.99) | 5.91(1.03) | 5.92(1.07) | 0.63 (3,55) |
| *Multiteam Interdependence* | | | | | | | | |
| MTS Task Interdependence | .82 | .17 | .73 | $4.98_{c, d}$ (1.19) | $4.75_{c, d}$ (1.07) | $5.22_{a, b}$ (1.17) | $5.09_{a,b}$ (1.03) | $2.21^{\dagger}$ (3,256) |
| MTS Goal Interdependence | .98 | .55 | .67 | $4.47_{c, d}$ (1.43) | $4.00_{c, d}$ (1.31) | $4.67_{a, b}$ (1.48) | $4.75_{a,b}$ (1.35) | 3.29*(3,256) |

Note. $^{\dagger}$ $p < .10$; * $p < .05$; $n$ = 264 individuals assembled into 22 MTSs composed of 4, 3-member teams; Const. = Construction, Eng. = Engineering, V.C. = Village Council, Geo. = Geology; ; Subscript indicates mean is significantly different from (a) Construction team mean, (b) Engineering team mean, (c) Village Council team mean, or (d) Geology team mean.

## Leadership Claiming and Granting

The relational, emergent, formal/informal, patterned, and situated nature of the leadership phenomenon makes social network approaches (Wasserman & Faust, 1994) particularly appropriate for studying leadership (Carter et al., 2015). Therefore, I used perceptual social network items to identify the patterns of leadership claiming and granting among MTS members. At three measurement occasions (i.e., after the team decision-making activity, at the midpoint of the MTS decision-making activity, and after the end of the MTS decision-making activity) participants were given a roster which includes the role names (e.g., "Hydrogeologist") of all of the other MTS members. They responded to sociometric ("round-robin") prompts identifying their participation in leadership claiming/followership granting (i.e., "Who did you provide leadership to?") and leadership granting/followership claiming ("Whom did you rely on for leadership?") in relation to each other MTS member by choosing all other MTS members who they believed corresponded to those items. These types of prompts are thought to capture individuals' underlying beliefs about the nature of 'leadership' (Lord & Maher, 1991; Mehra et al., 2006) and are aligned with prior sociometric research on leadership in teams (Bavelas, 1950; Carson et al., 2007).

The leadership network items used in this study are adapted from the prompt developed by Carson and his colleagues (2007). In their study of shared leadership and team performance, Carson et al. (2007) used a prompt asking all team members to rate the degree to which the entire *team* relied on each member for leadership. To the extent that they have witnessed interactions among other their fellow team members, individuals may be capable of rating the degree to which each member led the entire team. However, the *Law of N Squared* (Krackhardt, 1994) states that the number of possible links in a social system increases approximately as the square of the number of elements in the system. For example, in a 5-person team, there are 5 x 4 = 20 possible links among actors; in a 10-person team there are 10 x 9 = 90 possible links. Therefore, in comparison to small teams, it is more difficult for members of larger collectives to keep track of one another's relationships and evaluate the degree to which the group relies on each person for leadership. A more appropriate approach when assessing relationships in larger collectives (e.g., MTSs), and the one used here, is to take an *atomistic*, or 'person-to-person', perspective, asking participants: "Whom do *you* rely on for leadership?" (Contractor et al., 2012). Responses to the sociometric prompts were arranged into binary matrices such that each individual *i*'s relationship with *j*, as reported by *i* will be reported in row *i*, column *j*.

**Team and MTS Goal-Referencing Language**

*Hypotheses 2* and *3* concern the degree to which participants *sent* messages containing MTS goal- (H2) or team goal-referencing words (H3). *Hypotheses 6a* and *6b* concern the degree to which participants *received* messages containing MTS goal- (H6a) or team goal-referencing words (H6b) and responded to those messages with leadership grants. To operationalize the MTS goal- and own team goal-referencing language variables for these hypotheses, I identified the degree to which participants used words referencing the assigned MTS-level goal and their own assigned team-level goal in their outgoing (sending) and incoming (receiving) interteam chat messages to one another during the MTS decision-making phase (i.e., $n$ = 4835 messages across all sessions).

To begin, I prepared the interteam chat messages for analysis. First, I downloaded all participants' chat logs. Table 6 provides an example of the types of messages contained in these logs. As indicated in this Table, the chat logs specified the sender of each message (e.g., the Cultural Coordinator sent the first message in Table 6), the content of each message, and the target of each message. The interface allowed participants to send messages to individuals (e.g., the Cultural Coordinator) or to all three members of a team (e.g., all three Village Council members).

After extracting these data, I performed a set of pre-processing procedures on the text to prepare it for analysis (Cai, Spangler, Ying, & Li, 2010). I proofread each message and corrected errors so the data was in a format that is recognizable to text-analytic programs. Then, I programmatically trimmed the data for meaningless content. For example, this process included the removal of all punctuation, excluding apostrophes; the removal of all nonsense data (i.e. gibberish); and the translation of all characters into their lower-case variants.

A key-word related to the MTS goal is the word ‘well’ (i.e., the MTS goal is to build a well that provides as much clean water to as many people as possible). However, in the English language, the word ‘well’ is used for a variety of other meanings (e.g., “*well*, here’s the issue”; “that location works *well* for our team”; “that works for us as *well*”. Given the semantic analysis approach described next, in order to improve the accuracy of the categorization of messages in participant’s messages, I searched for, and removed the word ‘well’ throughout all chat messages where participants did *not* use the word to refer to a water well. These alternative uses of this word were replaced with filler words to maintain the original word count in the message.

Table 6.

*Example Chat Messages Sent During MTS Decision-Making Activity.*

| Sender | Message | Receiver |
|---|---|---|
| Cultural Coordinator (Village Council) | *During our individual discussion as a group, we decided that location 4, 41 worked best in all of our areas. What do you think?* | Engineering Team |
| Mechanical Engineer (Engineering Team) | *That one's very bad for us* | Cultural Coordinator |
| Sedimentologist (Geology Team) | *What factors would lead to reducing your costs? We share the same goal of getting water to as many people as possible.* | Village Council Team |
| Sedimentologist (Geology Team) | *Awesome!! So now we are just waiting to hear from the village council, because the coordinate we decided on wasn't great for them* | Engineering Team |
| Mechanical Engineer (Engineering Team) | *Listen...they're going to have to deal with it. They're late to the party! Where were they 45 minutes ago?* | Sedimentologist |
| Recruiter (Construction Team) | *we got 100 million dollars for that point, so no go.* | Geology Team |
| Recruiter (Construction Team) | *33, 24 is what we are willing to compromise on for the geology team* | Village Council Team |

After performing these proofreading steps, I applied a semantic analysis program called Linguistic Inquiry and Word Count (LIWC; Tausczik & Pennebaker, 2010) to classify the words contained in each of the interteam chat messages. The LIWC program identifies the extent to which certain words appear in a body of text. LIWC provides a set of internal dictionaries, each of which is pre-populated with a set of words related to a specific construct (e.g., affect) or language style (e.g., pronoun use). Additionally, the program allows users to create their own dictionaries. To operationalize team and MTS goal-referencing words, I used wording provided in participant materials regarding each goal to create user-defined dictionaries in LIWC for each team-level goal and for the MTS goal. These dictionaries are shown in Table 7. As this table indicates, the goal-referencing dictionaries contained key words from the manipulated team priorities as well as other words that were relevant to the goals (e.g., the word *money* was highly relevant to discussions of reducing costs). I passed all interteam chat messages through LIWC using these user-defined dictionaries. This resulted in an output file reflecting the number of times each team- and MTS-goal-referencing word appeared in each of the 4,835 chat messages. I used this output to calculate scores for each participant with regard to their sending and receiving of goal-referencing language in order to operationalize key variables in *Hypotheses 2, 3, 6a*, and *6b*. The calculation of the variables used to test *Hypotheses 2, 3, 6a*, and *6b* is described in more detail in Chapter 4.

Table 7.

*LIWC Dictionaries for Goal-Referencing Language Based on Project BLUE Task.*

| | Relevant Manipulated Team Priority | User-Defined LIWC Dictionary |
|---|---|---|
| Construction Team Goal | Construction Team Priority – “Keep the construction costs associated with the well-building project at a minimum (as close to zero dollars as possible)” | Minimize, expensive, cost, money, dollars, drilling, equipment, construction, suitability, labor |
| Engineering Team Goal | Engineering Team Priority – “Design a well that pumps as much water as possible (i.e., has a high water output)” | Water, gallons, pump, efficiency, output, piping, restriction, flow, maximize, wattage, torque |
| Village Council Individual Goals | Village Council Priority 1: “You should strive to minimize the security/cultural/maintenance costs associated with the well-building project” | Security, cultural, maintenance, training, cost, minimize, bankrupt, expensive, money, dollars |
| Geology Team Goal | Identify a location with a high potential for high water output (not top priority) | Contaminates, water, location, aquifer, recharge, ground, properties, flow |
| Multiteam System Goal | Village Council Priority 2: “strive to get as much clean water to as many people in the Maji Region as possible”<br>Geology Team Priority: Provide as much clean water to as many people in the Maji Region as possible” | Water, population, people, Maji, well, contaminates, clean |

## Additional Measures

I included additional measures in my data collection due to their potential to be considered alternative explanations for any observed effects on my study dependent variables, or as intervening mechanisms for my focal relationships between goal priorities and leadership emergence. The first set of additional measures probes constructs such as task difficulty and training comprehension that could act as confounding, or third variable explanations for my focal relationships. Measuring these variables will allow me to rule these out as potential alternative explanations. The second set of measures captures stable individual differences (e.g., personality; goal orientation; positive/negative affectivity; motivation to lead), I would expect random assignment to conditions to balance the effects of individual differences across treatment conditions. The third set of measures includes individual-level psychological constructs (e.g., commitment to team priority; motivation to work on behalf of one's team), emergent psychological team and multiteam states (e.g., team trust; team cohesion; Kozlowski & Ilgen, 2006) and teamwork processes (Marks et al., 2001). These variables could act as intervening mechanisms for my focal relationships. Appendix A provides a complete list of the measured constructs.

## Exploratory Analysis: Leadership Network Patterns Related to MTS Performance

This dissertation is largely concerned with explaining the motivational drivers of leadership emergence in multiteam systems. However, this begs the question of which configurations of leadership networks, once emerged, are functional to the performance of MTSs. To probe this issue, I conducted exploratory analyses examining two research questions.

*RQ 1: How does granting leadership to members of teams that prioritize their own team-level goal affect MTS performance?*

*RQ 2: How does granting leadership to members of teams that prioritize the superordinate goal affect MTS performance?*

Examining these research questions required first computing metrics of the degree to which each MTS granted leadership to (a) “team-focused” individuals, and (b) “superordinate goal-focused” individuals. To operationalize these tendencies, I partitioned each MTS leadership granting network (Wasserman & Faust, 1994) and calculated scores for each MTS to reflecting the number of interteam leadership grants directed toward team-focused and superordinate goal focused individuals.

To begin, I calculated four separate scores for each MTS reflecting the number of *interteam* leadership granting ties directed toward members of each of the four teams. Then, to operationalize the degree to which teams whose priority is their own team-level goal were granted leadership influence, I calculated scores for each MTS reflecting the number of interteam leadership granting nominations directed toward Construction or Engineering team members. To operationalize the degree to which teams whose team priority is the superordinate goal are granted leadership influence I calculated scores for each MTS reflecting the number of interteam leadership granting nominations for the Village Council and Geology teams. Finally, I calculated a score for each MTS reflecting the number of *intrateam* leadership grants (i.e., grants among fellow teammates). The number of intrateam leadership grants was used as a control.

