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2007

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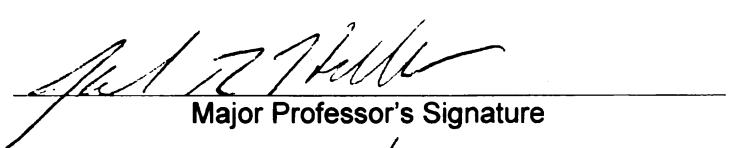
NEW FINDINGS IN VIRTUAL TEAM LEADERSHIP

presented by

ALEX J. BARELKA

has been accepted towards fulfillment
of the requirements for the

Ph.D. degree in Management



Major Professor's Signature

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NEW FINDINGS IN VIRTUAL TEAM LEADERSHIP

By

Alex J. Barelka

A DISSERTATION

Submitted to
Michigan State University
In partial fulfillment of the requirements
For the degree of

DOCTOR OF PHILOSOPHY

Department of Management

2007

ABSTRACT

NEW FINDINGS IN VIRTUAL TEAM LEADERSHIP

By

Alex J. Barelka

This study examines the impact different virtual team structural configurations, leadership style training sessions, and task complexity can have on team performance outcomes. To date, most studies that have examined leadership style and performance outcomes have been performed in a collocated context. These studies have shown that teams whose leader exhibits a transformational leadership style typically outperforms teams whose leader use transactional style. However, this study predicted that when all the team members are virtually connected by computer mediated communication systems a transformational leadership style will not be preferable. Specifically, it suggests that different team structural configurations, leadership styles and task complexity will impact the communication quantity, quality and leader centrality. These mediators will then impact team performance and affective reactions (as operationalized in terms of satisfaction with the team and leader).

ACKNOWLEDGEMENTS

I would first like to thank my wife and daughter for putting up with the long days, late nights, and non-existent weekends. Next I would like to thank my office mate Dr. Michael Johnson for answering all of my questions and listening to the constant complaining. I would also like to thank Dr. Daniel Ilgen and Dr. John Hollenbeck for providing access to the Team Effectiveness Laboratory and Dr. Fred Morgeson for taking the time to be part of my committee. Finally, I would like to thank Dr. Cheri Speier and Dr. Vernon Miller for listening to me describe the issues I faced while completing this study and providing excellent instruction and guidance on how to address them. I would also like to thank the professors and teaching assistants who provide all the subjects for this study.

The views expressed in this dissertation are those of the author and do not reflect the official policy or position of the United States Air Force, Department of Defense, or the United States Government.

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INTRODUCTION

Teams have become increasingly important in recent years due to a shift in the 1980's and 90's towards organizing around large clusters of tasks. This shift has occurred as organizations recognize that teams are well suited to respond to the changing business landscape. Increased global competition, consolidation, and innovation are driving a need for diverse skills, expertise, and experience. Teams are now being recognized as structures which are capable of providing the flexible and adaptive responses necessary to meet these new pressures (Kozlowski & Bell, 2003).

In an attempt to make teams even more relevant in today business environment, advanced communication systems are employed to more effectively and efficiently form and manage them. Information Technology (IT) has enabled work teams to migrate from the face-to-face to the virtual world and allow its members the flexibility of participating in several new arrangements including video teleconferences, e-mail, and mobile cellular phone conversations. Teams using this technology are no longer constrained by their physical location but can exist over vast distances (Lipnack & Stamps, 1997). In the past, members of a team had to be relatively collocated to work together but the flexibility that modern communications system offer allows groups to exist in multiple locations while still conforming to the basic attributes and principles of a team.

Such teams have several advantages over more traditional collocated organizational structures including (a) increasing the amount of potential knowledge available (Sanders, 2000), (b) providing more immediate feedback to management and other team members (Opper & Fersko-Weiss, 1992), (c) saving money on travel costs, and (d) establishing a "relay race" based work routine pattern (Cascio, 1999). Such a

"relay race" allows teams to hand-off a days work to another team in another time zone who have just begun their day. Once the second group finishes their day they hand-off their work to yet another team. This cycle repeats until the output of one team is the input of the original team. This continuous cycle can go on indefinitely allowing organizations to develop what has been referred to as software shift work (Gorton & Motwani, 1996).

Virtual teams also give organizations the added flexibility of bringing together the best and brightest people they have to work on a particular problem in a comparatively inexpensive and quick manner, rather than being restricted to only utilizing people that are employed at a particular geographical location (Townsend, DeMarie, & Hendrickson, 1998). Obviously, this becomes even more important to large organizations that are international or have many divisions spread over multiple time zones, countries, or even continents. This additional flexibility might function as a proxy or surrogate for the flexibility enjoyed by smaller, more agile firms. However, it might also allow these smaller firms to take advantage of the global marketplace by making it easier to integrate temporary or outsourced employees from outside their firms or stakeholders not collocated.

These technologies can also impact team processes. These effects can either be drastic such as when traditional team structures are fully supplanted by virtual teaming arrangements or they can be more modest such as when voice or e-mail are integrated into existing work patterns and routines. In the former, the use of information technology is critical to the existence of the team itself while in the later information technology might simply be regarded as a mechanism that allow traditional teams to extend their

productivity and/or reach. Regardless of the final effect, team leaders need to understand how to react and perform given the new and unique challenges they face as a result of such shifts in their setting and environment (Bell & Kozlowski, 2002). Complicating this situation is the fact that innumerable combinations of virtual team structures can exist.

Most research on virtual teams has almost exclusively treated spatial distance as a dichotomous variable. However, this might be considered a simplistic assumption (Kirkman, Rosen, Tesluk, & Gibson, 2004; Mortensen & Hinds, 2001). Many times, variation in the spatial distance between team members exists. Specifically, an increasingly larger percentage of teams are structured such that some team members are collocated (i.e., located at the same worksite), whereas others are distributed at various locations (Burke, Aytes, Chidambaram, & Johnson, 1999). Such a team structure as this can be thought of as a partially distributed team (PDT) or a team with an intermediate level of collocatedness. At the very minimum, a team in which one team member telecommutes from home could be labeled a PDT. More broadly, PDTs are likely to occur in organizations comprised of autonomous groups, (Allred, Snow, & Miles, 1996), as sets of team members span cells, and joint ventures or partnerships (Townsend, DeMarie, & Hendrickson, 1998), as each company provides a set of individuals for the team.

In 2001, nearly 28 million Americans utilized a distributed work setting and most of these were arrayed in some form of a PDT (Davis & Polonko, 2001). Yet, as prevalent as PDTs are, there has been very little research conducted that examines them. For leadership researchers this deficit can be particularly troubling given that there are

differences between PDTs and collocated teams (CTs) or even virtual teams (VTs) that could impact team leadership processes. For example, one major difference is that in a PDT, there can be large differences in the physical proximity between specific subsets of the team. The existence of these subsets might lead to the formation of subgroups each with separate group identities (Armstrong & Cole, 2002; Cramton, 2002; Humphrey, 2003). The development and strength of these subgroups might then impact the level of leader centrality inside each of these teams. Thus the purpose of this paper is to examine the impact of leadership styles, specifically, transformational and transactional leadership in teams that operate in collocated environment versus two other configurations of a virtual team.

In order to understand leadership in a virtual team, I feel there are three dimensions, or independent variables, that must be considered. First, it is important for leaders to understand how a change in collocatedness might impact team processes. For this study three different structures will be examined, a fully collocated structure, a fully virtual structure, and a partially distributed structure. To date, no single study has simultaneously examined all three of these structures so the insights gleaned from directly comparing and contrasting these different structures should be valuable. Second, it is important to consider different types of leadership. There are several different conceptualizations of leadership today but this study will focus on what is perhaps currently the most popular paradigm in the leadership literature and the one which is thought to be the most visibly influenced by in the introduction of virtual nodes into a team. This is the full range leadership model which includes both transactional and transformational leadership behaviors. Finally, it is also important to understand how

perceived leadership effectiveness in a virtual team might change based on the task complexity. For several decades the contingency perspective of leadership has shown that the environment and contextual variables within it play an important role in leadership (T. Burns & Stalker, 1961; Leavitt, 1951). It is important for those who are selected to be virtual leaders to understand how such variables might impact a virtual team so that they can operate in it as effectively as possible. It will later be proposed that each of these dimensions impacts both communication processes in the form of quality and quantity as well as leadership process. Further, it will be proposed that each of these constructs has a relationship with both performance and affective components of effectiveness.

In summary, this paper proposes that the outcomes of team performance and affective reactions (as operationalized in terms of satisfaction with the team and leader) are, in part, determined by three factors. First, it will describe the role of co-locatedness, highlighting the distinguishing feature of three different configurations including (a) face-to-face, where all of the team members are collocated, (b) totally distributed, where none of the members are collocated, and (c) a "reachback" a condition where all of the team members are co-located except the leader. Second, it will examine the role of transformational and transactional leadership styles and how they are effected by the nature of the co-locatedness. Finally, it will also examine the impact of complexity on leadership styles inside both collocated and virtual team configurations. The general proposition that will be examined in the proposed study is that these three features of the team influence performance and satisfaction because of the impact they have on communication quantity, communication quality, and the centrality of the leader in the

communication network. This conceptualization of team leadership maps very closely to the IPO model of teams popularized by McGrath and Hackman (Hackman, 1987). For example, the independent variables of structure, leadership style, and task environment can be considered input to the model while the mediators of communication and leader centrality can be considered processes within the team. Finally, the decomposed aspects of effectiveness selected provide a rich conceptualization of team output. Therefore, it is thought that an examination of these constructs will provide a rich and comprehensive window into virtual team leadership. Figure 1 below provides an overview of the general model guiding this research.

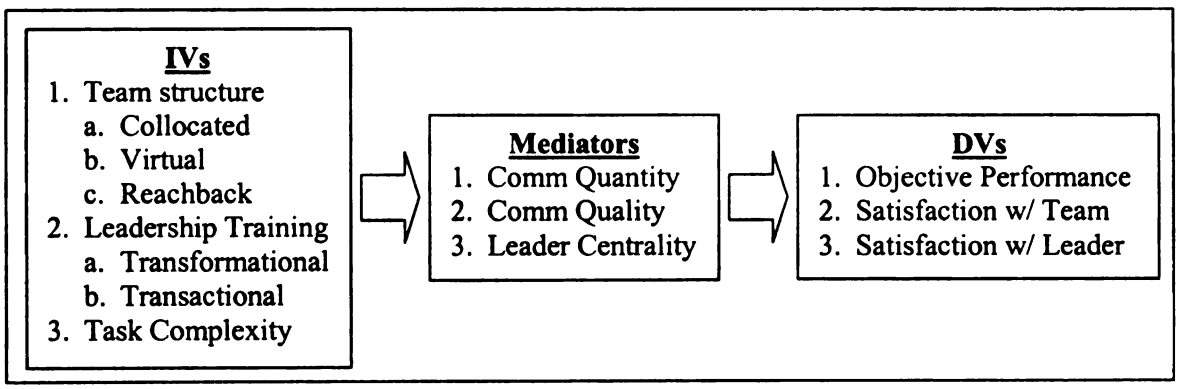


Figure 1. Basic model

Virtual Teams Leadership Literature

Given the ubiquity and ever growing popularity of virtual teams, it is surprising to learn that only a handful of studies have examined leadership within these structures especially given the major impact a shift from collocated teams to a virtual arrangement can have on leadership (Zigurs, 2003). This is an important topic to examine since as one executive has expressed, "The number one key success factor for virtual teams is strong leadership" (Blackburn, Furst, & Rosen, 2003, p. 102).