**MTS Performance**

For each MTS, I operationalized final MTS-level performance as the number of gallons of clean (i.e., uncontaminated) water the well plan would provide divided by the number of people who would be able to benefit from (i.e., access) the water. This ‘gallons of clean water per person’ variable is automatically generated by the Project BLUE interface after a MTS submits their final well design decision. There was substantial variability in this metric in the current sample of MTSs. MTS performance scores ranged from 1.54 gallons per person to 159.73 gallons per person (M = 25.80, SD = 32.12).

## Analytic Approach

Table 8 provides a summary of the analytic approach used to test each hypothesis along with the operationalization of each independent and dependent variable, and the test statistic for each hypothesis. *Hypotheses 1, 4, 5, 6a*, and *6b* posited that certain team priorities (H1, H4, H5) and team priorities in combination with language (H6a, H6b) would predict leadership claims and grants in MTSs. Based on the view of leadership as a type of social network (Carter et al., 2015), each of these hypotheses considered antecedents of social (i.e., leadership) network emergence. *Hypotheses 2* and *3* posited that certain team priorities predict MTS members' language when interacting with members of other teams.

### Non-independence of Data

The data gathered in this dissertation hold multiple sources of non-independence. The first is the reliance on social network data, which are inherently *non-independent* (Frank & Strauss, 1986). To illustrate the dependence in network data, consider that the likelihood of a relationship forming between actors *i* and *j* is dependent on the other types of relationships that exist among these two actors, the degree to which *i* or *j* already participate in many other relationships with other actors, and the relationships that exist among *other* actors in the embedding network. This dependence makes inferential models traditionally used in the organizational sciences (e.g., regression, ANOVA), which assume random variables are independently and identically distributed (i.i.d.), are not appropriate for modeling the antecedents of network emergence. The second source of non-independence is the multiteam structure; individuals within a given team are affected by a shared task and context and are therefore more similar than members of different teams, and teams within a particular MTSs are more similar to one another than are teams from different MTSs. I employed two analytic tools designed to appropriately model data with these two sources of dependence to test my hypotheses. The application of these methods to study hypotheses is summarized in Table 8.

Exponential Random Graph Models (ERGMSs)

To account for the dependence arising from social network data, relevant to Hypotheses 1, 4, 5, and 6, I used a class of inferential models called *p** or *exponential random graph models* (ERGMs) that model the antecedents of relationship emergence while accounting for the inherent dependencies of network data (e.g., Anderson, Wasserman, & Crouch, 1999; Contractor et al., 2012; Frank, 1981; Frank & Strauss, 1986; Pattison & Wasserman, 1999; Robins, Pattison, Kalish, & Lusher, 2007; Robins, Pattison, & Wasserman, 1999; Wasserman & Pattison, 1996). Broadly, ERGMs predict the probability of a relationship (tie) $Y_{ij}$ between every pair of actors $i$ and $j$ in a set of actors. These models regard each network tie as a random variable; meaning that although some relationships may be highly probable, ERGMs do not make "perfect deterministic predictions" (i.e., there is some statistical stochasticity or "noise" in the model; Robins et al., 2007, p. 177).

In the ERGM approach, researchers first specify models containing parameters that correspond to hypothesized *structural signatures*. In other words, these models work under the premise that a theoretical explanation for the emergence of a tie, such as a tendency to form ties based on an intra-team preference, can be represented as a structural signature in the network. For example, if actors are more likely to grant leadership identities to members of their own subgroups or teams than they are to nominate members of other subgroups or teams, then leadership networks will tend to exhibit a structural signature where a tie connects two members of the same subgroup as opposed to members of two different subgroups.

ERGM estimation involves identifying the degree to which specified structural signatures exist in the observed network (i.e., counting their occurrence) and then estimating parameter values by simulating a distribution of random graphs (i.e., networks) based on the parameter values. Then, graphs statistics (i.e., counts of the structural signatures) in the simulated graphs are compared to the graph statistics in the observed networks (Kalish, 2013). According to Robins et al. (2007), ERGM models have the following basic form:

$$\Pr(\mathbf{Y} = \mathbf{y}) = \left(\frac{1}{\kappa}\right) \exp\left\{\sum_{A} \eta_A g_A(\boldsymbol{y})\right\}$$

where (i) Y is the *n* x *n* matrix of network tie variables, with observed values *y;* (ii) $\kappa$ is a normalizing constant that ensures the model has an appropriate probability distribution; (iii) each $g_A(\boldsymbol{y})$ term represents a network statistic (e.g., ties between members of the same team); and (iv) $\eta_A$ represents the corresponding parameter estimate for the network statistic. ERGM parameter estimates reflect the degree to which these structural signatures appeared in the sample network(s) more (or less) often than would be expected by chance. Parameter estimates in ERGMs are similar to those obtained in traditional regression analyses such that each parameter describes the effect of a specified structural signature controlling for all other parameters in the model, and the parameter is statistically significant if it is twice the size of its standard error (Kalish, 2013).

I used the ERGM approach to conduct tests of Hypotheses 1, 4, 5, 6a, and 6b. All ERGM analyses were conducted using the statnet package in R (Handcock, Hunter, Butts, Goodreau, & Morris, 2003) version 3.1-0 (Handcock, Hunter, Butts, Goodreau, Krivitsky, & Morris, 2013). All models included *endogenous* controls (i.e., internal to the dependent variable network), *exogenous* controls (i.e., external to the dependent variable network), and hypothesized effects.

Table 9 summarizes the types of endogenous and exogenous structural signatures used to operationalize controls and hypothesized variables in each ERGM. The first two structural signatures, *arc* and *reciprocity*, were included in all models to control for the baseline tendency for a leadership claim or grant to exist and a baseline tendency towards reciprocity in leadership claiming and granting, respectively. The third structural signature in Table 9 *geometrically weighted in-degree*, was included to control for variation in the degree to which actors received multiple incoming leadership claims or grants. The fourth structural signature, *same team preference*, was included in some models to control for the possibility that leadership claims or grants might be more likely among fellow teammates than between members of different component teams in a MTS. The fifth structural signature reflects parameters that were included to evaluate the likelihood of *incoming* leadership claims grants based on the receiver's standing on a continuous variable (e.g., an individuals' degree of focus on the superordinate MTS goal). The sixth structural signature reflects parameters that were included to evaluate the likelihood of *outgoing* leadership claims or grants based on the *sender's* standing on a continuous variable. The last structural signature shown in Table 9 reflects parameters included to evaluate the likelihood that the presence of a tie between two actors in another social network (e.g., a leadership claiming/granting networks in the past; semantic networks) predicts the presence of a tie between the same two actors in a leadership claiming/granting network.

Multilevel Modeling

The second source of dependence in these data come about when testing Hypotheses 2 and 3. To test these two hypotheses, I used a multilevel modeling approach (Snijders & Bosker, 2012; Hox, Moerbeek, & van de Schoot, 2010) with three levels of analysis: individual, team, and MTS. The manipulated team priority was a team-level variable with expected effects at the individual and team level. The multilevel modeling approach evaluated the effects of the manipulation on individuals' language usage while accounting for the nesting of individuals within teams, and teams within MTSs. All multilevel analyses were conducted using the lme4 package in R (Bates, Maechler, Bolker, & Walker, 2014).

Table 8.

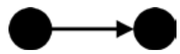
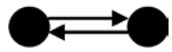
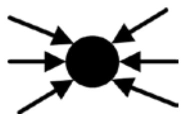
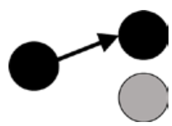
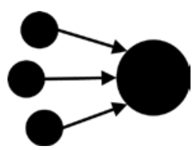
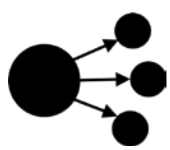
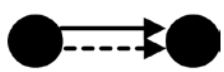
*Summary of Measurement and Analytic Approaches for Study Hypotheses.*

| Hypothesis | Measurement of IV | Measurement of DV | Analysis and Test Statistic |
|---|---|---|---|
| *H1: Members of component teams that prioritize the superordinate goal are more likely to attempt to claim leadership in relation to members of other component teams than are members of component teams that do not prioritize the superordinate goal.* | Team priority manipulation | Outgoing ties in leadership claiming network | *Analysis:* ERGM predicting leadership claiming network<br>*Test Statistic:* 'Nodeocov' parameter estimate for team priority predicting outgoing ties in leadership claiming network. |
| *H2: Members of component teams that prioritize the superordinate goal reference the superordinate collective entity in their communication with others more often than do members of teams that do not prioritize the superordinate goal.* | Team priority manipulation | Individuals' amount of MTS goal-referencing words | *Analysis:* Multilevel model evaluating the effect of team priority on individuals' ratio of MTS goal-referencing words out of their total words<br>*Test Statistic:* Unstandardized regression weights with *t*-tests using a Satterthwaite approximation of degrees of freedom |
| *H3: Members of component teams that prioritize a team-level goal at the expense of the superordinate goal reference their own team in their communication with others more often than do members of component teams that do not prioritize a team-level goal at the expense of the superordinate goal.* | Team priority manipulation | Individuals' amount of different teams' goal-referencing words | *Analysis:* Multilevel model evaluating the effect of team priority on individuals' ratio of 'own team goal-referencing words' out of their total words<br>*Test Statistic:* Unstandardized regression weights with *t*-tests using a Satterthwaite approximation of degrees of freedom |

| | | | |
|---|---|---|---|
| *H4: Members of component teams that prioritize the superordinate goal are more likely to be granted leadership by members of other component teams than are members of component teams that do not prioritize the superordinate goal.* | Team priority manipulation | Incoming ties in leadership granting network | *Analysis:* ERGM predicting leadership granting network<br>*Test Statistic:* 'Nodeicov' parameter estimate for team priority predicting incoming ties in leadership claiming network. |
| *H5: Members of component teams that prioritize the superordinate goal are more likely to grant leadership to members of other component teams than are members of component teams that do not prioritize the superordinate goal.* | Team priority manipulation | Outgoing ties in leadership granting network | *Analysis:* ERGM predicting leadership granting network<br>*Test Statistic:* 'Nodeocov' parameter estimate for team priority predicting outgoing ties in leadership claiming network. |
| *H6a: Members of component teams that prioritize the superordinate goal have a greater probability of relying on members of other component teams who use superordinate-goal referencing language than do members of component teams that do not prioritize the superordinate goal.*<br><br>*H6b: Members of component teams that prioritize a team-level goal have a greater probability of relying on members of other component teams who reference the focal member's team-level goal than do members of component teams that do not prioritize a team-level goal.* | Interaction between semantic networks and dummy-coded matrices based on team priorities | Outgoing ties in leadership granting network | *Analysis:* ERGM predicting leadership granting network<br>*Test Statistic:* 'Edgecov' parameter estimate for semantic network (i.e., superordinate-goal referencing words (H6a) or team goal-referencing words (H6b) multiplied by dummy coded matrices based on manipulated team priorities. |

Table 9.