While a few articles have been written to date about leadership and virtual teams, most of them are seemingly intended for the practitioner (Avolio & Kahai, 2003; Cascio & Shurygailo, 2003; Zaccaro & Bader, 2003; Zigurs, 2003). Such research typically explains obvious differences between virtual and traditional collocated teams, providing general guidance on how negative issues associated with these differences can be minimized and how any new opportunities that technology may provide to such teaming arrangements can be maximized. For example, these articles suggest leaders build trust, clearly communicate their intent, and use a balance of new and old technology to lead. Unfortunately, most of the guidance provided in these articles is high level and might be considered common sense by those who are already accustomed to working with technology and people. Although this literature is important to new virtual team leaders, it does not provide much new insights or do much to further our understanding regarding how leadership can develop and mature in a virtual world.

Other studies have attempted to use more of a theory building (Bourgeois, 1979) approach to not only review and apply theoretical and empirical literature to the existing question of virtual team leadership but also to construct a new theory from this empirical base and then extend it into a set of propositions using deduction. However, this research has also only provided heuristics or high level guidance to overcome many of the innate challenges of leading a virtual team (Avolio & Kahai, 2003; Avolio, Kahai, & Dodge, 2001; Bell & Kozlowski, 2002; Gretchen M. Spreitzer, 2003). For example, conclusions in this type of research are that high levels of trust, media richness and leadership processes lead to positive team outcomes. Although this literature provides virtual team leadership theories that are more grounded to previous research, it still does not provide

many new insights or revelations regarding why leading a virtual team might be different than leading a collocated team.

Perhaps the most compelling research that has examined virtual team leadership are the empirical studies which have either used deductive strategies based on previous literature to develop conceptual ideas that suggest how virtual team leaders might increase effectiveness and test these notions using case studies and survey data, or inductive strategies which form theories after an examination of the data. The ideas that have been presented in these studies have all assumed that potential differences between leadership in a virtual and traditional teams can be moderated by the judicious application of leadership behaviors previously tested to show their efficacy (Kayworth & Leidner, 2001; Lee-Kelley, 2002; Pauleen, 2003, 2004). However, assuming that leadership behaviors which work in a collocated environment have the same impact in the virtual word might be a simplistic viewpoint given that "research suggests that virtual team members cannot rely on simply transferring their behavior in traditional teams and expect to be successful in virtual environments." (Zigurs, 2003, p. 341).

Another potential gap in the literature is that the few studies which have examined leadership in computer mediated environments have used technologies or tasks that are commonly associated with virtual teams. For example, Hoyt and Blascovich (2003) examined the impact a virtual reality simulator can have on leadership. This is admittedly an interesting technology to study but it does not represent the predominate form of asynchronous communication typically used virtual teams (Tyran, Tyran, & Shepherd, 2003) or even simple voice based communication. Similarly, there are a few studies which consider the effects of different leadership styles when using group

decision making software systems (GDSS) (Kahai & Cooper, 1999; Kahai, Sosik, & Avolio, 1997, 2003, 2004; Sosik, Avolio, & Kahai, 1997; Sosik, Avolio, Kahai, & Jung, 1998; Sosik, Kahai, & Avolio, 1998). Again, while this might be an interesting context to study, the use of a single idea generation task does not allow for much task interdependence. As a result it is difficult to classify such studies as teams related research (Goodman, Ravlin, & Schmike, 1987).

Further, few studies to date have examined the effects of partially distributed teams and none have examined their impact on leadership. These types of teams exhibit different types of communication patterns (D. Cohen & Prusak, 2001; Walther, 1995), and patterns of contact (Kiesler & Cummings, 2002; Kraut, Fussell, Brennan, & Siegel, 2002) but since structure has not been manipulated in these groups, little knowledge regarding the differential effects of virtualness has been gained.

Finally, many of the studies that have examined leadership in virtual teams have, much like most any other leadership study, focused only on correlations or relationships but have not examined the underlying causes or mediators that connect these phenomena to outcomes. This study will attempt to develop a theory of leadership inside virtual teams using communication process and leadership variables to connect the structure of a virtual team with team effectiveness in an attempt to explain why leadership impacts situations rather than simply detailing the existence of an impact.

One of the interesting ramifications of this paper is to introduce the idea that leadership behaviors and traits which have proven highly effective in a collocated environment might not have the same effect in a virtual environment. That is, the nature of perceptual experience associated with face-to-face leadership versus virtual leadership

can be quite different, and hence different standards may apply in terms of predicting the relationship between various leader behaviors, styles, or traits on the one hand and outcomes on the other. In fact, recent research has unexpectedly found that leadership behaviors and traits which are known to be effective in collocated environments sometimes are not the most effective the virtual world, therefore, a complete theory which explains why this might be true is required (Balthazard, Potter, & Warren, 2004; Hoyt & Blascovich, 2003).

Literatures examined

There are several literatures that this paper will attempt to unite in order to explain the impact of the collocatedness on leadership, team processes, and team effectiveness. First, the literature that examines media effects will be used to better understand the impact of different structural configurations on the team. This literature relies heavily on communication process so that will be a major focus of this part of the paper. Second, the literature on task complexity will be examined to determine its potential impact on communication processes. Specifically, the potential relationship between task complexity and communication processes will be examined. Next, the leadership literature will be examined to help understand what type of impact a structural change might have on communication outcomes. Here, the impact of transformational and transactional leadership behaviors on communication outcomes will be examined. Transformational leadership can be considered a neo-classical form of charismatic leadership which incorporates many of the previous conceptualizations of leadership (Yukl, 1998). In contrast, transactional leadership, is a more ordered and structured approach that builds on rewards. The voluminous research that has examined both of these approaches has concluded that the transformational approach is typically more

desirable (Bass, Avolio, & Goodheim, 1987; Deluga, 1988; Dumdum, Lowe, & Avolio, 2002; House, Woycke, & Fodor, 1988; Keller, 1992; Lowe, Kroeck, & Sivasubramaniam, 1996; Seltzer & Bass, 1990; Waldman, Bass, & Einstein, 1987; Waldman, Bass, & Yammarino, 1990; Yammarino & Bass, 1990). However, in the virtual environment, leaders and followers are no longer able to freely communicate face-to-face thus lost are a multitude of natural communication signals, cues, and associated processes that are important to this leadership process (Gitter, Black, & Fishman, 1975; Gitter, Black, & Goldman, 1975; Gitter, Black, & Walkley, 1976; Masters & Sullivan, 1989; Masters, Sullivan, Lanzetta, McHugo, & et al., 1986; Pauleen, 2003). This especially weighs heavily on the transformational leadership style given that so much of this style is based on the ability to communicate using non-verbal behavior (Sashkin, 2004). Therefore, this paper suggests that given the communication restrictions between virtual team members, the behaviors associated with a transactional leadership style are preferable and should lead to higher team effectiveness as compared to when a transformational style is employed. This is not to say that high quality transactional leaders somehow become more effective in a virtual environment but simply that the natural communication channels that a transformational leader relies on are unavailable in such a setting and thus render this approach much less effective for them.

It is important to understand that this theory is not intended to be an indictment of the transformation style. It is fully recognized that in many situations the transformation style will still be preferable. The presented theory is merely an attempt to develop more of a balance within the leadership literature and continue to point out that in some

situations the behaviors consistent with the transactional style might still have merit and should not be forgotten (Judge, Piccolo, & Ilies, 2004).

In addition to the potential impact that each of these antecedents might have on communication outcomes, their impact on leadership centrality will also be examined. Centrality relates to the number of connections an individual has within a social network (Klein, Lim, Saltz, & Mayer, 2004). As such, it reflects the extent to which interactions are concentrated in certain individuals rather than distributed equally among all members (Sparrowe, Liden, Wayne, & Kraimer, 2001). Individuals who are perceived to have a high amount of centrality are viewed as being more influential (Brass, 1984). This literature will be combined with diversity studies to better understand how structural changes, leadership behaviors and task environment might impact this construct.

Contributions

It is hoped that this paper will make at least four major contributions to the existing literature. First, it will investigate the implications of different types of virtual structure on effectiveness. Instead of testing a single static virtual team configuration, the level of collocatedness will be defined and varied during the experiment. Second, it will examine the impact of the task complexity in both collocated and virtual team configurations. Third, it will examine what impact different types of leadership behavior can have on effectiveness. Finally, interactions between each of these dimensions will be examined. It is hoped that all of this will presented a rich and comprehensive picture of virtual team leadership.

Another interesting aspect of this study is that it will be performed as an experiment using a real time virtual team task using technology more associated with

virtual teams. Instead of using a GDSS task or virtual reality technology, this experiment will use a real time, multi-player, military command and control simulation.

CHAPTER 1 - DIRECT EFFECTS

In the proposed model three independent variables have a relationship with three different mediators which in turn are predicted to have a relationship with three outcome variables. The three independent variables are structure, leadership style, and task complexity. The three mediators are communication quantity, communication quality, and leadership centrality. Finally, the three dependent variables are objective performance, team satisfaction, and leader satisfaction. Each of these constructs will be presented below and then linked using specific hypotheses.

Teams

There are several definitions of what a team is but a fair amount of emerging literature on this subject tends to focus on a few common themes (Kozlowski & Bell, 2003). First, a team exists to perform organizationally relevant tasks. This implies that instead of existing as a stand alone entity, teams function within a larger organizational context which sets the boundaries between teams and constrains their action. Second, teams share one or more common goals. This suggests that team members work towards a common purpose rather then each working on divergent and unconnected tasks. Third, teams interact socially which has the potential to either improve or disrupt the processes that exist inside them. For example, social interaction allows teams to learn or become more cohesive, yet it also provides opportunities for conflict to emerge. Fourth, a team exhibits task interdependencies such as work flows, goals, and outcomes. Some feel that it is this important characteristic which separates teams from simple groups (Goodman, Ravlin, & Schmike, 1987).

In an attempt to better define the boundaries of such arrangements, and emphasize the teaming structures being examined, this research also includes the concepts of task

interdependence and goal orientation as part of this definition (Ilgen, Major, Hollenbeck, & Sego, 1993). Task interdependence stresses that the work teams require the efforts of the entire team and goal orientation implies that team members have a focused purpose. Further, this paper concentrates on teams that are project or deliverable orientated rather than collaboration work groups where information sharing is the ultimate goal (S. G. Cohen & Bailey, 1997). These task orientated teams many times have a hierarchical team structure that helps increase decision making accountability and speed (Humphrey, Hollenbeck, Meyer, & Ilgen, 2002). As a result, this paper only considers teams which have a formal leader rather than a self-managed structure. This is an important distinction when examining leadership in teams since self-managed teams many times tend to have different leadership requirements (Druskat & Wheeler, 2003). In such structures, leaders must pay closer attention to team boundaries and interfaces and requests for information can be initiated and satisfied by team members themselves without a leader present. Further, the mix of different types of coaching that work best in a self-managed team might be different than it is in a traditional teaming arrangement (Morgeson, 2005). Given that the need for leadership is different in these two types of teams, any single study that examines both of them would be expected to obtain different results.

In an attempt to make this investigation even more applicable and interesting it will consider teams which operate in real time situations. Real time situations are defined here as those which unfold unpredictably and require all participants to take immediate action in order to solve the problem. Such a categorization could be considered similar to that of an action team (S. G. Cohen & Bailey, 1997) so long as it is understood that the

team would not necessarily disband after the completion of one task, as action teams many times do, but would continue to exist to solve a number of different issues each related to a larger problem. As a result, the intended lifespan of such a team is what could be thought as the primary differentiator between it and an action team.

Traditionally most studies that have examined teams have focused on collocated structures. In this situation, all team members are geographically collocated with the leader and as a result, everyone in the team is not only able to see and hear everything that is being communicated but also how it is being communicated. For example, they are able to easily perceive and use the non-verbal behaviors important to the communication process. Further, they are able to understand and interpret the emotional content embedded within verbal communication. On the other hand, members of a virtual team use information technology to communicate so they are usually not collocated.

Usually, virtual teams are defined as a team that is (a) geographically distributed to some degree and (b) uses technology as a communications mediation device (Townsend, DeMarie, & Hendrickson, 1998). However, this is a rather vague definition which have lead some researchers to go so far as to propose that all teams possess some type of a virtual component (Griffith, Sawyer, & Neale, 2003; Martins, Gilson, & Maynard, 2004). Therefore, in an attempt to better define the boundaries of such arrangements this paper will define a virtual team as one in which each team member exists in a different geographical location. In other words, the team is considered to be "fully virtual." As a result, team members and leaders are unable to participate in any verbal team communication which makes it much more difficult for them to attach any

emotional content to their messages. Further, even though the predominate form of communication in a virtual team is still based on asynchronous computer mediated communication systems (Tyran, Tyran, & Shepherd, 2003) this study will define it as one in which members can still communicated using voice channels. It is thought that this will remove any potential confounds in the research design between team structure and communication media.

Although this definition is the one that most previous virtual team studies have subscribed to, recent research has begun to attack the notion that virtual teams solely exist in a fully virtual environment. Now, partially distributed teams, or teams that can be part collocated and part virtual are now being investigated.

Structure

New studies have begun to investigate the subtleties associated with how virtual teams structurally differ from traditional teams and each other (Martins, Gilson, & Maynard, 2004). For example, while past research has treated spatial distance inside a virtual team as a dichotomous variable (teams are either fully collocated or fully distributed), Griffith (2003) recently proposed that the amount of team virtualness can be described using three separate dimensions (a) technological support used by the team, (b) the percentage of work that the team does with its members distributed across time or space and (c) the distribution of the physical locations occupied by the team members. With regards to the last dimension, others have investigated the effects of partially distributed virtual teams or teams comprised of nodes. Here, a node is simply a physically separated location that can contain either a collocated group or just a single individual (Burke, Aytes, Chidambaram, & Johnson, 1999; Humphrey, 2003). Examples of teams with different a number of nodes is shown below in Figure 2.

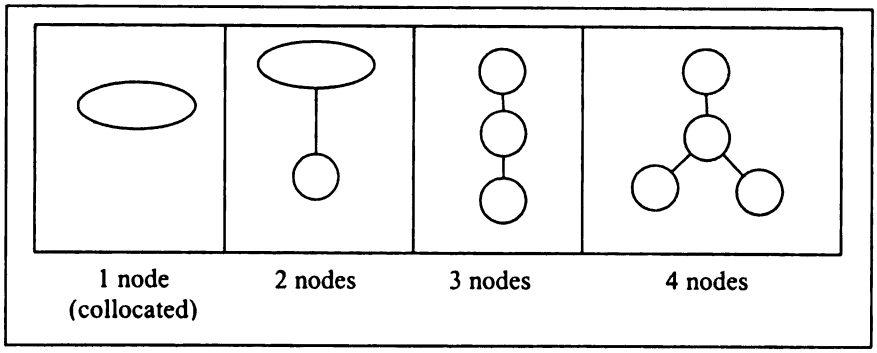


Figure 2. Teams with a different number of nodes

These studies tend to view virtual team structures as forming a continuum between traditional collocated teams that only interact using a face-to-face arrangement and teams that exist solely in the virtual environment where members only communicate via a technical platform. Between these two poles exists any number of partially distributed team configurations (Humphrey, 2003). In an attempt to better define this continuum, this study will focus on fully collocated teams, fully virtual teams, and a 'reachback' configuration.

A reachback structure is a specific type of team configuration that combines both collocated and virtual elements. In this configuration all team members are collocated but the team leader is remote. As a result, all of team members act as a collocated team but the geographically separation of the leader introduces a virtual component to this structure. Therefore, all of the collocated team members are able to participate in the rich communication available to collocated individuals but the leader is restricted only to communicating via voice only. This configuration is based on teams who have a home base for training and administrative purposes but deploy a majority of their action and operational components to a specific area when their services are required. This structure is called a "reachback" configuration because the collocated members of the team must reach back to the home base for leadership or resources. Teams that typically might use

this configuration are those who are able to provide a rapid response to situations but still need leadership from superiors due to dynamic nature of the environment or a need to obtain additional resources. Examples of these teams include military teams, news collection teams, as well as disaster response teams in both the public (e.g. FEMA) and private sector (e.g insurance companies). To realize how important these contexts are you do not have to do anything more then open a newspaper or turn on a television. The recent increase in destruction caused by natural disasters such as hurricanes and tsunamis, as well as countless terrorist attacks coupled with the inability to private and public agencies and leaders to sometimes respond adequately to these situations only underscores how important an examination of leadership is in these contexts. Given the highly interconnected and technological advanced reality we now exist in, it is more important then ever to understand how to lead in these virtual team settings.

Specific to the military, "Reachback" or distributed operations (Colarusso & Trowbridge, 2004), has become an essential component of any current or future deployments. In the military reachback is "the electronic ability to exploit organic and non-organic resources, capabilities and expertise, which by design are not located in-theater" (Neal, 2000). This is not a new concept but today's military is increasing its scope and reach to touch more aspects of warfare. For example, imagery analysts, intelligence experts, sensor operators, and mission planners now no longer need to be deployed together in order to perform their mission as they once did (Colarusso & Trowbridge, 2004). Instead, they can continue to operate as a seamless team in a virtual environment by communicating electronically. Given that Joint Vision 2020 (Defense, 2002) establishes that information superiority will be a key component to winning future

conflicts, a major element of Reachback, "refers to the ability of combat forces to receive intelligence, surveillance, and reconnaissance (ISR) data directly from databases and experts located in the US" (Tirpak, 2000). It is thought that by using such teaming arrangements, the amount of deployed support personnel can be reduced thus allowing whole teams that would have once been deployed into a hostile area to now remain out of harms way and in essence, telecommute to the war. Proponents think that this concept could ultimately lower required troop strengths at forward command posts from 1,500 to about 300 (Tirpak, 2000).

Developing a capability that keeps military personnel from having to deploy not only decreases the disruption created in their lives but also saves money. Already Air Force officials have estimated they have saved between $6M-$15M by not having to forward base a portion of the intelligence assets that help prosecute Operation Enduring Freedom in Afghanistan and Operation Iraq Freedom (Herbert, 2004). This also translates into over 150 transport aircraft flights that did not need to be assigned for this activity and could therefore be applied elsewhere (Colarusso & Trowbridge, 2004).

It is thought that by addressing these types of teams, this paper also responds to the call by several prominent researchers in a recent issue of the Academy of Management Journal (Shapiro & Rynes, 2005) to better unite management scholarship and public policy formation. The two primary problems listed in the introduction to this issue that could have been avoided had management scholarship been better prepared and linked to policy development were the leadership issues associated with the September 11, 2001 attacks and the confusion caused by hurricane Katrina. In both these situations, reachback teams were in heavy use by the Government. A graphical representation of

each of the team configurations that will be examined in this study are provided in Figure 3.

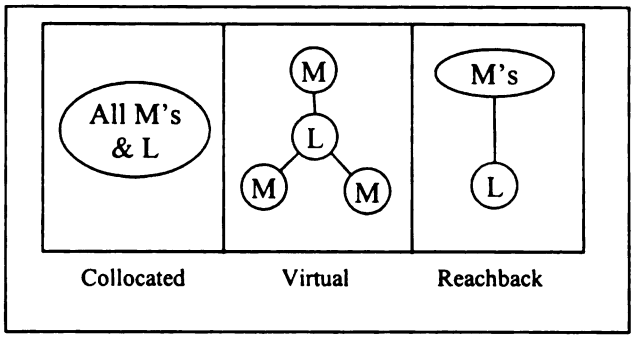


Figure 3. Team structures (M=Members; L = Leader)

Having now explained which structural configurations will be examined in this study, we can now turn our attention to how different structures might impact communication processes within a team.

Communication

Communication is a major behavioral process associated with teams. A recent literature review on teams considers it to be a lens that helps to define the level of coordination and cooperation within a team (Kozlowski & Bell, 2003). To best capture these elements, communication in this study will be conceptualized as both communication quantity and quality.

Communication quantity is a team level construct and is defined as the number of comments that are made during a discrete amount of time. In a collocated team it can be thought of as the number of comments made by the team members and leader. In a reachback team such a count would be added to the number of comments made by, or sent to, the leader electronically. Finally, in a virtual team it could be conceptualized as the number of electronic comments made between all the team members and the leader.

Communication quality can also be thought of as a group level construct (Jablin & Sias, 2001). At this level it is often conceptualized as communication competence or the communication effectiveness of group communication, and as such can be thought of as quality of the interaction between team members. Traditionally, this construct has been examined from both the behavioral or cognitive perspective. Using the behavioral perspective, communication quality can be thought of as the ability of a group to gather, transmit, and interpret information (Jablin, Cude, House, Lee, & Roth, 1994). From the cognitive perspective, communication quality can be viewed as the cognitive resources associated with group rules, structure, culture, and history (Jablin, Cude, House, Lee, & Roth, 1994). Studies that focus on this perspective tend to examine distributed cognitions, group knowledge structures, and transactive memory (Hinsz, Tindale, & Vollrath, 1997; Liang, Moreland, & Argote, 1995; Walsh, 1995). For the purposes of this study both the behavioral and cognitive perspectives will be considered.