*Summary of Structural Signatures included in ERGM analyses.*

| **Parameters (*term in statnet)*** | **Qualitative Pattern** | **Explanation** |
|---|---|---|
| *Endogenous Parameters* | | |
| 1. Arc (*edge)* |  | Included to control for baseline tendency for a leadership claim or grant to exist. |
| 2. Reciprocity (*mutual)* |  | Included to control for tendency towards reciprocity in leadership claiming/granting. |
| 3. Geometrically-weighted In-degree *(gwidegree)* |  | Included to control for variation in the degree to which an actor receives multiple incoming tie nominations. |
| *Exogenous Parameters* | | |
| 4. Same Team Preference (*nodematch(team))* |  | Included to control for leadership claims/grants based on common team membership. |
| 5. In-degree based on a continuous actor attribute *(nodeicov(var))* |  | Included in analyses as a control or as a test of a hypothesis. Evaluates the degree to which incoming leadership claims/grants are predicted by a continuous variable actor attribute. |
| 6. Out-degree based on a continuous actor attribute (*nodeocov(var))* |  | Included in analyses as a control or as a test of a hypothesis. Evaluates the degree to which outgoing leadership claims/grants are predicted by a continuous variable actor attribute. |
| 7. Other network (*edgecov(predictor_net))* |  | Included in analyses as a control or a test of a hypothesis. Evaluates the degree to which a predictor network (e.g., matrices reflecting receiving messages containing MTS goal-referencing words) predicts a dependent variable network (e.g., Time 2 leadership granting ties) |

# CHAPTER 4

# RESULTS

This chapter summarizes the results of all tests of all hypotheses. Additionally, this chapter presents results of supplemental analyses evaluating differences between teams with regard to participants' perceptions of emergent psychological states, supplemental multilevel models assessing the impact of team priorities on individuals' use of language referencing specific team-level goals, and supplemental analyses evaluating relationships between patterns of leadership granting multiteam performance.

## Network Data Preparation

Prior to conducting the ERGM analyses, I prepared the data for analysis by creating two large data matrices containing all participants' responses to the perceptual leadership claiming network item at each measurement occasion. I modeled the antecedents of the leadership networks collected at the midpoint of MTS collaboration and at the final time point to test my hypotheses. I did not model the antecedents of leadership networks measured immediately after MTS collaboration because leadership is conceptualized as an emergent construct that requires a certain depth and duration of interaction before coalescing at the relational level of observation (DeRue & Ashford, 2010). Leadership networks assessed at the end of team decision-making, prior to MTS collaboration, were used as a control.

A value of '1' in a matrix indicates that the individual listed in the row relied on the individual listed in the column. Ties that were not substantively meaningful or possible were marked as structural zeros. This includes leadership ties to oneself, which are not meaningful (i.e., a participant could not report relying on himself or herself for leadership), and ties between individuals who were in different MTS sessions. To account for the lack of ties between different MTSs, I used the '*block-diagonal'* function in the statnet package. This function afforded model estimation without estimation of ties between different MTSs.

## Tests of Hypothesis 1

Hypothesis 1 predicted that members of MTS component teams that prioritize the superordinate goal are more likely to claim leadership in relation to members of other component teams than are members of component teams that do not prioritize the superordinate goal. To test Hypothesis 1, I used the ERGM approach to model the antecedents of leadership claiming networks at the midpoint of MTS decision-making and at the final measurement occasion. Table 10 presents tests of Hypothesis 1 at each of the two measurement occasions.

Each of the models shown in Table 10 included endogenous controls, exogenous controls, and the hypothesized effect—outgoing leadership claiming ties based on a participants' manipulated team priority. The values presented in this table reflect *Odds Ratios* for each term based on the parameter estimates obtained through model estimation. When an odds ratio is significant and the value is less than '1,' this indicates that a structural signature was observed significantly *less* often than would be expected by chance; when an odds ratio is significant and the value is greater than '1' this indicates that the structural signature was observed significantly *more* often than would be expected by chance. Because the dependent network is leadership ties, significant odds ratios above 1 indicate the predictor variable (i.e., network signature) increases the likelihood of a leadership tie forming; conversely, a significant odds ratio below 1 indicates the predictor variable decreases the likelihood of a leadership claiming tie forming.

**Endogenous Antecedents of Leadership Claiming Networks (Controls)**

Beginning with the endogenous controls, in both models the *arc* structural signature (i.e., the *edge* term in the ergm r package) was significant and less than 1 (i.e., negative), meaning that in general, highly dense leadership claiming networks with many ties were unlikely. This finding is consistent with prior research showing that social networks tend to exhibit low density (Newman & Park, 2003). The second control variable, reciprocity in leadership claiming (i.e., the *mutual* term in ergm), was significant and greater than 1 indicating that, at a dyadic level of observation, leadership claiming is more likely to be reciprocated than would be expected by chance. At the midpoint, MTS members were, on average, 2.96 times more likely to provide leadership to another member if that other person had reported providing leadership to the first person. The reciprocity effect was also significant at the final measurement occasion (odds ratio = 1.37).

The third endogenous control variable, geometrically-weighted in-degree (i.e., the *gwidegree* term in ergm) was not a significant predictor of leadership claiming networks at the midpoint, but was a significant and negative predictor of leadership claiming networks at the final measurement occasion. According to Hunter (2007), a *positive* geometrically-weighted degree coefficient means that low-degree nodes (e.g., people with few ties) are more likely to add additional ties than high-degree nodes (e.g., people with many ties). Thus, the current negative coefficient indicates that that low-degree nodes were only .32 times more likely than high degree nodes to add additional incoming leadership claims, suggests that leadership claims were focused on fewer MTS members rather than distributed evenly across the system. This effect has been described as preferential-attachment (Newman, 2001).

## Exogenous Antecedents of Leadership Claiming Networks (Controls)

With regard to the exogenous controls, at both the midpoint and the final measurement occasions, the positive and significant effects for the pre-measure of leadership claiming on leadership claiming at the midpoint and final measurement occasions (i.e., using the *edgecov* term in ergm) indicate that the leadership claiming ties that occurred initially, prior to MTS collaboration, tended to be maintained throughout the task. The positive and significant effects for the initial leadership claiming network indicated that a leadership claiming tie was 148.54 times (midpoint) or 1.50 times (final) more likely to exist between two members if a leadership tie had existed between those two people during the team activity. The positive and significant effect for same team preference at the final measurement occasion (i.e., using the *nodematch* term) indicates that a leadership claiming tie was 5.18 times more likely to exist when two people are on the same team than when two people are members of different teams.

Lastly, I controlled for the effect of the manipulated team priorities on *leadership grants* (i.e., incoming leadership claims) using the *nodeicov* term. I coded each persons' level of alignment between their manipulated team priority and the MTS goal using a 4-point scale where 1 = the Construction team priority, 2 = the Engineering team priority, 3= the Village Council team priority, and 4 = the Geology team priority. I included this parameter to control for the possibility that members of teams that prioritize certain goals may have been more likely to be seen as followers and thus, may have been more likely to have been granted followership. However, this term was not a significant predictor of leadership claiming ties in either of the models.

## Hypothesized Effect of Team Priority on Leadership Claiming (H1)

The final line of Table 10 reports the odds ratios based on the parameter estimation for out-degree due to a MTS member's manipulated team priority. Supporting Hypothesis 1, the positive and significant values for this parameter in both models indicate that ***individuals who prioritize the superordinate goal claim leadership from a greater number of MTS members*** as compared to individuals in teams that do not prioritize the superordinate goal. At the midpoint, for every 1-point increase in team priority alignment with the superordinate goal, MTS members were 1.21 times more likely to report providing leadership to an additional member. At the final time point, a 1-point increase in team priority alignment with the superordinate goal, meant that members were 1.39 times more likely to report providing leadership to an additional member.

Table 10.

*Results of ERGM Analyses Evaluating the Effects of Team Priorities on Leadership Claiming (Hypothesis 1).*

| Dependent Variable Network: | Leadership Claiming/ Followership Granting | |
|---|---|---|
| Parameter | Model 1: Midpoint | Model 2: Final |
| *Endogenous Controls* | | |
| Arc | 0.11** | 0.10** |
| Reciprocity | 2.96** | 1.37* |
| Preferential Attachment (GWI-degree) | 4.42 | 0.32* |
| *Exogenous Controls* | | |
| Initial Leadership Claiming Network | 148.54** | 1.50** |
| Same Team Preference | 0.12** | 5.18** |
| Followership Grants (In-degree Based on Team Priority; nodeicov) | 1.03 | 0.96 |
| *Hypothesized Effects* | | |
| ***H1: Leadership Claims*** (Out-degree Based on Team Priority; nodeocov) | 1.21** | 1.39** |

Note. † $p < .10$; * $p < .05$; ** $p < .01$; Odds Ratios reported; $n$ = 264 individuals assembled into 22 MTSs composed of 4, 3-member teams; 2,904 possible ties.

## Tests of Hypotheses 2 and 3

In order to understand the mechanism through which goal priorities affect leadership claiming, I examined how goal priorities manifest in the use of different words signaling goals at the team and MTS levels. Hypothesis 2 posited members of component teams that prioritize the superordinate goal would reference the superordinate goal more often in their communication with others than would members not prioritizing the superordinate goal. In contrast, Hypothesis 3 argued that members of component teams that prioritize a team-level goal would reference their team-level goal more often than members of teams not prioritizing a team-level goal. To test these hypotheses I began by calculating scores for each participant using the semantic analysis output from the LIWC program (described in the previous chapter).

### Data Preparation and Analytic Approach

For each participant, I calculated (a) the total number of words he or she sent in interteam chat messages; (b) a ratio score reflecting the total number of 'MTS goal-referencing' words he or she used out of his or her total word count; and (c) a ratio score reflecting the total number of words referencing his or her own team-level goal out of his or her total word count.

Then, I used multilevel modeling (Bliese, 2015; Snijders & Bosker, 2012) to capture the impact of the team priority manipulation on participants' use of goal-referencing language in their interteam chat messages. I used a dummy-coded regression approach to compare the differences between teams with regard to individuals' language use while accounting for the nesting of individuals in teams, and teams in MTSs. In these analyses, manipulated team priority was a team-level variable with expected effects at the individual and team level. All multilevel models were conducted using the lme4 package in R (Bates et al., 2014).

**Descriptive Indices**

Table 11 summarizes the correlations, means, and standard deviations for the variables included in tests of Hypotheses 2 and 3. This table also includes descriptive information and correlations with regard to the number of times participants' used words referencing each team-level and MTS-level goal. The degree to which participants' teams prioritized the superordinate goal (i.e., Construction = 1, Engineering = 2, Village Council = 3, Geology = 4) was uncorrelated with the number of words participants sent in interteam chat messages ($r = .06$, *ns*). However, this variable was positively correlated with the proportion of MTS-goal referencing words participants used (out of their individual word count; $r = .35$, $p < .01$) and negatively correlated with participants' proportions of own team goal-referencing words ($r = -.26$, $p <.0$). This pattern of correlations is consistent with the hypothesized effects of participants' team priorities on their use of specific goal-referencing words. Table 12 presents the means and standard for the goal-referencing language variables by team.

Table 11.

*Means, Standard Deviations, and Correlations among Variables included in Tests of Hypotheses 2 and 3.*

| | *Min, Max* | *Mean* (*SD*) | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Team Prioritization of MTS Goal [Const. = 1; Eng. = 2; V.C. = 3; Geo. = 4] | | | | | | | | | | |
| 2. Individual's Word Count in Interteam Chat Messages | [1, 667] | 152.41 (133.21) | 0.06 | | | | | | | |
| 3. Proportion of MTS Goal-Referencing Words out of Word Count | [0, 6.25] | .87(1.28) | 0.35** | 0.17** | | | | | | |
| 4. Proportion of Own Team Goal-Referencing Words out of Word Count | [0, 20] | 1.66(2.72) | -0.26** | -0.08 | 0 | | | | | |
| 5. Construction Team Goal-Referencing Words | [0, 17] | 1.52(2.53) | -0.26** | 0.38** | -0.02 | 0.24** | | | | |
| 6. Engineering Team Goal-Referencing Words | [0, 17] | 2.07(3.56) | -0.34** | 0.39** | -0.12$^{\dagger}$ | 0.17** | 0.23** | | | |
| 7. Village Council Team Goal-Referencing Words | [0, 6] | .25(.67) | 0.14* | 0.15* | 0.27** | 0.06 | 0.12$^{\dagger}$ | 0.02 | | |
| 8. Geology Team Goal-Referencing Words | [0, 25] | 2.72(3.73) | .19** | .62** | .14** | -.02 | .03 | .19** | .03 | |
| 9. MTS Goal-Referencing Words | [0, 17] | 1.53(2.82) | 0.30** | 0.60** | 0.68** | -0.07 | 0.12$^{\dagger}$ | 0.05 | 0.29** | .40** |

Note. $^{\dagger}$ $p < .10$; * $p < .05$; ** $p < .01$; $n = 264$ individuals assembled into 22 MTSs composed of 4, 3-member teams; Const. = Construction teams, Eng. = Engineering teams, V.C. = Village Council teams, Geo. = Geology teams.

Table 12.

*Means and Standard Deviations for Goal-Referencing Language by Team.*

| | Construction Teams (Priority: Team Goal) | | Engineering Teams (Priority: Team Goal) | | Village Council Teams (Priority: Ind. & MTS Goals) | | Geology Teams (Priority: MTS Goal) | |
|---|---|---|---|---|---|---|---|---|
| | *Min, Max* | *M*(*SD*) | *Min, Max* | *M*(*SD*) | *Min, Max* | *M*(*SD*) | *Min, Max* | *M*(*SD*) |
| Participant Word Count in Interteam Chat Messages | [3, 567] | 138.29 (128.34) | [4, 538] | 153.02 (122.79) | [1, 536] | 148.69 (130.35) | [15, 667] | 165.52 (151.75) |
| Proportion of MTS Goal-Referencing Words out of Participant Word Count | [0, 3.70] | .25(.60) | [0, 4.26] | .41(.77) | [0, 6.25] | 1.64 (1.62) | [0, 5.03] | 1.16 (1.31) |
| Proportion of Own Team Goal-Referencing Words out of Participant Word Count | [0, 19.05] | 2.72(3.31) | [0, 20.00] | 2.37(3.53) | [0, 8.11] | .74(1.73) | [0, 5.03] | 1.16(1.31) |
| # of Construction Team Goal-Referencing Words | [0, 17] | 3.23(3.89) | [0, 4] | (.52, .97) | [0, 10] | 1.70(2.08) | [0, 5] | .87(1.27) |
| # of Engineering Team Goal-Referencing Words | [0, 16] | 3.48(4.84) | [0, 17] | 3.39(3.92) | [0, 11] | 1.42(2.53) | [0, 5] | .43(.96) |
| # of Village Council Team Goal-Referencing Words | [0, 1] | .08(.27) | [0, 2] | .08(.33) | [0, 6] | .66(1.09) | [0, 2] | .16(.42) |
| # of Geology Team Goal-Referencing Words | [0, 8] | 1.58(2.09) | [0, 25] | 3.89(4.37) | [0, 8] | 1.58(2.03) | [0, 20] | 4.54(4.86) |
| # of MTS Goal-Referencing Words | [0, 8] | .45(1.11) | [0, 7] | .83(1.58) | [0, 17] | 2.87(3.76) | [0, 16] | 2.28(3.37) |

Note. $n$ = 264 individuals assembled into 22 MTSs composed of 4, 3-member teams.

**Multilevel Models Testing Hypotheses 2 and 3**

Table 13 shows the results of the multilevel model predicting individuals' use of MTS goal-referencing words. Table 14 shows the results of the multilevel model predicting individuals' usage of words referencing their own team-level goal. Before conducting these multilevel analyses, I evaluated the appropriateness of using multilevel modeling to test my hypotheses. I tested two three-level, null models with no predictors with MTS goal-referencing language and own team goal-referencing language as the dependent variables, respectively. The results showed that 35% of the variance in MTS goal-referencing language (ICC(1) = .57) and 9% of the variance in own-team goal referencing language (ICC(1) = .67) resides between teams. Therefore, team membership explains a large amount of the variance in participants' MTS goal-referencing language, and a small, but meaningful amount of variance in participants' use of own-team goal-referencing language (Bliese, 2000). MTS membership accounted for virtually no variance in MTS goal-referencing language (ICC(1) = .00) and a moderate amount of variance in own team goal-referencing language i.e., 3%, (ICC(1) = .26)..

After conducting the null models, I generated target models to test Hypotheses 2 and 3 using a dummy-coding approach to compare a base line condition—the Geology team for Hypothesis 2 and the Construction team for Hypothesis 3—to all other conditions. Chi-square difference tests assessing the comparative fit between the null and target models are presented in the bottom right-hand corner of Tables 13 and 14. The chi-square difference tests presented in Tables 13 and 14 indicate that the target models explained a significant amount of variance compared to the null models ($\Delta\chi2$ (3) = 36.16, $p < .01$), and ($\Delta\chi2$ (3) = 22.75, $p < .01$), respectively.

Table 13 shows the results of comparisons between the conditions with regard to the effect of the manipulation on individuals' use of MTS goal-referencing words. The reported values are unstandardized regression weights with corresponding *t*-tests using a

Satterthwaite approximation for degrees of freedom (Neter, Wasserman, & Kunter, 1990; Satterthwaite, 1946). In support of Hypothesis 2, individuals on the Construction and Engineering teams, whose manipulated team priority was their team-level goal, were significantly less likely to use words referencing the superordinate goal as compared to Geology team members, whose manipulated team priority was the superordinate goal, (B = -.90 and -.75, respectively, $p < .01$). ***Individuals who prioritized their own team goals were less likely to reference superordinate goals in their communication than were individuals who prioritized other goals.*** There was no difference in use of MTS goal-referencing language between Geology team members and Village Council team members, whose team priority encompassed both their own individual-level goals as well as the MTS-level goal.

Table 13.

*Results of Multilevel Models Assessing the Impact of Manipulated Team Priority on MTS Goal-Referencing Language (Hypothesis 2).*

| ***DV: Proportion of MTS Goal-Referencing Words out of Words Sent*** | | | | |
|---|---|---|---|---|
| **Model** | **Fixed Effects** | **Coefficient** | **Std. Error** | ***t*-value (*df*)** |
| Null | Intercept | .86** | .10 | 8.29(89) |
| Target | Intercept (Geology Team) | 1.16** | .17 | 6.67(65) |
| | Construction Team | -.90** | .24 | -3.75(66) |
| | Engineering Team | -.75** | .24 | -3.08(66) |
| | Village Council Team | .48 | .24 | 1.98(64) |
| **Model** | **Random Effects** | **Variance (*SD*)** | **BIC** | **$\Delta\chi 2(\Delta df)$** |
| Null | Team | .57(.76) | 828.47 | . |
| | MTS | .00(.00) | | |
| | Error | 1.05(1.03) | | |
| Target | Team | .26(.51) | 808.89 | 36.16 (3)** |
| | MTS | .01(.12) | | |
| | Error | 1.05(1.03) | | |

Note. * $p < .05$; ** $p < .01$; the intercept in the target model reflects the mean number of MTS goal-referencing words sent by Geology team members; slope parameters represent differences between focal group and Geology; $n = 264$ individuals assembled into 22, 4-team MTSs. Coefficients are unstandardized regression weights; *t*-tests use a Satterthwaite approximation of degrees of freedom.

Table 14 summarizes the results of comparisons between the conditions with regard to the effect of the manipulation on individuals' use of language referencing their team goal. As this table shows, individuals who prioritized individual and MTS goals (i.e., Village Council and Geology) were significantly less likely reference their team goals than were individuals on the Construction or Engineering teams (B = -1.96 and -1.75, respectively, $p$ <.01). The difference in own team-level goal-referencing words between the Engineering and Construction teams was not significant. ***Thus, in support of Hypothesis 3, members of teams that prioritized their own team-level goal were more likely to reference their own team-level goal in their interteam communications as compared to teams that did not prioritize their team-level goal.***

Table 14.

*Results of Multilevel Models Assessing the Impact of Manipulated Team Priority on Individuals' use of Own Team Goal-Referencing Language (Hypothesis 3).*

| ***DV: Proportion of Own Team Goal-Referencing Words out of Words Sent*** | | | | |
|---|---|---|---|---|
| **Model** | **Fixed Effects** | **Coefficient** | **Std. Error** | ***t*-value (*df*)** |
| Null | Intercept | 1.75** | .22 | 8.13 (21) |
| Target | Intercept (Construction Team) | 2.71** | .35 | 7.75(128) |
| | Engineering Team | -.35 | .46 | -.75(227) |
| | Village Council Team | -1.96** | .46 | -4.31(228) |
| | Geology Team | -1.56** | .46 | -3.38(228) |
| **Model** | **Random Effects** | **Variance (*SD*)** | **BIC** | **$\Delta\chi 2(\Delta df)$** |
| Null | Team | .67(.82) | 1239.8 | . |
| | MTS | .26(.51) | | |
| | Error | 6.71(2.59) | | |
| Target | Team | .00(.00) | 1233.6 | 22.75 (3)** |
| | MTS | .42(.65) | | |
| | Error | 6.63(2.58) | | |

Note. † $p$ < .10; * $p$ < .05; ** $p$ <.01; $n$ = 264 individuals assembled into 22, 4-team MTSs; The intercept in the target model reflects the mean ratio of 'own-team goal-referencing' words divided by individuals word count for participants in the Construction Team condition (team goal-focused and competitive); Slope parameters represent differences between focal group and Construction with regard to mean ratio score;. Coefficients are unstandardized regression weights; $t$-tests use a Satterthwaite approximation of degrees of freedom.

## Tests of Hypotheses 4 and 5

I followed a similar analytic approach to test Hypotheses 4 and 5 as was used to test Hypothesis 1. I estimated two ERGMs, summarized in Table 16, identifying antecedents of MTS leadership granting networks at the midpoint (Models 1) and at the final measurement occasion (Model 2). Again, the values reported in this table represent the Odds Ratios for each effect which were calculated based on the parameter estimates obtained through model estimation.

### Endogenous Antecedents of Leadership Granting Networks (Controls)

Beginning with the endogenous controls, the odds ratio for the arc parameter was significant less than 1 indicating that leadership granting ties are much less likely to appear between sets of actors than would be expected by chance. These effects parallel those observed for the leadership claiming network (Table 10). At the midpoint, leadership granting ties were significantly more likely to be reciprocated than would be expected by chance. MTS members were 12.15 times more likely to reciprocate another person's leadership grant than to not reciprocate another's leadership grant. Like the models evaluating the leadership claiming networks presented in Table 10, the significant or marginally significant and low odds ratio values for the geometrically-weighted in-degree term indicate that MTS members with many incoming leadership grants (i.e., those with many 'followers') were more likely to add additional followers as compared to MTS members with fewer incoming leadership grants.

### Exogenous Antecedents of Leadership Granting Networks (Controls)

With regard to the exogenous controls, the leadership granting network assessed after the team activity was a significant predictor of the leadership granting network assessed at the midpoint and final measurement occasion during MTS collaboration. However, this effect was much stronger (Odds Ratio = 26.30, $p$ <.01) at the midpoint than it was after the MTS members gained more experience interacting with one another (Odds Ratio = 2.34, $p < .01$). The effect for same team membership driving leadership granting was non-significant at the midpoint but grew stronger and significant by the final measurement occasion (Odds Ratio = 15.28, $p < .01$).