Structure and Communication

It is thought that communication outcomes will be impacted by the structural aspects of the team. As teams become more virtual the amount of co-locatedness decreases and the level of computer mediated communication typically increases (Tyran, Tyran, & Shepherd, 2003). As this occurs, all three major theories used to describe the effects of computer mediated communication (media richness theory, social media theory, media naturalness theory) predict that communication processes will be negatively impacted. There are two reasons for this. First, the amount of communication will decrease and second the quality of the communication will decrease.

With regards to communication quantity it is thought that as teams become less collocated and use more computer mediated technology the amount of communication

they engage in will decrease. Several studies have shown that communication quantity is lower in virtual teams compared to a collocated team (Bhappu, Griffith, & Northcraft, 1997; Hiltz, Johnson, & Turoff, 1986; Hollingshead, 1996; Ibarra, 1993; Straus, 1996). The simple explanation for this is that people can not type as fast they can talk. However, it has been shown that even after the natural ability of most to speak faster than they can type has been controlled for, over 10 times as many words are communicated in a face-to-face context than they are in a virtual environment (Kock, 1998). As a result, it is predicted that less communication will occur in a virtual team compared to a collocated team. What is less clear is how much communication occurs in a reachback team compared to a collocated and a virtual team.

As mentioned earlier, a reachback team is one in which all the team members are collocated except for the leader who is remote. Compared to a collocated team, this configuration can be considered to be a collocated structure minus one individual. Given that one person is being removed from the group the number of communication channels or links between the remaining individuals also decreases. In fact, it decreases exponentially based on the number of people in the group (Vavelas, 1950; J. Wofford, Gerloff, & Cummins, 1977). As a result, the overall amount of communication within the group will also decrease. However, this decrease will be partially offset by any comments the leaders make using the computer mediated communication devices present. Yet given that previous research has shown that virtual team members do not communicate as much as collocated team members, it is thought that this offset will not overcome the decrease caused by the structural change. As a result I would expect that a

reachback team would exhibit less communication than a collocated team but more than a virtual team. As a result the following hypotheses are presented.

> H1: Overall team communication quantity will be higher in a collocated team than a reachback team
>
> H2: Overall team communication quantity will be higher in a reachback team than a virtual team

With regards to the quality of communication it has been shown that in a virtual team, members are not able to clearly communicate their ideas, thoughts, or intentions to each other. This leads to a decrease in the level of communication quality or an increase in the level of communication ambiguity. There are two reasons for this. First, computer mediated technology tends to decrease the emotional content of communication. For example, Kahi and Cooper (2003) shows that as media richness decreases so does the level of socio-emotional communication. Second, computer mediated technology tends to decrease non-verbal communication which carries a large amount of the emotional content found in messages. Potential information derived from non-verbal communication such as facial expressions, voice inflections, and gestures are severely retarded or distorted when using computer based communication channels. Communicating via text or audio based media alone does not provide the rich non-verbal behaviors that can be crucial to determining an individuals true feelings (Pauleen, 2003). This has the effect of decreasing social presence, or the amount of communication that is inherent in a collocated environment (Kiesler & Sproull, 1992; Warkentin, Sayeed, & Hightower, 1997).

Further, team members can communicate several messages simply by their physical presence. It has been shown that individuals use physical and linguistic co-

presence to make inferences about each others knowledge and that these inferences have been shown to be antecedents of successful communication (Hollingshead, 1998). Similarly, it has been shown that when conversing electronically it is more difficult for individuals to form impressions of each other since it takes longer to decode social cues (Sproull & Kiesler, 1986; Walther, 1993). Additionally, where they sit, what their appearance is, how many times they arrive early or late to a meeting can all convey different messages (Ferrara, Brunner, & Whittenmore, 1990; Spears & Lea, 1994). In a virtual team most of these signals and cues are lost, as well as the messages that accompany them.

Turning again to a reachback team many of these issues are not thought to be as acute as they are in a virtual team. For example, a reachback team has a significant number of members that are collocated. This allows members to interact face-to-face and increase the overall emotional content of the team communication. Further, since they can see each other they will also be able to use non-verbal behaviors to communicate. Therefore, it is thought that the overall communication quality of a reachback team will be higher than a virtual team but lower than a collocated team.

> H3: Overall team communication quality will be higher in a collocated team than a reachback team

> H4: Overall team communication quality will be higher in a reachback team than a virtual team

The nature of hypotheses 1-4 are plotted in Figure 4.

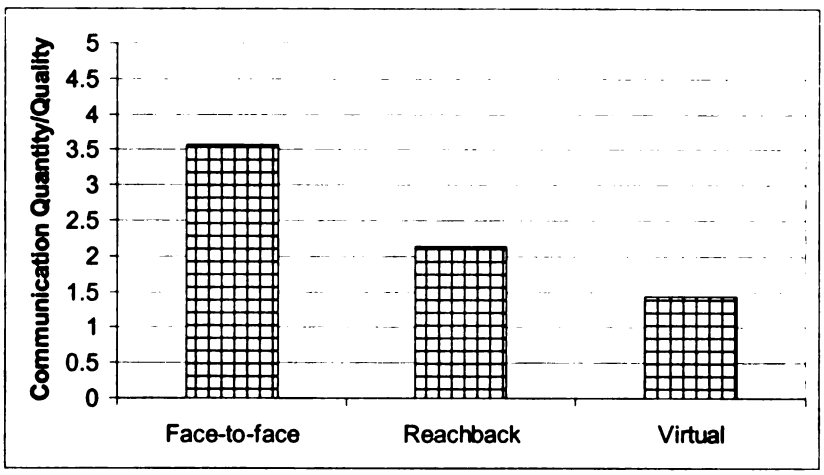


Figure 4. Predicted hypotheses 1-4

Leadership style

Leadership can sometimes be a difficult concept to grasp and understand given the extensive focus that has been applied to it in the area of psychology and organizational behavior. In fact, over 30 years ago Fiedler (1971) and Stogdill (1974) concluded that there are as many definitions of leadership as there are researchers who have studied it.

Despite the fact that it is difficult to define leadership, core elements of the definition have begun to emerge (Northhouse, 2004; Yukl, 1998). At the highest level leadership can be considered a process for influencing groups to achieve specific goals. It is difficult to add anything else to this definition and still have it generalize to most any context because so many other aspects of leadership are situationally dependent. Several different conceptualizations of leadership have been developed over time to examine the different aspects of leadership, however, this study will focus on what is perhaps the most dominant paradigm in the leadership literature today and the one which is thought to be the most visibly influenced by in the introduction of virtual nodes into a team. This is the

full range leadership model which includes both transformational and transactional leadership behaviors.

Transformational leadership can be considered a neo-classical form of charismatic leadership which incorporates many of the previous trait and behavioral conceptualizations of leadership (Yukl, 1998). Transformational leadership concerns the process of influencing major changes in the attitudes and assumptions of team members and building commitment for major changes in a team's objectives and strategies. Transformational leaders motivate followers to work towards transcendental goals or an organizational vision (J. C. Wofford & Goodwin, 1994). It was first introduced by Burns in 1978 but later Bass (1985) expanded it by decomposing it into four specific dimensions: idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration.

Idealized influence refers to leaders who demonstrate behaviors consistent with high ethical standards and doing the right thing. These individuals typically provide followers with a vision and a sense of mission. Many times they result in followers placing a great deal of trust in leaders who exhibit them. The second transformational dimension is inspirational motivation. This factor describes leaders who communicate high expectations to followers, inspiring them through motivation to become committed to and a part of the shared vision of the organization. To accomplish this, leaders many times use symbols and emotional appeals to focus the effort of group members. The third dimension is intellectual stimulation which relates to the ability of leaders to stimulate followers to be creative and innovative, and to challenge their own beliefs. The final transformational dimension is individualized consideration which relates to a leaders

ability to provide a supportive climate in which they listen carefully to the individual needs of followers.

Transactional leadership behaviors views the relationships between leaders and followers as an exchange process in which followers' needs can be met if their performance is adequate (J. M. Burns, 1978). It is comprised of two components: contingent reward and management-by-exception. Contingent reward refers to an exchange process between leaders and followers in which the effort of followers is exchanged for specific rewards (Komaki & Barnett, 1977; Stajkovic & Luthans, 2003). When leaders use this type of leadership they try to obtain agreement from followers on what needs to be done and what the payoffs will be for doing the work. Management-by-exception refers to leadership that is based on setting standards and monitoring deviations from these standards (Bass, 1985; Bono & Judge, 2004; Northhouse, 2004). Given this focus on external rewards and standards it has been shown that individuals who emphasize a transactional style focus on tasks and the cognitions that accompany them (Goodwin, Wofford, & Boyd, 2000; J. C. Wofford, Goodwin, & Whittington, 1998).

The primary strengths of the full range leadership model is that it is intuitively appealing, treats leadership as a process, offers a broad view of leadership, and provides a strong emphasis on followers' needs, values and morals. Further, it has been widely researched and supported. For instance, Lowe, Kroeck, & Sivasubramaniam (1996) used a meta analysis to show that discriminate validity exists between transformational and transactional leadership and that the correlation between transformational leadership and job performance is .73. More recently, Judge and Piccolo (2004) used a meta-analysis to show that transformational leadership correlates .44 with job performance and

transactional leadership correlates .39. Despite the fact that the numbers were not as high as those associated with Lowe et al., (1996) they were still appreciable.

However, criticisms of this approach exist including a claim that the theory lacks conceptual clarity since it does not provide clear evidence of discriminate validity between charismatic or visionary leadership. Other drawbacks of this approach is that it treats leadership as a trait or predisposition rather than a learned behavior (Bryman, 1992), is elitist, antidemocratic, suffers from a "heroic leadership" bias (Yukl, 1999), and was conceived based on data collected from CEO's (Bryman, 1992). However, despite these claims, the full range model still remains the dominate paradigm in leadership studies.

Leadership Style and Communication

It is proposed here that for each structural configuration, teams whose leader has been trained to use a transformational style will exhibit a higher level of communication compared to teams whose leaders have been trained to use a transactional style. This is thought to be true for three reasons.

First, transactional leaders focus mainly on the task (Goodwin, Wofford, & Boyd, 2000; J. C. Wofford, Goodwin, & Whittington, 1998) but transformational leaders attend to a much broader range of member behavior and processes. For example, transformational leaders exhibit behaviors consistent with the dimension of idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration. On the other hand, transactional leaders are only concerned with contingent reward and management by exceptions. Therefore, transformational leaders have more behaviors to attend to and as a result, more messages to communicate. Additionally, in order to perform well transformational leaders will also need to focus at

least part of their effort on task orientated communication. It cannot be assumed that teams can perform well if the leader does not at least in part attend to the task. Therefore, transformational leaders will not only concentrate on the emotional behaviors transactional leaders do not, they will also focus on the task behaviors they do. This is consistent to the augmentation effect which suggests that high performing transformational leaders focus not only focus on transformational behaviors but on task orientated transactional behaviors as well (Bass & Avolio, 1993).

The second reason why it is thought that communication quantity will be higher in a transformational team has to do with the nature of the messages themselves. A major aspect of transformational leadership is based on encouraging followers to share there ideas with the group. It has been shown that in such a cooperative environment, followers are more inclined to ask questions, help others to clarify the problem or solution, and assess peer input (Slavin, 1996). As a result, we can expect to see an increase in communication due to these activities in a transformational condition that are not present in a transactional condition.

Third and finally, leader communication used to support the transformational behaviors is more likely to spawn additional communication between team members compared to transactional leader communication. This is due to the fact that transformational communication has a highly affective component to it. If the leader makes comments that address these affective dimensions, it is possible that they could act as a catalyst or contagion and lead to others in the team making similar affectively based comments (Kelly & Barsade, 2001; Pugh, 2001) which will increase the overall level of comments made in the team. On the other hand, communication associated with

transactional behaviors is more task orientated and directed towards meeting the goals of specific team members. It is predicted that this type of communication will be far less likely to spawn additional comments by other team members than will affective leader comments. Therefore, based on these three reasons we can expect that there will be more communication in a transformational team than a transactional team.

> H5: In each structural configuration, teams whose leader used a transformational leadership style will have a higher level of communication quantity than teams whose leader used a transactional style.

It is also expected that collocated teams whose leader have been trained to use a transformational style will have a higher level of communication quality compared to teams whose leaders have been trained to use a transactional style. This is due to the fact that followers will more favorably interpret leader behaviors that are targeted towards their affective states than their simple task based performance. This will lead to a perception that the communication quality in transformational teams is higher than it is in transactional teams.

> H6: Communication quality will be higher in a collocated transformational team than in a transactional team.

The collocated nature of hypotheses 5&6 are plotted in Figure 5.

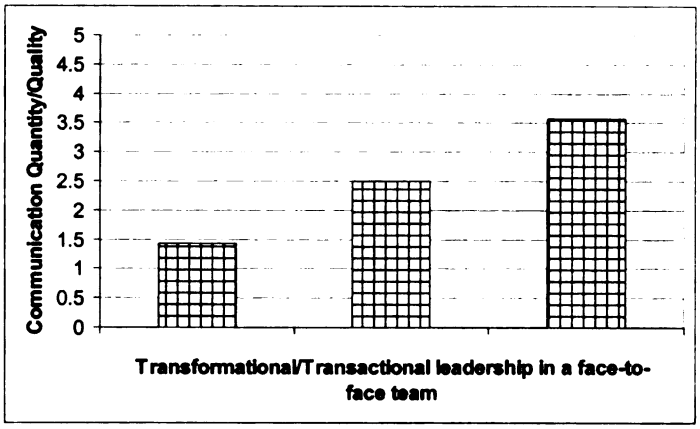


Figure 5. Predicted hypotheses 5 and 6 for a collocated team

Task Complexity

When investigating team processes it is important to consider the task being accomplished given that many times the task can dictate the team processes employed and the degree to which they apply. Tasks are so important to teams that they can actually define a team. For example, Sundstrom, McIntyre, Halfhill and Richards (2000) suggested that there are six different types of teams: action, advisory, service, project, management, and production. Each of these kinds of teams performs a different set of tasks and therefore has different knowledge, skills, and resources. "All tasks contain three essential components; products, (required) acts, and information cues" (Wood, 1986, p. 64). These are the "building blocks" for a general theory of tasks and can be arranged to explain to any number of task characteristics such as complexity.

Task complexity describes the relationship between task actions, information, and products. Any changes in the levels of these components, or the relationships between them can impact task complexity. Given such degrees of freedom, it is best not to view task complexity as a uni-dimensional construct but rather as a linear combination of three

different variables: coordinative complexity, dynamic complexity, and component complexity (Wood, 1986).

Coordinative complexity is defined as the number of tasks and the precedence of relations between each act and every other act in the task. It refers to the sequencing of actions and the strength of the relationships between information cues, actions, and products. More specifically, it deals with the timing, frequency, intensity, and location requirements of the actions. The more precise the timing, higher the frequency, greater the intensity, and dispersion of locations, the greater the complexity. As an example, painting a wall has low coordinative complexity while assembling a car has high coordinative complexity. In the painting example, it really does not matter what side of wall you start from or whether you paint top to bottom or vice versa. In the end the wall is painted just the same. However, a car must be assembled in a very specific order. The hood can not be installed until the engine is in place and the wheels can not be attached until the axles are connected.

The second type of task complexity is component complexity. This type of complexity relates to the number of actions which must be taken by individuals and the number of informational cues that must be processed. In situations where a large number of actions must be taken or a high number of informational cues must be processed, a high degree of component complexity exists. For example, making your bed has less component complexity than building car. In the case of making your bed, there are only a few steps which need to be accomplished and they relatively easy to perform.

The final type of task complexity is dynamic complexity. This type exists when environmental changes impact the relationship between task actions and information cues

and products over time. Therefore, it is defined as changes over time in the amount of coordinative and component complexity (Wood, 1986). As a result, coordinative and component complexity can be considered to be more static indicators of complexity while dynamic complexity refers to the degree that these other types of complexity change over time (Wood, 1986). An increase in dynamic complexity often times accompanies a change in the environment. For example, air traffic controllers realize an increase in dynamic complexity by a change in the winds, mechanical breakdowns, or medical emergencies. Each of these events impacts the dynamic complexity of the task.

Task complexity in a team

The problem with all of these types of task complexity is that they were created with a focus on the individual and not the team in mind (Wood, 1986). The literature also follows this trend by typically examining individual task complexity rather than team task complexity (Campbell & Gingrich, 1986; DeShon & Alexander, 1996; Earley, Lee, & Hanson, 1990; Gardner, 1990; Kozlowski & Hults, 1986; Paquette & Kida, 1988; Swait & Adamowicz, 2001a, 2001b). In fact, recent experiments that are advertised to examine team task complexity fail to do so. These studies either use subjective measures which generate responses at the individual level (Man & Lam, 2003), use survey items that focus on the individual level (Akgun, Byrne, Keskin, Lynn, & Imamoglu, 2005) or only vary the individual level aspects of task complexity (Roberts, Cheney, Sweeney, & Hightower, 2004). However, there is little reason why the types of task complexity developed by Wood can not be extended to the team level so long as the resulting conceptualization focuses on that level. Doing so has the added benefit of allowing

individual and team task complexity to be compared directly rather than using separate typologies for each type.

The question then becomes how to define team task complexity using this typology. In order to answer this question each type must be examined from a team level perspective in order to determine what aspects of the work performed by teams might relate to each of these types. To begin, a major aspect of a team that can define its coordinative complexity is its structure.

Structure is an inherently team based attribute because it defines the way teams organize themselves. Structure varies based on several different dimensions including the degree of centralization, specialization, and departmentation (T. Burns & Stalker, 1961; Donaldson, 2001). Another aspect of structure is the degree to which it is arranged in a functional or divisional structure (Hollenbeck *et al.*, 2002). In a functional structure each member or group has a specialized function and therefore must work with others in order to finish tasks which require more than one function to complete. A common example of this might be a corporation that has dedicated accounting, marketing, and operations groups. All three of these functions must work together in order for the corporation to be successful. In contrast, a divisional structure is characterized by independent groups, each with a complete set of functions that are able to be used in order to complete the task. An example of this would be a corporation with different product divisions each with their own, accounting, marketing, and operations department. Given that the amount of interdependence between groups is higher in a functional structure we can see that the amount of coordinative complexity would also greater.

A major dimension of a task that defines the level of component complexity in a team is the amount of learning it must accomplish in order to perform well. When the amount of learning required is high, team members must be connected to a multitude of different communication channels each providing a different piece of information. They must then cognitively process this information in order to be able to use it. All of this leads to an increase in the component complexity of a task since it adds additional actions that must be performed in order to complete the task.

As with coordinative complexity, it is important to consider the distinction between the individual and team level. Team level learning derives from the social cognition movement (Fiore & Schooler, 2004), in the sense that it examines "those social processes... that relate to the acquisition, storage, transmission, manipulation and use of information for the purpose of creating a group-level intellective product" (Larson & Christensen, 1993, p. 6). Thus in the end "...teams can process information not only within, but also between the minds of team members." Ellis et al.'s (2003, p. 822). Unless information is transmitted between team members, true *team-level* learning does not take place (Johnson, 2006). Therefore, it is the team learning which impacts team component complexity.

An aspect of a task that can define the level of team dynamic complexity is the amount of uncertainty it faces. In environments with a high degree of uncertainty team members need to exhibit problem solving skills and adapt to a constantly changing set of conditions. However, in a low uncertainty environment team members are exposed to more routine or patterned activities which do not require the same level of cognitive processing. Therefore, if a lot of uncertainty exists, the environment changes over time

and team members must work in order to counteract any negative impacts that they face as a result of this. As a result, an increase in the uncertainty of the environment leads to an increase in the dynamic complexity of a task.

In summary, coordinative, component and dynamic complexity are all types of complexity that are well suited for a team level analysis when they are defined using team level conceptualizations. As a result, a high level of task complexity within a team will be defined as an environment in which a high level of coordinative (conceptualized using a functional structure), component complexity (conceptualized as the amount of team learning) and dynamic complexity (conceptualized as the amount of uncertainty) exists. This typology is summarized in Table 1.

Table 1. Task complexity in a team

	High task complexity	**Low task complexity**
Coordinative	Functional structure	Divisional structure
Component	High team learning	Low team learning
Dynamic	High uncertainty	Low uncertainty

Such differences in complexity, corresponds in part to the differences between working harder and working smarter. Within the popular management press there has been a substantial amount written about the differences between working harder vs. working smarter (Sujan, Weitz, & Kumar, 1994). Working smarter has been conceptualized as being based on adaptive behaviors (Sujan, Weitz, & Kumar, 1994) and the ability to plan, both of which have a heavy cognitive component to them (Fang, Palmatier, & Evans, 2004). Here the focus is not on the number of actions that are required to complete a task but rather on the level of interdependence, precedence, and dynamism of the actions and information cues. In this situation there is not so much of an increase in the physical task demand but rather in the cognitive task demand. In this

environment teams are forced to work together in order to develop a set of information complete enough to base good decisions on. Such a state can be characterized by a large number of interdependencies, elevated need for learning, and increased uncertainty, all of which correspond to a high level of task complexity.