### Hypothesized Effects of Team Priorities on Leadership Granting (H4) and Followership Claiming (H5)

Lastly, I included two terms in each model to represent the structural signatures implied by *Hypotheses 4* and *5*. The first term, *in-degree* based on team priority, reflects a tendency for MTS members to be granted leadership based on their teams' level of prioritization of the superordinate goal (H4). Again, the coding for alignment between manipulated team priority and the superordinate goal ranged from 1 to 4, with 1 = Construction team, 2 = Engineering team, 3 = Village Council, and 4 = Geology team. As shown in Table 15, this parameter was not significant at the midpoint. However, at the final measurement occasion, in-degree based on team priority was a positive and significant predictor of incoming leadership granting nominations. In this model, MTS members were 1.17 times more likely to receive additional incoming leadership granting nominations given a one-point increase in their team's prioritization of the MTS goal. ***Thus, results showed partial support for H4—at the final time point, members of teams that prioritized the superordinate goal were more likely to be granted leadership than were members of teams that did not prioritize the superordinate goal.***

The second hypothesized effect, *out-degree* based on team priority, reflects a tendency for members to claim followership in relation to other members (i.e., grant others leadership) to a greater extent if their priority is more aligned with the superordinate goal. In support of Hypothesis 5, this parameter was positive and significant at both measurement occasions. At the end of MTS collaboration, MTS members were 1.16 times more likely to grant others leadership given a one point increase in their team's prioritization of the MTS goal. ***To summarize, these results showed full support for H5—members of teams that prioritized the superordinate goal were more likely to claim followership than members of teams that did not prioritize the superordinate goal.***

Table 15.

*Results of ERGM Analyses Evaluating the Effects of Team Priorities on Leadership Granting (Hypothesis 4) and Followership Claiming (Hypothesis 5).*

| Dependent Variable Network: | Leadership Granting/ Followership Claiming | |
|---|---|---|
| | Model 1: Midpoint | Model 2: Final |
| *Endogenous Controls* | | |
| Arc | 0.09** | 0.05** |
| Reciprocity | 12.15** | 1.04 |
| Preferential Attachment (GWI-degree) | 0.04** | $0.47^{\dagger}$ |
| *Exogenous Controls* | | |
| Pre-measure of Leadership Granting Network | 26.30** | 2.34** |
| Same Team Preference | 1.32 | 15.28** |
| *Hypothesized Effects* | | |
| ***H4: Leadership Grants*** (In-degree based on Team Priority; nodeicov) | 1.08 | 1.17** |
| ***H5: Followership Claims*** (Out-degree based on Team Priority) | 1.25** | 1.16** |

Note. $^{\dagger}$ $p$ < .10; * $p$ < .05; ** $p$ <.01; Odds Ratios reported; $n$ = 264 individuals, 2,904 possible leadership granting ties.

## Tests of Hypotheses 6a and 6b

My last hypothesis considered how team priorities predict the likelihood of members *responding* to particular language styles with leadership granting. *Hypotheses 6a* and *6b* argued that individuals whose team priority is the superordinate goal would be more likely to grant leadership to members of other teams who reference the superordinate goal (6a), and individuals whose team priority is their team-level goal would be more likely to grant leadership to members of other teams who reference that team-level goal. To test these hypotheses, I conducted three additional ERGM analyses, summarized in Table 16, modeling the antecedents of *interteam* (within-team ties removed) leadership granting networks. To maximize the power for these analyses, these models predicted the leadership granting networks collected at final measurement occasion using the entirety of the messages sent and received throughout the hour-long multiteam discussion phase.

### Data Preparation for Hypothesis 6

Prior to conducting these analyses, I created a 264 x 264 semantic matrix for 'MTS goal-referencing words' and another 264 x 264 semantic matrix for 'own team goal-referencing words' based on the output obtained through the LIWC semantic analysis of participants' interteam chat messages. In the 'MTS goal-referencing words' semantic matrix, the ties between actors represented a ratio score reflecting the number of times actor *i* (sender) used a word contained in the MTS goal-referencing dictionary in his or her messages to actor *j* (receiver) divided by the number of words *i* sent to *j*. In the 'own team goal-referencing words' semantic matrix, the ties between actors represented a ratio score reflecting the number of times actor *i* used a word contained in the team goal-referencing dictionary of actor *j* in his or her messages to actor *j* divided by the number of words *i* sent to *j*. These matrices were constructed so that the rows represented the *recipient of the words* (actor *j*) and the columns represented the *sender of the words* (actor *i*). This structure allowed for comparison with the leadership granting network matrices where the rows represented the senders of leadership grants and the columns represented the receivers of leadership grants.

Next, I created three 264 x 264 dummy-coded matrices, each of which contained a value of 1 in the columns for certain MTS members and a value of 0 in all other cells. The first dummy-coded matrix was designed to isolate effects for MTS members whose team priority was solely the superordinate MTS goal (i.e., members of Geology teams). This matrix contained 1's in the columns below the Geology team members and 0's in all other cells. The second dummy-coded matrix was intended to isolate effects for MTS members whose team priority included the superordinate MTS goal, but also included other activities (i.e., members of Village Council teams). This matrix contained 1's in the columns below the Village Council team members and 0's in all other cells. The third dummy-coded matrix was intended to isolate effects for MTS members whose team priority was their own team-level goal (i.e., members of the Construction and Engineering teams). This matrix contained 1's in the columns below the Construction team and Engineering team members.

After creating the semantic matrices and the three dummy-coded matrices, I multiplied each semantic matrix by each dummy-coded matrix to create 6 unique predictor matrices for inclusion in the three ERGMs. I then proceeded with the ERGM analyses, again using the 'blockdiagonal' control term in the statnet R statistical package to account for the fact that members of different MTS experimental sessions were not able to send or receive leadership nominations.

### Endogenous Antecedents of Leadership Granting Networks (Controls)

Each of the ERGMs presented in Table 16 included a set of three endogenous control variables (arc, reciprocity, and geometrically weighted in-degree), exogenous controls based on *Hypotheses 4* and *5* and a set of predictor networks created by multiplying a semantic goal-referencing matrix by a dummy-coded matrix. Model 1 included the three semantic predictor networks created by multiplying the ‘MTS goal-referencing’ semantic matrices by the three dummy-coded matrices. Model 2 included the three semantic predictor networks created by multiplying the ‘own team goal-referencing’ semantic matrices by the three dummy-coded matrices. Model 3 included all six semantic predictor networks.

In each of the three models shown in Table 16 the arc parameter estimate was negative, with odds ratios below 1 (.32, .44, and .11, respectively), meaning that leadership granting was less likely among any random pair of MTS members than would be expected by chance alone. This effect was marginally significant in Models 1 and 2 and significant in Model 3 ($p < .01$). The reciprocity parameter estimate was significant and positive in all three models (odds ratios = 1.75, 1.58, and 1.45, respectively), however, this term was only marginally significant in Model 2 and non-significant in Model 3, suggesting that other parameters included in those models accounted for greater variance in leadership granting. Again, the geometrically weighted in-degree term was statistically significant and negative (odds ratios = .01, .01, and .19, respectively, $p < .01$) meaning that hubs were *likely* in leadership granting networks such that participants with higher in-degree scores more less likely than participants with lower in-degree scores to add additional incoming leadership granting nominations.

**Exogenous Antecedents of Leadership Granting Networks (Controls)**

I also controlled for incoming and outgoing leadership grants based on the manipulated team priorities. Paralleling the results presented in Table 16 above, the parameter estimates for these two terms were positive in all models with odds ratios above 1. Again, this suggests that individuals whose team priorities are more closely aligned with the superordinate goal are more likely to be granted leadership by members of other teams (H4) and more likely to grant leadership to members of other teams (H5) as compared to individuals in teams that do not prioritize the superordinate goal. Notably however, the parameter estimate in Model 1 was non-significant and was only marginally significant in Model 3.

### Hypothesized Multiplicative Effects of Followers' Team Priorities and Leaders' Language on Leadership Granting (H6a and H6b)

The final terms in each model in Table XX were included to test *Hypotheses 6a* and *6b*. Beginning with Model 1, we see that the semantic predictor network created by multiplying the matrix representing the degree to which each actor received messages containing words referencing the MTS-level goal by the dummy-coded matrix for Geology team members was a positive and significant predictor of interteam leadership grants. This means that when a tie with a higher value exists between two actors in this semantic predictor network (i.e., when the messages sent from a member of another team to a Geology team member contain a high proportion MTS goal-referencing words) there is also likely to be a leadership grant from that Geology team member to the member of the other team. Neither of the other two semantic predictor matrices which were created using dummy-coded matrices for the other teams, were statistically significant. This pattern of results supports *Hypothesis 6a*.

In Model 2, I included the semantic predictor networks created by multiplying the 'own team goal-referencing' semantic matrices by the three dummy-coded matrices. As shown in Table 16, each of these semantic predictor networks was a statistically significant and positive predictor of leadership granting ties. This means that all MTS members were more likely to grant leadership to members of other teams who used relatively more language referencing the focal member's own team-level goal. This effect was slightly weaker for Geology team members (Odds Ratio = 1.40, $p$ <.05) as compared to Village Council team members (Odds Ratio = 1.58, $p$ < .05) and Engineering/Construction team members (Odds Ratio = 1.50, $p$ < .05), suggesting that, in comparison to teams that prioritize goals at lower-levels of the MTS goal hierarchy, members of teams who prioritize the superordinate goal are less likely to respond with a leadership grant to those who reference their team-level goal. However, the effect for Village Council team members was slightly larger than that of Construction/Engineering team members. Thus, this model provides only partial support for Hypothesis 6b.

Finally, Model 3 includes all six semantic predictor networks in addition to the controls. Showing further support for Hypothesis 6a, the semantic predictor network combining Geology team membership with receiving MTS goal-referencing language is a statistically significant predictor of leadership granting ties. Again, the Odds Ratio for the semantic network representing Village Council team membership and the receipt messages containing Village Council team-level goal-referencing language is a stronger predictor of leadership granting (Odds Ratio = 2.15, $p < .01$) as compared to the semantic network representing Construction/Engineering team memberships and the receipt of Construction or Engineering team goal-referencing language (Odds Ratio = 1.50, $p < 01$). However, in this model, the semantic predictor network reflecting Geology team membership and the receipt of messages containing Geology team goal-referencing language was non-significant suggesting that Geology team members are more likely to respond to messages containing words referencing the MTS-level goal than they are to respond to messages containing words referencing their own team-level goal.

***In summary, the results shown in Table 16 provide full support for Hypothesis 6a such that individuals whose top priority was the superordinate goal were more likely to grant leadership to members of other teams who used more superordinate goal-referencing language. Showing partial support for H6b, both team-focused teams (Engineering and Construction) and teams whose priority was a mix between the superordinate goal and their own individual-level goals (Village Council teams) were more likely to grant leadership to members of other teams who used a more words referencing the potential follower's team-level goal.***

Table 16.

*Results of ERGM Analyses Evaluating the Interactive Effects of Team Priorities and Goal-Referencing Language on Leadership Granting (Hypotheses 6a and 6b).*

| Dependent Variable Network: Interteam Leadership Granting Network (Within Team Ties Removed) | | Model 1 | Model 2 | Model 3 |
|---|---|---|---|---|
| *Endogenous Controls* | | | | |
| | Arc | 0.32 † | 0.44† | 0.11** |
| | Reciprocity | 1.75* | 1.58† | 1.45 |
| | Preferential Attachment (GWI-degree) | 0.01** | 0.01** | 0.19** |
| *Exogenous Controls* | | | | |
| ***H4:*** | ***Leadership Grants*** (In-degree based on Team Priority, nodeicov) | 1.04 | 1.11* | 1.10† |
| ***H5:*** | ***Followership Claims*** (Out-degree based on Team Priority, nodeocov) | 1.17** | 1.18** | 1.19** |
| ***H6: Leadership Granting Based on Semantic Predictor Networks*** | | | | |
| ***H6a:*** | ***MTS goal words X Geo*** (Team Priority = MTS-level goal) | 1.72** | | 1.74* |
| | MTS goal words X VC (Team Priority = Ind./MTS-level goals) | 1.15 | | 1.20 |
| | MTS goal words X Const. & Eng. (Team Priority = Team-level goal) | 1.26 | | 0.81 |
| | Own team goal words X Geo (Team Priority = MTS-level goal) | | 1.40* | 1.25 |
| | Own team goal words X VC (Team Priority = Ind. /MTS-level goal) | | 1.58* | 2.15** |
| ***H6b:*** | ***Own team goal words X Const. & Eng.*** (Team Priority = Team-level goal) | | 1.50* | 1.50* |

Note. † $p < .10$; * $p < .05$; ** $p < .01$; Odds Ratios reported; Const. = Construction; Eng. = Engineering; VC = Village Council; Geo. = Geology; Ind. = Individual; $n$ = 264 individuals assembled into 22, 4-team MTSs; 2,376 possible *interteam* ties.