One the other hand, working harder can be thought of as an increase in the amount of labor that an individual performs (Sujan, Weitz, & Kumar, 1994). In this situation the amount of physical effort used to accomplish the task is greater but there is no change to the task itself. As a result, team members are forced to work quicker in order to perform well but the task complexity of the task is low. Therefore, this condition corresponds to a situation in which a team works harder but not necessarily smarter.

Team Task Complexity and Communication

In the past task complexity has been shown to impact a number of different constructs including information processing strategies (Paquette & Kida, 1988), non-task related movements (Gardner, 1990), goal acceptance, personal goals, and performance (Earley, 1985). This study adds to this list by proposing that higher task complexity leads to a greater amount of team communication

As previously mentioned, a high level of task complexity is defined as an environment in which a high level of coordinative complexity (functional structure), component complexity (team learning) and dynamic complexity (high level of uncertainty) exists. With regards to structure, it has been thought that a functional structure has the potential to lead to an increase in communication as compared to a divisional structure (Johnson *et al.*, 2006). This is due to the fact that when a functional structure is present each team member only has access to a particular asset. If each team is exposed to a variety of different problems, it is not until the specialized assets of

individual members are combined that an effective system to complete the assigned task is realized. In other words, each person has a different "piece of the puzzle" in a functional structure which leads to an increased level of interdependence. It is therefore hypothesized that managing the increase in the level interdependence between groups or people will lead to higher levels of communication. However, if a divisional structure is used, each team member has a number of different assets from which to draw. If a member is again exposed to the same variety of problems, we would expect that they would be able to solve them without the help of others. This would decrease the required level of coordination within the group and therefore the overall level of communication between members.

When it comes to team learning we can expect that an increase here would also drive up the level of communication. It has been shown that communication, in terms of sharing information, ideas, and cognitive processes, is an important component of team level learning (Hinsz, Tindale, & Vollrath, 1997). In order to effectively learn at the team level, team members must communicate their ideas to the rest of the team. MacMillan, Entin, and Serfaty (2004, p. 61) call this "the hidden cost of team cognition," noting that communication between team members has no analogue at the individual level.

With regards to uncertainty, an increase here can force team members to work together more closely in order to understand what is happening in the environment and then determine the most appropriate course of action. Supporting this notion is Kraatz (1998) who showed that increases in communication lead to decreases in overall uncertainty. Therefore, it can be expected that in teams which are sufficiently motivated

to perform well, a positive relationship will exist between the level of uncertainty and team communication.

Such a predicted increase in communication relates to a condition in which a team is working smarter and not harder. As mentioned earlier, working smarter is characterized by the ability of a team to plan and remain agile. By communicating more and sharing information the team is exhibiting behaviors consistent with working smarter not harder. No one is required to do more, they just need to work together which increases the level of planning, coordination, and cooperation within the team. In the end, this will increase the amount of communication.

> H7: The quantity of communication will be greater in environments with a high level of task complexity than it will be in environments with a low level of task complexity.

Leader Centrality

Besides communication related variables, leader centrality is also proposed to act as a mediator between team structure, leadership styles, task complexity and performance outcomes. Traditionally, centrality has been conceptualized as the strength of an individual's social network within an organization (Brass, 1984) and reflects the extent to which interactions are concentrated in certain individuals rather than distributed equally among all members (Sparrowe, Liden, Wayne, & Kraimer, 2001). The strength of these connections has been shown to directly relate to an individual's power (Ibarra & Andrews, 1993), performance (Sparrowe, Liden, Wayne, & Kraimer, 2001), and the amount of influence they wield within a group (Brass, 1984). Using the resource dependency perspective, it has been theorized that much of this comes from the ability of

highly central individuals to have greater access to, and control over information (Brass, 1984; Salancik & Pfeffer, 1977).

Centrality has been conceptualized as the number, strength, and significance of connections an individual has within a social network. More specifically, it has been thought of as the (a) degree, or number of contacts, (b) closeness or proximity, and (b) the betweenness (Freeman, 1979). Degree can be thought of as the number of direct connections an individual has to others within a social network, closeness or proximity is the ease with which someone can access another individual in that network (Burkhardt & Brass, 1990) and betweenness can be thought of as the potential control that individuals have over others (Brass, 1984). One common thread between these different conceptualizations of centrality is that they all are objective. However, more recent studies have started to consider the more subjective nature of centrality. In addition to examining the simple objective presence of connections within a network these studies also consider the subjective strength of these connections. Such studies tend to downplay the degree and closeness in a network and emphasize the betweenness that exists. For example, Ibarra (1993) used an "aggregate prominence" scale to examine not only the existence of connections between individuals in a network but also the centrality of those who were connected. Drawing from this study, Sparrowe et al., (2001) asked subjects to characterize the strength of their own network connections. Using such an approach not only characterizes the existence of connections but also the strength of these connections. Since, in the present study the existence of the connections is preordained by the given structure, it is the subjective strength of these connections which will be emphasized.

In addition to different conceptualizations of centrality there are also several different types of social networks. For example, Brass (1984) considers workflow networks, communication networks, and friendship networks while Iberra (1993) examined communication, advice, support, influence and friendship networks. Each of these networks might yield different outcomes for the same set of initial conditions so it is important to also specify what type of network is being considered when examining centrality. For this study an advice network will be selected. As a result, leader centrality for this study will be defined as the subjective strength of the leader's betweenness or the potential control that they have over others in an advice network

Structure and Leader Centrality

Several different antecedents of centrality have been investigated including individual attributes, formal position (Ibarra, 1993), technologies (Burkhardt & Brass, 1990) and LMX (Sparrowe, 2005). To this list the present study adds structure such that the centrality of the leader is predicted to be higher in a collocated team compared to virtual team. This difference is thought to exist because as teams migrate from a collocated team to the virtual world there will be a different amount of perceived control and influence that the leader is expected to have over the team members. For example, in a collocated team all of the team members, including the leader, can see each other face-to-face. In this configuration the perceived level of centrality, as conceptualized as betweenness or the amount of control, that the leader is able to exert will probably be high due to the fact that it is very salient to all who the leader is in this configuration. In this structure, the leader's guidance is given directly to each team member and without a good reason it would probably be considered counterproductive, tasteless, or even damaging to overall team performance to ignore their direction.

However, in a virtual team all the members exist within remote nodes, which causes a decrease in co-locatedness and an increase in the use of computer mediated communication systems. It is proposed that these changes will lead to a decrease in the level of perceived leader centrality for at least two reasons. First, the increased use of computer mediated communication systems will make it more difficult for the leader to effectively influence team members. For example, he or she will no longer able to use non-verbal behaviors or emotions to persuade team members. Second, due to the decrease in the social presence, the leader is not immediately visible to the members of the group which has been shown to be an important antecedent of centrality (Klein, Lim, Saltz, & Mayer, 2004).

It is predicted that in a reachback team the amount of leader centrality will actually decrease further. This is due to the fact that in a reachback team the leader is the only one who is not collocated with the team. This will establish a strong faultline within the team between collocated team followers and the remote team leader (Lau & Murnighan, 1998) which will make the leader feel partially ostracized and alienated relative to a co-located group that is growing in cohesiveness over time. As has been written, "The faultline model (Lau & Murnighan, 1998) suggests that, when groups split into subgroups, (even implicitly), the members' group-related identities are associated more with their subgroups than with the entire group" (Lau & Murnighan, 2005, p. 646). Given that the group identities of the members in the collocated group will be associated more with this subgroup than the entire team, a cohesiveness will begin to emerge within this subgroup that does not include the leader. This cohesiveness can be a substitute for leadership (Kerr & Jermier, 1978) and local emergent leadership could develop among

the co-located team members. It is predicted that this will have the effect of causing remote team members to discount the leadership offered by their leaders which will manifest itself as a reduction in their influence and perceived centrality. However, when all of the team members are remote, as is the case in a virtual team, this faultline will disappear and with it the negative feelings associated with it. In this situation remote team members will understand that everyone else on the team is in the same situation and feel more connected to each other and the leader.

This set of relationships is significant because they suggest that leader centrality in a reachback team is lower than it is in either a collocated or virtual team. This is potentially interesting because one would expect that leadership centrality would increase as individuals in remote nodes combine to form one large group. However, it is predicted here that if the team leader is remote, the amount of leader centrality will decrease regardless of the number of people in the subgroup. Therefore, it is not the number of people in each subgroup which is important but rather the number of subgroups. This is because as the number of subgroups increase the saliency of the faultlines between them will decrease. Therefore, the effect of the faultlines will be greatest when there are only two subgroups, as is the case of a reachback team.

> H8: Team member perceptions of leader centrality will be higher in a collocated team than in a reachback team
>
> H9: Team member perceptions of leader centrality will be lower in a reachback team than a virtual team

Hypotheses 8&9 are plotted in Figure 6.

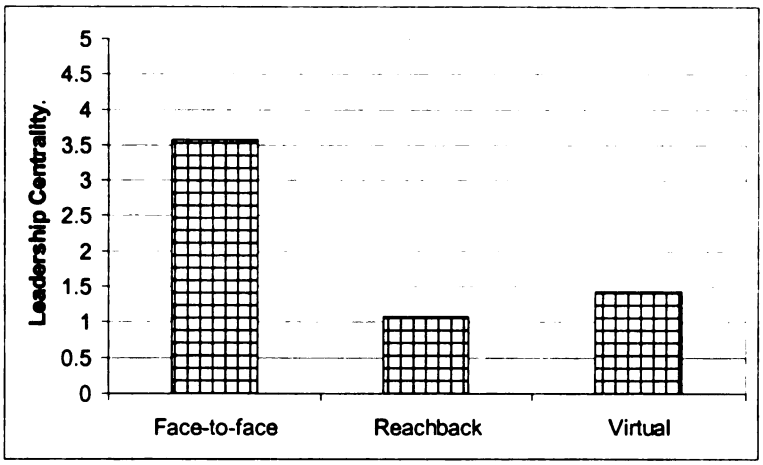


Figure 6. Predicted hypotheses 8 and 9

Leadership Style and Leader Centrality

It is proposed that in a collocated team, a transformational leadership style will increase perceived leader centrality more than a transactional style. As already mentioned a transformational style is based on the ability of leader to motivate and influence members to achieve higher performance. Similarly, centrality can be thought of as the amount of influence that members have over others in their group (Sparrowe, Liden, Wayne, & Kraimer, 2001). As a result, the amount of leader centrality can be thought of as the amount of influence that a leader has over his team members. Given then that transformational leadership is based on many of the same antecedents and constituents of leader centrality, it stands to reason that if the leader exhibits stronger transformational leadership behaviors, the amount of perceived leader centrality will also increase. For example, one of the dimensions of transformational leadership is idealized influence. If this dimension was to increase, leader centrality would also increase given that it can be considered a proxy for influence. Further, leaders who are better able to motivate, intellectually stimulate, and provide individualized consideration could also be expected to have a higher level of centrality. In contrast, a transactional leadership style

is based on rewards and focusing on mistakes. If leaders exhibit behaviors consistent with this style, members might respond but they may do so because they feel coerced rather then influenced. As a result the following hypothesis is forwarded:

> H10: A positive relationship exists between transformational leadership and the perceived leader centrality in a collocated team

Having now completed the examination of the relationships between the proposed independent variables and the mediators we can now examine how overall team effectiveness is impacted by these constructs. Effectiveness can be conceptualized in many different ways but for this study it will be comprised of three different variables: objective performance, team satisfaction, and leader satisfaction. Objective performance is often thought of in terms of speed and accuracy while satisfaction subscribes to the notion that teams must also be able to remain viable and keep making high quality decisions over an extended period of time (Kozlowski & Bell, 2003). The following section provides additional details regarding each of the selected components of effectiveness after which the relationships between these variables and the mediators already described will be explored.