## Supplemental Analyses: Leadership Networks and MTS Performance

I conducted supplemental regression analyses to evaluate the impact of leadership granting network patterning on multiteam performance (i.e., *RQ1 and RQ2).* Whereas *RQ1* considered whether the degree to which individuals who prioritize their team-level goal are granted leadership by members of other teams would affect MTS performance, *RQ2* considered whether the degree to which individuals who prioritize the superordinate goal are granted leadership by other teams would affect MTS performance.

Table 17 summarizes the means, standard deviations, and correlations among the variables included in the supplemental regression analyses. Unsurprisingly, given the inherent dependencies of social network data, many of the network descriptive indices shown in this table are highly correlated.

Table 18 presents the results of the regression analyses. Model 1 was a control model intended to determine if the amount of *intrateam* leadership granting was a significant predictor of MTS performance. As shown in this table, this model did not account for a significant proportion of variance in MTS performance. Model 2 was an exploratory model intended to determine if the overall amount of *interteam* leadership granting (in general) was a significant determinant of MTS performance in this task. This model did not account for a significant proportion of variance in MTS performance, and neither interteam nor intrateam leadership grants were significant predictors of MTS performance.

Model 3 included effects for incoming leadership nominations directed toward each component team in the MTSs, in addition to the control variable of intrateam leadership granting. This model accounted for a marginally significant proportion of variance (49%) in MTS performance, $F(5, 15) = 2.88$, $p = .057$. Interestingly, the parameter estimates representing the number of incoming leadership grants directed toward Geology or Village Council team members were both positively related to MTS performance (*B* = 9.89 and 4.62, respectively, $p < .05$). In contrast, the number of incoming leadership grants directed toward Construction team members was not a significant predictor of MTS performance, and the number of incoming leadership grants directed toward Engineering team members was significantly and negatively related to MTS performance (*B* = -1.71, $p < .05$).

The final Model shown in Table 18, Model 4, accounted for a significant proportion of variance (37%) in MTS performance $F(3\ 17) = 3.93$, $p < .05$. In this Model, the combined number of incoming leadership grants directed members of the Geology or Village Council was a *positive* predictor of MTS performance (*B* = 4.87, $p < .01$) and the combined number of incoming leadership grants directed toward members of the Construction or Engineering teams was a *negative* predictor of MTS performance (*B* = -3.37, $p < .05$). Thus, this model shows that ***the degree to which MTSs grant leadership to individuals who prioritize a team-level goal is negatively related to MTS performance and the degree to which MTSs grant leadership to individuals who prioritize the superordinate goal is positively related to MTS performance***.

Table 17.

*Means, Standard Deviations and Correlations among Variables included in Supplemental Regression Analyses Predicting MTS Performance (# of Gallons of Clean Water per Accessible Person).*

| | | Range | *M*(*SD*) | 1. | 2 | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | MTS Performance (# of Gallons of Clean Water Per Person) | [1.54, 159.73] | 25.80 (32.12) | | | | | | | | |
| 2. | Intrateam Leadership Grants | [13, 23] | 17.09 (2.88) | .13 | | | | | | | |
| 3 | Interteam Leadership Grants | [0, 39] | 13.67 (11.32) | .21 | -.15 | | | | | | |
| 4. | Interteam Leadership Grants toward Construction | [0, 9] | 2.33 (3.03) | -.10 | .00 | .68** | | | | | |
| 5. | Interteam Leadership Grants toward Engineering | [0, 10] | 3.051(3.17) | .10 | -.16 | .93** | .54* | | | | |
| 6. | Interteam Leadership Grants toward Village Council | [0, 10] | .53 (.17) | .39$^{\dagger}$ | -.08 | .73** | .33 | .76** | | | |
| 7. | Interteam Leadership Grants toward Geology | [0, 14] | 4.48 (4.34) | .25 | -.20 | .76** | .36 | .59** | .26 | | |
| 8. | Interteam Leadership Grants toward Cons. and Eng. | [0, 22] | 7.36 (5.90) | .01 | -.10 | .94** | .84** | .91** | .65** | .56** | |
| 9. | Interteam Leadership Grants toward VC & Geo. | [0, 18] | 5.91 (6.07) | .39$^{\dagger}$ | -.18 | .93** | .43$^{\dagger}$ | .83** | .71** | .86** | .75** |

Note. $^{\dagger}$ *p* < .10; * *p* < .05; ** *p* <.01; *n* = 264 individuals assembled into 22, 4-team MTSs.

Table 18.

*Results of Supplemental Analyses Regressing Final MTS Performance (Gallons of Clean Water per Person in Maji Region) on Final Leadership Granting Network Structures.*

| | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| Intercept | 1.62 | -14.52 | -28.23 | -33.81 |
| Intrateam Leadership Grants (Control) | 1.41 | 1.81 | 2.05 | 2.55 |
| Total Amount of Interteam Leadership Granting | | 0.68 | | |
| Interteam Leadership Granting to Construction Teams | | | -1.71 | |
| Interteam Leadership Granting to Engineering Teams | | | -7.31* | |
| Interteam Leadership Granting to Village Council Teams | | | 9.89** | |
| Interteam Leadership Granting to Geology Teams | | | 4.62* | |
| Interteam Leadership Granting to Construction and Engineering Teams | | | | -3.37* |
| Interteam Leadership Granting to Village Council and Geology Teams | | | | 4.87** |
| $R^2\Delta$ (Compared to Model 1): | . | .05 | .47* | .35* |
| $R^2$ | .02 | .07 | .49$^{\dagger}$ | .37* |

Note. $^{\dagger}$ $p$ < .10; * $p$ < .05; ** $p$ <.01; $n$ = 264 individuals assembled into 22, 4-team MTSs. Unstandardized beta weights reported.

# CHAPTER 5

# DISCUSSION

Multiteam systems are complex collective entities composed of individuals with the volition to act in support of any number of objectives. This dissertation emphasizes that MTS members are embedded in distinct *teams* and different team contexts within the same system can exert unique pressures on constituent members to prioritize and pursue different goals. I show empirically that the priorities emphasized *within* teams have significant ramifications for members' participation in critical processes of leadership claiming and granting *between* teams.

My results suggest that membership on a team that prioritizes a superordinate MTS goal might confer influence. However, in comparison to members of teams that do not prioritize the superordinate goal, members of teams whose team priority is the superordinate goal were more likely to claim followership (i.e., grant leadership)—potentially to others with *incompatible* priorities. These results suggest that if a system includes teams that prioritize more proximal goals that conflict with MTS objectives, members who prioritize superordinate goals might allow those team-focused teams to unduly influence the system. Moreover, supplemental analyses suggest that the degree to which systems grant leadership influence to members of teams that do *not* prioritize superordinate goals can undermine MTS performance.

This dissertation advances a broader understanding of both multiteam collaboration and organizational leadership. Therefore, this chapter organizes study contributions based on their implications for MTS theory or leadership theory, respectively. I end by summarizing potential implications for practice and study limitations.

## Key Contributions to MTS Theory

This dissertation contributes to MTS theory in at least three ways. First, I advanced the new concept of team priorities, arguing that patterns of team priorities are important MTS compositional attributes with significant implications for interteam processes and collective outcomes.

MTS research has clarified repeatedly that a key challenge of multiteam collaboration is that in addition to superordinate goals, component teams hold more proximal individual- and team-level objectives, which are not always compatible with others' proximal goals or with superordinate goals (Davison et al., 2012; Marks et al., 2005; Mathieu et al., 2001; Luciano et al., 2015; Zaccaro et al., 2012). Additionally, researchers have suggested that due to a variety of factors, such as reinforcement strategies that reward proximal outcomes or ambiguous feedback between members' actions and the achievement of superordinate goals, MTS members may emphasize their own proximal goals over those of the system (Kanfer & Kerry, 2012; Mathieu, 2012).

However, prior empirical studies of MTSs have overlooked the likely scenario of component teams that are *differentially* committed to pursuing superordinate goals. The reality is that in many large complex systems, component team contexts *vary* in terms of the ambient, discretionary, and multidimensional stimuli that direct members' attention toward particular pursuits. This can result in systems composed of teams with very different, and sometimes competing, team priorities. After advancing the concept of team priorities, I leveraged classic theories of intergroup relations (Tajfel & Turner, 1979) and social interdependence (Deutsch, 1949) to predict how differences in priorities between teams would underpin members' participation in critical interteam processes of leadership claiming and granting.

As such, the second key contribution of this dissertation to MTS research is the emphasis on leadership *emergence*. As reviewed in the introduction, research on MTS leadership has focused almost exclusively on the outcomes of leadership. These studies have identified significant effects of a variety of top-down interventions enacted by members of formally-appointed leadership teams on interteam coordination and performance. This emphasis on the outcomes of formal leadership is understandable given the need to demonstrate the relevance of leadership within the MTS research domain. However, the field has thus far avoided inquiries into why leadership might arise throughout MTSs. Understanding why and how leadership comes about is particularly relevant in light of the growing body of evidence showing leadership has significant effects on MTS performance.

The results of my analyses demonstrate that team priorities affect both the claiming as well as the granting sides of leadership emergence. Inferential models of network emergence showed support for *Hypotheses 1* in that individuals whose teams prioritized the superordinate goal were more likely to claim leadership to others as compared to those embedded in teams that did not prioritize the superordinate goal. Aligning with the notion that individuals emerge as leaders in groups when they demonstrate commitment to a common group identity (Hogg, 2001), my results showed that members of teams that prioritized the superordinate goal were the most likely to use language referencing the superordinate goal in their interteam communications (*Hypothesis 2*) and the most likely to be granted leadership by members of other teams (*Hypothesis 4*).

However, in support of *Hypothesis 5,* members of teams that prioritized the superordinate goal were also the most likely to *grant others'* leadership influence. Arguably, this may be because these individuals tended to perceive members of others teams as linked to themselves through positive, as opposed to negative, forms of interdependence and thus, were more open to inducibility by these other members. Indeed, supplemental manipulation check analyses demonstrated that team priorities predicted MTS members' perceptions of interteam interdependence. Those participants who were randomly assigned to teams that prioritized the superordinate goal tended to perceive greater levels of task and goal interdependence with other teams.

Furthermore, supplemental regression analyses of leadership granting patterning suggest whereas high levels of leadership granting directed toward members of teams that prioritized superordinate goals were positively related to MTS performance, high levels of leadership granting directed toward members of teams that prioritized their own team-level goals was negatively related to MTS performance. These results clarify that there can be downsides to MTS goal achievement when component teams that prioritize team-level goals become too influential, and suggest a need for future research that continues to uncover how, when, and why MTS members are likely to claim and be granted leadership.

The third key contribution of this dissertation to MTS theory is to broaden the generalizability of MTS research. Not only does this work advance a new concept (i.e., team priorities) and a new question (i.e., leadership emergence) for the MTS research domain, it does so in a new experimental *context*, developed for this dissertation. Thus far, the generalizability of MTS research has been limited in that most empirical studies of MTSs have considered collaboration processes in *military* contexts using tasks with clear objectives and guidelines. However, real-world MTSs vary widely with regard to their compositional, linkage, and developmental attributes (Zaccaro et al., 2012). Furthermore, although clearly not the case in all real-world MTS contexts, laboratory investigations of MTSs have tended to assume that all teams are members of a common organizational entity (e.g., the military). As a recent review of MTS research put it: systems whose teams are “internal to one organization are more often examined in laboratory and mixed methods studies, whereas cross-boundary MTSs are more common in case and field studies” (Shuffler, Jimenez-Rodriguez, & Kramer, 2015. p. 11).

Broadening the generalizability of MTS research, this study considered collaborative processes in an experimental scenario designed to mimic systems composed of teams with different organizational identities and team priorities that are tasked with leveraging their diverse knowledge to develop a plan to address a multifaceted problem without a clear solution. Additional empirical research is needed that continues to clarify the nature of collaboration and leadership in systems that tackle other types of complex challenges such as innovation (e.g., Carter, DeChurch, & Zaccaro, 2014), community planning (Mathieu, 2012), scientific discovery (DeChurch & Zaccaro, 2013), and cybersecurity (Steinke, Zaccaro, Chen, Hargrove, & Repchick, 2015), as well as in MTSs with different configurations of organizational memberships, team priorities, and individual attributes.

## Key Contributions to Leadership Theory

This dissertation also makes substantial contributions to the study of organizational leadership. First, this work leverages a conceptualization of leadership 'as a network' (Carter et al., 2015; Contractor et al., 2012; DeRue, 2011) in order to develop and test hypotheses about the emergence of networked patterns of leadership relationships throughout larger collectives. Thus, this study provides a foundation for how future research can continue to investigate ***'leadership systems'*** **(i.e., networked patterns of leadership relationships across larger collectives).**

Certainly, a large body of research on leadership emergence exists in the broader leadership literature. Questions of leadership emergence have intrigued scholars and laymen alike for centuries. However, most prior studies of leadership emergence to date have been only *somewhat* applicable for predicting why, how, and among whom leadership is likely to arise across large collectives. Most prior studies of leadership emergence have been 'leader-centric'—focusing on attributes or behaviors that predict individuals' eventual occupancy of leadership positions (e.g., Anderson et al., 2001; Bendersky & Shah, 2013; Bono & Judge, 2004; DeRue, Narhgang, Wellman, & Humphrey, 2011; Eagly & Karau, 1991; Emery, 2012; Foti & Hauenstein, 2007; Ilies, Gerhardt, & Le, 2004; Livi, Kenny, Albright, & Pierro, 2008; Lord, De Vader, & Alliger, 1986; White et al., 2014; Zaccaro, 2007). For example, Judge, Bono, Ilies, and Gerhardt's (2002) meta-analysis demonstrated that people's enduring "Big Five" personality traits of Conscientiousness, Neuroticism, Extraversion, and Openness to Experience relate to their occupation of a leadership role.

Under some circumstances (e.g., a leaderless discussion in a small group), these leader-centric studies of de-contextualized leader traits or behaviors *might* provide sufficient guidance for identifying the patterns of influence that are likely to arise among group members. However, 21st century challenges are demanding the collective efforts of groups and systems that are larger and complex than those modeled in most studies of leader emergence. Numerous leadership relationships are possible within these systems (Carter & DeChurch, 2014). For example, in a 20-member MTS, the number of possible leadership relationships that might exist among members at any given moment (i.e., $N*(N-1)$) is equal to 380. In a 100-member MTS, up to 9,900 leadership relationships are possible, hypothetically. These relationships might be arranged in almost countless ways. Given the potential for high levels of complexity in terms of leadership patterning, it is unlikely that merely identifying the individual(s) with the highest level of 'extraversion' (Judge et al., 2002), for example, will clarify the patterns of leadership that are likely to emerge across larger systems.

In summary, the first key contribution to the leadership field stemming from this dissertation is to demonstrate that a view of leadership as a network (Carter et al., 2015) is a useful *'meso-level'* approach that allows researchers to scale-up the study of leadership emergence for larger collectives. Future research can continue to leverage the types of inferential models of network emergence and development used in this study to identify why, how, and among whom leadership is likely to arise among members of small and large collectives.

Second, this study contributes to leadership research by answering calls in the leadership literature for more research investigating both the leader as well as the follower sides of leadership emergence in conjunction with the embedding context leaders and followers operate within.

Numerous leadership scholars have highlighted that the attributes, actions, and interactions of *both* leaders and followers, as well as the social situations they are embedded within, play critical roles in leadership emergence (Balkundi & Kilduff, 2006; DeRue & Ashford, 2010; Hollander & Offerman, 1990; Oc & Bashshur, 2013; Osborn, Hunt, & Jauch, 2002). For example, Klein and House's (1995) "Charisma on Fire" theory argues that "charisma is the product of three elements: (1) a spark—a leader who has charismatic qualities, (2) flammable material—followers who are open or susceptible to charisma, and (3) oxygen—an environment conducive to charisma" (p. 183). Similarly, others have suggested that rather than a stable personality trait, perceptions of a leader's charisma are negotiated between followers and leaders (Klein & House, 1995; House, Spangler, & Woycke, 1991) and are strongly impacted by situational characteristics, such as an individuals' position in an team social network (e.g., Balkundi, Kilduff, & Harrison, 2011).

Nonetheless, most empirical research on leadership emergence has discounted the role of followers and situations in the co-construction of leadership (Uhl-Bien, Riggio, Lowe, & Carsten, 2014). Similarly, research on leadership emergence has de-emphasized the impact of the social context that leaders and followers operate within (Hogg, 2001). In contrast, this study advances a broader understanding of leadership emergence by highlighting how the teams MTS members are embedded in (i.e., a critical aspect of their social context) predict not only who will lead, but also who will follow and *how* (i.e., through what communication processes).

Thus, the third contribution of this dissertation to leadership research is to provide a starting point for developing a more coherent understanding of the *communication* *processes* involved in leadership. As Fairhurst and Antonakis (2012) put it, at present, "there is not enough theorizing about relational communication insofar as leading (and managing) are concerned" (p. 453). This study considered how team priorities impact both the types of messages people *send* as well as the types of messages they *respond* to in terms of leadership granting.

In support of my *Hypotheses 6a*, members of teams who prioritized the superordinate goal exclusively (i.e., Geology teams) were most likely to grant leadership to members of other teams who referenced the superordinate goal. In contrast, and in support of *Hypothesis 6b*, members of teams that did not prioritize the superordinate goal exclusively (i.e., Village Council teams, Engineering teams, Construction teams) tended to grant leadership to members of other teams who referenced the focal member's own team-level goal.

In this study influence members conferred influence to those who discussed their prioritized goal. Yet goals and priorities are often unique to the context within which they occur. Thus, these results suggest the indicators of leadership emergence may be context dependent such that the language of influence between some sets of individuals may be different from the language of influence between other sets of individuals.

However, these results also suggest that the messages indicative of leadership emergence are somewhat predictable given an understanding of individuals' motivations. Developing a more complete understanding of the patterns of communications that reflect leadership claiming and granting under different circumstances is an area ripe for future inquiry.

## Implications for Practice

The primary contributions of this dissertation are to basic research on leadership and multiteam collaboration. However, there are potential implications for managerial practice stemming from this study that could be evaluated in future research. For example, formal team leaders and component teams might be trained to understand that the goals and objectives prioritized within their own teams are not necessarily shared across teams, and to look for signals (e.g., communication messages) to better understand the nature of other teams' priorities. Additionally, leader and/or team development initiatives may be designed to focus members' attention toward particular pursuits and therefore help develop specific team-level priorities that might allow members to become more influential across systems.

Furthermore this study suggests that HR managers or leadership development practitioners may be able to anticipate or identify the emergence of leadership claiming and granting processes through digital traces of people's interactions. One could imagine the design of new computer-based leadership development interventions that monitor organizational collaborations for indicators of leadership relationships. Such a system might include a dashboard interface that provides outputs to collaborators or external managers which enable them to recognize emergent patterns of influence. Moreover, as technology evolves to support new forms of collaboration, teams are increasingly relying on these new technologies to team up with other teams to solve large-scale collective challenges. For example, many collectives rely heavily on cloud file-sharing (e.g. Dropbox, Microsoft SharePoint), real-time virtual collaboration tools (e.g. Google Docs, Git), and computer-mediated communication platforms (e.g. Skype, GroupMe). These tools leave behind a rich pool of digital trace data that can be analyzed using text-analytic approaches. This study demonstrates that these digital traces hold the potential to reveal the emergence of leadership processes.

## Limitations

As is the case in any program of research, this study has limitations, some of which open up avenues for future inquiry. For example, a key limitation of the current study is the use of a student sample engaged in a low-stakes and short-term laboratory task. This approach may limit the generalizability of the findings to ‘real-world’ organizations and MTSs. Certainly, leadership and multiteam collaboration may operate somewhat differently in longer-term organizational systems. For example, in many MTSs, individuals are vested with different amounts of power or authority. Individuals’ positions in formal organizational hierarchies are likely to impact how and why they engage in leadership claiming and granting behaviors. Similarly, occupying positions of authority may alter the word choices that indicate the emergence of leadership. Gilbert’s (2012) finding that emails sent vertically, horizontally, or downward through organizational hierarchies exhibit different patterns of words and phrasing, suggests this might be the case.

Arguably, the Project BLUE laboratory task provided a number of benefits. For example, this platform was designed to model features of many ‘real-world’ systems including teams with different organizational memberships, expertise, and priorities, and it provided an opportunity to observe all interactions across teams throughout the duration of their collaboration as a MTS. However, future research is needed to verify the impact of team priorities on leadership emergence in other samples.

Another limitation of the present study is the relatively limited ability of the semantic analysis program to extract semantic meaning in members’ interteam chat messages. The LIWC program, which counts the number of words from internal or user-defined dictionaries contained in a body of text, provides only a high-level depiction of the types of interactions that occurred across teams. Although this program was sufficient for investigating the hypotheses posed by this dissertation, future research is needed that uses more advanced semantic analysis approaches that afford more detailed investigation into the communication patterns related to leadership.

Another potential limitation of the current study is the measurement of leadership relationships. The items used in this study to represent leadership claiming and granting: “who did you provide leadership to?” and “who do you rely on for leadership?”

respectively, provided only a limited view of a complex and dynamic phenomenon that might exist without the participants' explicit acknowledgement of its presence. For example, some leadership scholars maintain that leadership 'exists' when, through social processes, two or more people have established agreement on a collective goal, aligned their efforts in pursuit of the goal, and have committed to pursuing the goal (Drath et al., 2008). Through this lens, participants in leadership may engage in processes that lead to direction, alignment, and commitment prior to developing an understanding that influence transpired between them. This is akin to Kozlowski and colleagues' (2013) argument that teams researchers have primarily studied emergent phenomena 'after the fact' (Kozlowski, Chao, Grand, Braun, & Kuljanin, 2013). That is, organizational psychologists have typically sought to measure emergent phenomena after they have become ostensively recognizable to members and thus reliably ratable constructs (Carter, Carter, & DeChurch, in press). Future research should continue to explore the dynamic patterns of interactions that constitute the phenomenon of leadership—potentially leveraging more fine-grained communication data than that explored in the current study.

## Conclusion

In conclusion, this dissertation demonstrated that leadership claiming and granting processes between teams in MTSs, which form the basis of collective action (Johnson & Johnson, 2006), are predictable given an understanding of the patterns of motivations within component teams. I elaborated the new concept of team priorities in the MTS research domain, and thus, provided a more accurate depiction of the complexities of these collectives than has been discussed previously. Finally, by leveraging a social network approach to conceptualizing and evaluating leadership emergence, this dissertation advanced a new paradigm and a methodological approach with which to identify the antecedents of *leadership systems*.