Objective Performance

The first characteristic of objective team performance is the speed at which they work. Speed can be considered a dimension of performance because teams that work faster can perform more work. This becomes especially important when teams have a limited amount of time to complete multiple tasks. Teams that can accomplish more tasks in a fixed amount of time will then be considered to be better performers. The second dimension of objective performance is accuracy. Teams might be very fast but if they are not accurate or make poor decisions their speed will not be important. In fact, a

quick team might even be detrimental in this situation given that they will be making more bad decisions.

Satisfaction with the team

Traditionally team effectiveness has been thought of as being comprised as the quantity and quality (speed and accuracy) of team related decisions (Shea & Guzzo, 1987). However, Hackman (Hackman, 1987, 2002) and others have proposed that team viability, or the satisfaction of the team, should also be considered. The thought is that without the team being satisfied with the experience there is little chance that they will continue to perform. Therefore, this study will not only examine the more traditional "external" team effectiveness constructs of speed and quality but also the "internal" construct of team satisfaction.

Satisfaction with the leader

As a compliment to the level of satisfaction with the team, the level of satisfaction with the leader will also be explored. Team satisfaction is important but given the important position that leaders play in hierarchical teams it is also important to examine the effects associated with how the team feels about these individuals.

Communication and Team Effectiveness

As previously mentioned, communication quality at the team level has both a behavioral and cognitive component. From a behavioral viewpoint communication quality is the ability of the team to gather, transmit, and interpret information (Jablin, 1994). When communication quality is low team members are not able to clearly communicate their ideas, thoughts, or intentions to each other. In these situations they need to spend more time making sure that what they communicate is what they want to communicate. For example, Propp and Nelson (1996) found that teams which where able to more effectively communicate how to analyze the problem or task and orientate or

establish procedures made more effective decision. In the same way it is theorized here that groups which have a higher level of communication quality will realize a higher level of performance.

From a cognitive viewpoint quality is the ability of a team to establish common team cognitions and use those cognitions to promote communication quality. In the same way, the present theory suggests that the ability of teams to form these cognitive connections also leads to an increase in performance. If the team is unable to quickly establish these links then the time spent correcting these problems is time that cannot be applied to other task work. As a result the following hypothesis is presented:

> H11: A positive relationship exists between communication quality and performance (objective and subjective)

As the amount of communication increases there is a natural positive relationship that exists with performance attributes. This is due to the fact that as the level of team communication increases there will be more information that is available to each member to processes, and use (Propp & Nelson, 1996). This will lead to more informed decisions which will increase their quality (Hollenbeck, Ilgen, LePine, Colquitt, & Hedlund, 1998).

> H12: A positive relationship exists between communication quantity and performance (objective and subjective)

Leader Centrality and Team Effectiveness

Centrality has been shown to be an antecedent of influence such that as an individual's centrality grows so does their influence over other team members (Bass, 1985). Given that influence can be considered an enabler of leadership, studying leader centrality helps form a richer picture of the leadership process. Further, as a more

proximal indicator of leadership compared to leader effectiveness, it helps isolate the specific effects of the phenomena.

Leaders are not only classified as such due to the power which has been conferred upon them by the organization, but also due to the fact that they have access to information that other members do not have. Based on this access they are presumed to have a latent value to the team that may not be realized because of the structure, leadership style, or task environment. This value is realized when the leader provides this information to the team which then acts on it. The chance that a team will actually receive this information and then use it is partially a function of the leader centrality. Since leader centrality can be thought of as a proxy of influence, there is a greater chance that team members will use the information provided to them if centrality is high. Thus, team with leaders who have high centrality, and thus more influence, stand a greater chance of using this information.

In this study the leaders will have aggregated information related to threats and opportunities in the environment that no other member has. Therefore, if they are more central and have more influence, there is more of a chance that this information will be used by the team. The more this information is used, the more that the threats will be avoided and opportunities will be exploited.

> H13: A positive relationship exists between perceived leader centrality by remote workers and performance (objective and subjective)

Now that all the direct effects in the model have been considered we can turn our attention to the interactions that these constructs might have with each other. The

purpose of this is to provide a more complete and accurate picture of leadership within virtual structures.

CHAPTER 2 - INTERACTION EFFECTS

Although it has been suggested that communication and leadership outcomes may suffer in virtual and reachback teams, it is now proposed that different leadership styles and task complexity might play a significant role in terms of ameliorating these effects.

Structure, Leadership Style, and Communication Quality

Even though Hypothesis 6 proposes that teams whose leaders exhibit a transformational leadership style tend to have greater levels of communication quality in a collocated team, it is suggested that communication quality in teams whose leader uses a transactional style will be higher in both a virtual and reachback structure. This is based in part on the fact that transformational leaders rely on highly affective based communication but since computer mediated communication cannot easily support such content, leaders who must use these systems will be at a disadvantage. Further, transactional leaders do not rely on emotionally laden communication. They focus on contingent reward and management by exception, which are based more on unemotional exchange processes. As a result, an increase in the usage of computer mediated technology between team members will not negatively impact their leadership style as much.

In a reachback team the difficulties that a transformational leader faces are not quite as pronounced. They still must lead using only computer mediated communication devices but the collocated nature of the larger subgroup promotes transformational behaviors within the subgroup because these members can still interact face-to-face and thereby increase the emotional content of their communication. This might make it appear that overall team communication quality is not as low as it is when everyone in the team is remote. On the other hand, the effect of a reachback team when a

transactional style is used will probably be much the same as it was in a virtual team. In this situation, the existence of a collocated subgroup does not promote transactional behaviors as it does transformational behaviors. Here, the team members might be collocated but the leadership being provided still comes from a remote source. As a result, there is not expected to be a major change in the overall level of communication quality between virtual and reachback teams who have a transactional leader.

> H14: The relationship between structure and communication quality is contingent on leadership style, such that transformational style is superior in collocated contexts, but a transactional leadership style is superior in reachback and virtual contexts.

This is shown below in Figure 7.

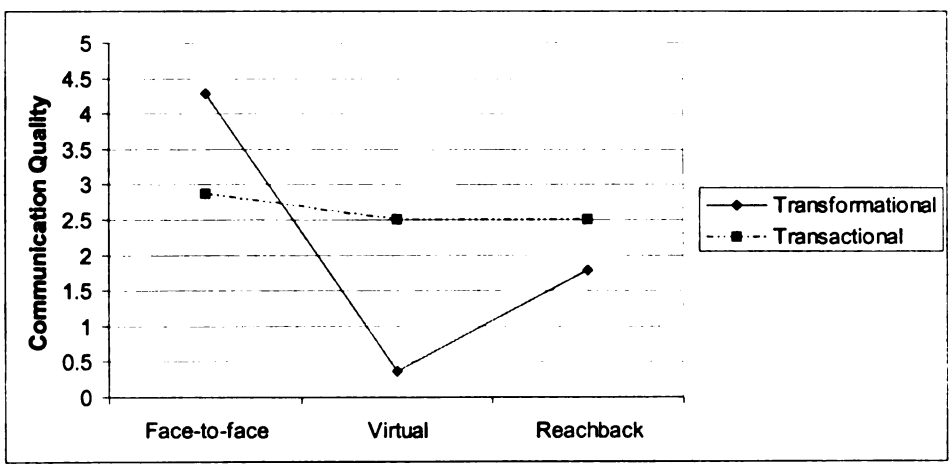


Figure 7. Predicted hypothesis 14

Leadership style, Task Complexity, and Communication Quantity

One of the important revelations in the evolution of leadership studies was the conclusion that contextual variables can be a major determinant of what type of leadership style is most appropriate (Yukl & Fleet, 1992). This notion is classically referred to as the contingency approach to leadership and suggests that environmental factors can influence the effectiveness of different leadership styles. For example,

Fiedler (1967) showed that the best leadership style to use is dependent on situational variables of leader-member relations, task structure, and position power. Other popular contingency leadership theories include Houses' (1971) path-goal theory, and Hersey and Blanchards (1969) Situational leadership model. Path-goal theory states that leaders motivate higher performance in subordinates by acting in ways that influence them to believe valued outcomes can be attained by making a serious effort and Situational Leadership suggests that the optimal amount of task-oriented and relations-oriented behavior by a leader depends on subordinate maturity.

Consistent with these theories it is suggested here that the effectiveness of the transformational or transactional leadership style is contingent on task complexity. Specifically, I propose that in an environment with a high level of task complexity, a transactional leadership style will increase leadership centrality, whereas in an environment with a low level of task complexity a transformational leadership style will lead to high leadership centrality. This is due to the fact that in an environment with a high level of task complexity, a larger amount of communication and coordination is necessary. If a transformational leader attempts to form an emotional connections with his team in order to increase his or her perceived level of inspirational motivation, idealized influence, or individual consideration, this is time that is not being applied to those coordination activities and communications that need to be occur. On the other hand, both dimensions of transactional leadership focus on the tasks performed by the followers. For example, contingent reward is based on rewarding followers for their task performance and management by exception focuses on the mistakes the followers make while performing certain tasks. This is consistent with previous studies which have

shown that transactional leaders tend to focus on task related cognitions more than anything else (Goodwin, Wofford, & Boyd, 2000; J. C. Wofford, Goodwin, & Whittington, 1998). It is this focus on the tasks that will make a transactional leadership style preferable when task complexity is high.

On the other hand, in environments with a low level of task complexity there is not as much of a need for communication or coordination. As are result leaders do not have to spend as much time addressing such task work related activities and can spend more time appearing transformational. In fact, if the level of task complexity is low it is suspected that a transformational leader will thrive. In this situation leaders do not have to worry so much about making sure that the team communicates task orientated activities but instead can concentrate on keeping the motivational level of individuals high as they perform boring or uninteresting tasks. It is in this environment that the ability of a transformational leader will begin to shine for it is here that they can capitalize on their ability to appear charismatic, motivating, and inspiring.