# APPENDIX A

## MEASURES COLLECTED IN ADDITION TO FOCAL STUDY CONSTRUCTS

| **Construct** | **# of Items** | **Sample Item** | **Reference** |
|---|---|---|---|
| *Demographics and individual differences* | | | |
| Gender | 1 | What is your gender? | Created for this study |
| Class Year | 1 | Which of the following describes your class year? | Created for this study |
| Ethnicity | 1 | What is your ethnicity/cultural background? | Created for this study |
| First Language | 1 | Is English your first language? | Created for this study |
| Other Languages | 1 | What languages other than English do you speak? | Created for this study |
| Major | 1 | What is your major/prior formal training? | Created for this study |
| GPA | 1 | What is your current college GPA? | Created for this study |
| Psychological Collectivism | 15 | I preferred to work in those groups rather than working alone. | Jackson, Colquitt, Wesson, & Zapata-Phelan (2006) |
| Motivation to Lead | 27 | Most of the time, I prefer being a leader rather than a follower when working in a group. | Chan & Drasgow (2001) |
| Goal Orientation | 13 | I am willing to select a challenging work assignment that I can learn a lot from. | VanDewalle (1997) |
| Generalized Self-Efficacy | 8 | I will be able to achieve most of the goals that I have set for myself. | Chen, Gully, & Eden (2001) |
| Political Skill | 6 | I understand people very well. | Ferris et al. (2005) |
| Locus of Control | 29 | Children get into trouble because their parents punish them too much. | Rotter (1966) |

| | | | |
|---|---|---|---|
| Personality: Big 5 | 60 | I am not a worrier. | NEO-FFI (short-form). Psychological Assessment Resources (1991). |
| Negative and Positive Affectivity | 20 | Choose the response that best describes how you generally feel. | Watson, Clark, & Tellegen (1988). |
| Five-Factor Narcissism | 60 | I am extremely ambitious. | Glover, Miller, Lynam, Crego, & Widiger (2012) |
| Adaptability | 30 | I believe it is important to be flexible in dealing with others. | Ployhart & Bliese (2006) |
| *Self-report measures of psychological states, team processes, and networked relationships* | | | |
| Task Comprehension | 30 | Training comprehension scores | Created for this study |
| Goal Difficulty | 4 | This goal will be difficult to meet | Hollenbeck, Klein, O'Leary, & Wright (1989) |
| Task Interdependence Within Own Team and With Other teams | 4-item measures | I needed information from my team members to perform my task well | van der Vegt et al., 1998 |
| Goal Interdependence Within Own Team and With Other teams | 3-item measures | If my team members attained their goals, it would facilitate goal attainment for me. | van der Vegt et al., 1998 |
| Goal Commitment | 14 | I am strongly committed to pursuing this goal. | Hollenbeck, Klein, O'Leary, & Wright (1989) |
| Team Entitativity | 3 | I perceive myself as a member of this team. | Castano et al. (2003) |
| Team Identity | 1 | Select the picture that best describes your relationship with your team. | Hinds & Mortensen (2005) |
| Competition (within team/between) | 2 | How competitive was the situation between members of your own group? | |
| Team/MTS Cohesion | 2, 6-item measures | Our team/Project BLUE taskforce has a unified vision for what we should do. | Powers (2012) |
| Motivation to Work on behalf of Self/Team/MTS | 3, 3-item measures | I am motivated to go above and beyond what is required to fulfill my duties/help my team/help my Project BLUE taskforce | Created for this study |
| Task-Specific Self-Efficacy, Team Collective Efficacy, and MTS Collective Efficacy | 3, 6-item measures | I will be able to achieve most of the goals involved in my role as the Hydrogeologist; My team/ Project BLUE | Chen, Gully, & Eden (2001). |

| | | | |
|---|---|---|---|
| | | taskforce will be able to achieve most of our goals. | |
| Team Transactive Memory System | 11 | My team has a good "map" of each other's talents and skills. | Faraj & Sproull (2000). |
| Shared Team Leadership | 9 | To what degree did your team share in planning how the work gets done. | Hiller, Day, & Vance (2000) |
| Shared Between-Team Context | 4 | How frequently does your team experience the following issues in attempting to coordinate work with other teams in the Project BLUE task force: Different teams having different priorities | Hinds & Mortensen (2005) |
| Socio-Cognitive Structures | 12 | Of the following people, who does the Hydrogeologist enjoy working with? | Created for this study |
| Functional Leadership Behavior Networks (Energizing; Direction-Setting; Coordination; Positive Atmosphere; External Representation) | 5 | Who on the list: energizes you to work on the team? sets directions for your work on the team? coordinates your actions with other members of the team? helps create a positive team atmosphere? represents your team to people who are external to your team? | Created for this study; developed based on Yukl (2013) leadership functions |
| Trust Network | 1 | Who on this list do you trust? | Created for this study |
| Socialization Network | 1 | Who on this list did you find yourself wanting to chat with? | Created for this study |
| Hindrance Network | 1 | Who on the list made it difficult for you to carry out your responsibilities? | Created for this study |
| Advice Network | 1 | Who on the list did you go to for information or assistance during the task? | Created for this study |
| Common View of the Task Network | 1 | Who shares your view of how to complete the task? | Created for this study |
| Information Sharing Network | 1 | Who is a valuable source of information? | Created for this study |
| Social Status Network Within Team; Across MTS | 2 | Who has high status in: your team? your Project BLUE task force? | Created for this study |

| | | | |
|---|---|---|---|
| Team/MTS Viability | 2, 4-item measures | I really enjoyed being part of this team/Project BLUE task force. | Reisck et al. (2010) |
| Team/MTS Satisfaction | 2, 3-item measures | I am satisfied with my teammates/ Project BLUE task force members. | Gladstein (1984) |
| Prior relationships | 1 | Who did you know before this experiment? | Created for this study |

# APPENDIX B

# DESCRIPTIVE INDICES AND TESTS OF BETWEEN-TEAM DIFFERENCES FOR EMERGENT TEAM AND MULTITEAM STATES

This appendix reports the means and standard deviations for self-report measures of psychological states assessed at the end of the team decision-making activity, at the midpoint of the MTS decision-making activity, and at the final measurement point for each type of team, as well as the scale reliabilities (coefficient alphas) for each scale. This table also reports the results of one-way ANOVA tests of between-team differences for each scale. The results of these analyses suggest that after the team decision-making activity, members of team-focused teams (i.e., Construction, Engineering) tended to report higher levels of team trust, team entitativity, motivation, shared team leadership, shared team process, and collective efficacy as compared to the teams that did not prioritize their own team-level goal. However, at later measurement occasions, there were not significant between-team differences in these states.

| | | | Const. Teams $_a$ | Eng. Teams $_b$ | V.C. Teams $_c$ | Geo. Teams $_d$ | |
|---|---|---|---|---|---|---|---|
| | α | *rwg* | *M(SD)* | *M(SD)* | *M(SD)* | *M(SD)* | *F(df)* |
| Pre-measure (T1) | | | | | | | |
| Commitment to Team Priority | .77 | .92 | $3.42_c$ (.58) | $3.64_d$ (.56) | $3.79_{a,d}$ (.58) | $3.29_{b,c}$ (.63) | 9.87(3, 260)** |
| Team Entitativity | .87 | .93 | 3.98(.52) | 4.02(.45) | 3.86(.56) | 3.80(.67) | 2.11(3, 257)$^{\dagger}$ |
| Team Trust | .93 | .92 | $4.04_d$ (.60) | $3.98_d$ (.52) | $4.06_d$ (.60) | $3.70_{a,b,c}$ (.64) | 5.14(3, 257)** |
| Team Cohesion | .94 | .94 | $4.39_c$ (.57) | $4.36_c$ (.49) | $4.08_{a,b}$ (.51) | 4.20(.55) | 4.92(3, 257)** |
| Task Self Efficacy | .94 | .93 | $3.90_d$ (.52) | $3.98_d$ (.46) | $4.04_d$ (.56) | $3.59_{a,b,c}$ (.54) | 9.57(3, 257)** |
| Task Collective Efficacy | .96 | .95 | $4.10_d$ (.47) | $4.19_d$ (.47) | $4.19_d$ (.52) | $3.84_{a,b,c}$ (.51) | 7.41(3, 257)** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Shared Team Leadership | .95 | .93 | $4.17_{d}$ (.59) | $4.17_{d}$ (.52) | $4.29_{d}$ (.41) | $3.93_{a,b,c}$ (.60) | 5.15(3, 257)** |
| Shared Team Process | .93 | .96 | $3.38_{d}$ (.48) | $3.36_{d}$ (.44) | $3.39_{d}$ (.47) | $3.15_{a,b,c}$ (.46) | 3.99(3, 257)** |
| MTS Midpoint (T2) | | | | | | | |
| Commitment to Team Priority | .93 | .97 | $2.93_{c}$ (.39) | 3.10(.29) | $3.17_{a}$ (.35) | 2.95(.47) | 3.16(3, 139)* |
| Team Entitativity | .98 | .91 | 4.11(.60) | 4.14(.64) | 4.09(.51) | 4.01(.67) | 0.53(3, 238) |
| Team Trust | .98 | .91 | 4.10(.57) | 4.10(.63) | 3.96(.74) | 3.89(.66) | 1.68(3, 238) |
| Team Cohesion | .99 | .90 | 4.43(.54) | 4.24(.61) | 4.16(.78) | 4.17(.74) | 2.07(3, 238)$^{\dagger}$ |
| MTS Cohesion | .96 | .86 | 3.23(.81) | 3.08(.71) | 3.25(.84) | 3.39(.73) | 1.62(3, 238) |
| Task Self Efficacy | .98 | .89 | 3.93(.68) | 3.88(.71) | 3.76(.74) | 3.69(.67) | 1.53(3, 238) |
| Team Collective Efficacy | .96 | .92 | 4.08(.56) | 3.96(.66) | 3.88(.69) | 4.04(.51) | 1.20(3, 238) |
| MTS Collective Efficacy | .97 | .85 | 3.59(.78) | 3.33(1.10) | 3.20(1.18) | 3.32(.79) | 1.68(3, 238) |
| Shared Team Process | .98 | .93 | 3.30(.46) | 3.25(.48) | 3.16(.74) | 3.12(.43) | 0.74(3, 238) |
| Negative Bet-Team Context | .92 | .81 | 3.32(.88) | $3.56_{c}$ (.79) | $2.97_{b}$ (1.23) | 3.17(1.13) | 3.63(3, 245)* |
| MTS Final Time Point (T3) | | | | | | | |
| Team Trust | .95 | .89 | 4.06(.83) | 4.14(.63) | 4.10(.51) | 4.00(.67) | 0.55(3, 257) |
| Team Cohesion | .97 | .92 | 3.89(.94) | 3.87(.81) | 3.81(.68) | 3.78(.73) | 0.31(3, 25) |
| MTS Cohesion | .92 | .88 | 3.31(.85) | 3.25(.64) | 3.28(.81) | 3.33(.65) | 0.14(3, 257) |
| Negative Between-Team Context | .90 | .82 | 3.56(1.03) | 3.63(.83) | 3.67(.83) | 3.41(.90) | 1.02(3, 257) |
| Team Satisfaction | .97 | .90 | 4.24(.81) | 4.27(.74) | 4.26(.61) | 4.23(.62) | 0.04(3, 257) |
| MTS Satisfaction | .98 | .82 | $3.09_{d}$ (1.11) | 3.23(.99) | $3.35_{a}$ (.95) | 3.51(.93) | 2.08(3, 257)$^{\dagger}$ |

Note. $^{\dagger}$ $p < .10$; * $p < .05$; ** $p < .01$; $n = 264$ individuals assembled into 22 MTSs composed of 4, 3-member teams; Subscript indicates mean is significantly different from (a) Construction team mean, (b) Engineering team mean, (c) Village Council team mean, or (d) Geology team mean.

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