Support for such a theory is provided by studies which have shown that positive affect has a positive impact on outcomes including motivation, judgment, and decision making ability (Erez & Isen, 2002; Forgas & George, 2001; George & Brief, 1996). Given that boredom has been shown to be an antecedent of lower positive affect (Gordon, Wilkinson, McGown, & Jovanoska, 1997) and low task complexity is the primary reason for such boredom (Fisher, 1993) the potential exists that positive affect will decrease when task complexity is low. However, by expressing confidence that goals will be met, coaching individual members, and inspiring subordinates to perform better,

transformational leaders can lift the spirits of followers and increase their positive affect. Such behaviors might then mitigate the negative effects of a boring task.

> H15: The relationship between leadership style and leadership centrality is contingent on the task complexity, such that a high task complexity is superior for a transactional leadership style, but low task complexity is superior for a transformational leadership style.

Structure, Leadership Style, and Leader Centrality

The present theory suggests that in a collocated team a transformational leadership style will result in a higher level of leader centrality. This is due to the fact that in a collocated team, leaders who exhibit a transformational leadership style are attending to both the individual needs of the group members and the goals of the team. If members feel that their leaders are focusing on their own needs there will be a greater chance they will form a positive affective attachment to the leader and such an attachment will lead to a higher leader centrality. In contrast, transactional leaders are more focused on the task itself and any relationship with the followers is based on a contingent reward or comparisons to standards rather than affective components. Therefore, followers will not feel as connected to their leaders in this context.

However, in a virtual team it is thought that these results will be reversed. In this situation, teams whose leaders have been trained to use a transformational style will have a much lower level of leader centrality. This is due to the fact that in this structure there will be a complete loss of any face-to-face communication and as a result very few affective components will be present. Given that transformational leaders heavily rely on these components their absence will cause them to have less influence over team members. However, if a transactional style is exhibited, it is predicted that the level of centrality will not fall nearly as dramatically. In this situation the leaders behaviors do

not require an affective component to be present so not having them present will not be as much of an issue as it was for the transformational leader.

In a reachback team it is proposed that the level of leader centrality will increase (compared to a virtual team) for teams lead by a transformational leader. This is due to the fact that if a transformational style is being used it is possible that there could be some affective components at work within the collocated group that could be attributed to the leader. In contrast, when a reachback team is lead by someone who has been trained to use transactional behaviors the level of leader centrality will be lower in a reachback team compared to a virtual team. This is primarily driven by the increase in the saliency of faultlines between remote workers and collocated workers. In a reachback configuration the impact of the leadership provided by a transactional leader will be the same as it was in a virtual configuration. The only thing that has changed is the increased saliency of the faultline. As a result the amount of perceived leadership centrality will decrease in a reachback team compared to a virtual team for transactional leaders. However, due to the fact that this structure still severely restricts the affective mechanisms that transformational leaders need to operate, it is suggested that teams lead by a transactional leader will still exhibit a higher level of leader centrality.

> H16: The relationship between structure and leader centrality is contingent on leadership style such that a transformational style enhances centrality in collocated contexts, but a transactional style enhances centrality in reachback and virtual contexts.

This is shown below in Figure 8.

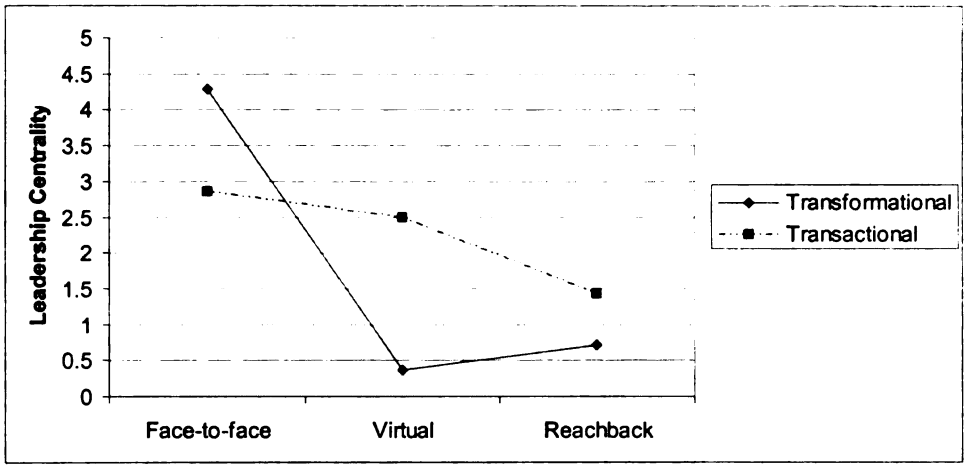


Figure 8. Predicted hypothesis 16

CHAPTER 3 - METHOD

Choice of setting

This study was performed as a laboratory experiment. There are several advantages this approach has over other research designs including the ability to infer cause and manipulate variables One of the primary goals of experimentation is to derive causal relationship. This process involves identifying specific causal events and their relationship to outcomes along with any intervening mediators. Experiments have an advantage over other popular research designs such as the cross-sectional survey in that they do not simply describe a covariation between constructs but also establishes temporal precedence as defined by John Stuart Mills. An experiment also allows researches to manipulate active variables, which means that they can control variance instead of relying on natural occurring conditions favorable to answering the particular research question. This has the effect of allowing the researcher to create the most efficient research design possible (McClelland, 1997) and maximize the systemic variance of the active variables (Kerlinger & Lee, 1999).

Participants

The participants for this study where three hundred and forty four undergraduate students enrolled in an upper-level management course at Michigan State University. The sample was comprised of 56.6% male and the mean age was 21.74. These subjects where arrayed into 86 four-person teams for the task. Participants signed up for a research session at their discretion, and were randomly assigned to teams in order to play two 30-minute simulations. Each subject was given course credit for their participation.

Power analysis

For this experiment an a priori power analysis was performed to establish the desired sample size in order to achieve a power or .8. Four different types of statistical

tests were performed in order to test the hypotheses so four different calculations needed to be performed, each with their own input variables, to determine the power level. The first test was multiple regression with three independent variables (Hypotheses 1-4, 8-9, 11-13). The second was an independent t-test (Hypotheses 5, 7). The third was a moderated regression that included one independent variable, one dependent variable and a single categorical moderator (Hypotheses 14-16) and the fourth was a hierarchical moderated regression (Hypotheses 6,10). Equations for the first two tests came from Cohen (1992; , 2003) while the moderated regression came from Aguinis (2004). Equations for the hierarchical moderated regression came from a combination of both sources.

For this analysis several assumptions needed to be made. First, all the tests assumed an alpha level of .05 for a one-tailed test. For the multiple regression and t-tests, the effect size needed to be estimated. The effect size for multiple regression is f^2 (based on R^2) while for a t-test it is Cohen's d. To estimate f^2 (using R^2) several previous studies which have investigated similar phenomena were referenced. Recent empirical studies that examined the effects of media on teams have shown R^2 ranging from between .24 to .43 with a mean of .35 (Kahai & Cooper, 2003). Therefore, a conservative estimate R^2 for this study was .30 which yields a f^2 of .4285. Cohen's d was set at .8 for the independent t-test which is similar to an R^2 of .3. For the moderated regression a correlation between the IV and DV for each group was estimated at .3 for one group and -.3 for the other. The correlation between the IV and moderator was set at .3 also. Finally, the standard deviation was assumed to be one. For the hierarchical moderated regression the number of predictors in the first set was two and one in the second set.

Also, the anticipated incremental effect size f^2 for the second set was assumed to be .2. Using these values the required sample size for the multiple regression was found to be 30, for the independent t-test it was 42, for the moderated regression it was 210, and for the hierarchical regression it was 43.

Task Description

Participants played a networked computer game based on a military command and control context. This game is a modified version of the Distributed Dynamic Decision-making (DDD) simulation developed for the Department of Defense for research and training purposes (Miller, Young, Kleinman, & Serfaty, 1998). The version of the simulation played in this experiment was developed for use by four member teams with little or no military experience (MSU-DDD).

The game playing area is comprised of a 20x20 grid that is further broken down into a quad cell with 10x10 regions. Each region has a base that is located in the middle of it. The purpose of the game is for players to monitor the ground and air space around the bases and keep enemy targets out of the region which has been assigned to them. To perform this function, each player is assigned assets allocated to their base which have the ability to be directed towards and prosecute targets

The game is programmed to present a fixed radar representation only of the region they have been assigned. Therefore, any target outside of radar range of an individual's base is usually invisible to them. However, each mobile asset also has the ability to detect and identify targets. As a result, team members can determine the nature of a target outside their bases radar display either by working together and asking their teammates to share information or by launching a vehicle and moving it near the target.

Typically, the mobile assets for each team are comprised of AWACS planes,

tanks, helicopters and jets. Each of these vehicles varies in its capacities on four different dimensions: (a) range of vision, (b) speed of movement, (c) duration of operability, and (d) weapons capacity. However, for this study the AWACS was not but the leader sat in the position typically assigned to this role. To ensure that they were given an informational advantage over the other team members, they were allowed to see all the targets on the entire screen.

There were eight types of "standard targets" that were known a priori to have specific characteristics. These were taught in the training session prior to the start of the simulation. Each target had a combination of three different attributes; air or ground, friendly or unfriendly, and the three different levels of power it takes to disable them if they are unfriendly. There were also four types of unknown targets. These were targets that even after the players identify them they still do not know what they were. Each correspond to a different type of ground target so they had to figure out which is which in order to perform well.

During the games, subjects were given a number of different episodes to complete. Each episode could be considered a different task which relates to a larger problem. Typically these episodes consisted of a number of enemy targets that simultaneously attacked the team's bases. In order to score well on the simulation, the followers needed to work hard to complete the tasks and the leader needed to effectively fulfill their role.

Manipulations, Measures and Reliability

This experiment consisted of a 3(structure) x 2(leadership style) x 2 (task complexity) mixed factorial design. It is mixed factorial design because task complexity was a within subjects manipulation. The three different types of structure (collocated,

virtual, and reachback) were crossed with the two different types of leadership styles taught (transformational and transactional) which were crossed with a high and low complexity environment. Each of variables examined along with their measures is presented below. A complete listing of measurement items can be found in Appendix A.

Structure

Structure was manipulated by having all the participants play the simulation in the same room if they were in a collocated team or different rooms if they were in a virtual and reachback team. For the collocated condition, all team members were assigned to the same room and arranged such that they could see each other (see Appendix C for pictures of the rooms). For the virtual team, subjects where assigned to stations in separate rooms after the training. In the reachback teams only the leader was assigned to a station in a different room. It is thought that training the members together and then dividing them up is consistent with the population that this study was intended to model. For example, most response teams typically have a home base and are trained together but when a disaster strikes, a portion of the team is forward deployed into the effected area.

Subjects in the virtual and reachback teams were able to communicate with their non-collocated teammates via a voice over internet (VOIP) computer network application. By using such an application all members of the group could hear what everyone else was saying. Such an application is analogous to a telephone switch since it allows all those who are connected to it via a computer network to communicate using headset and microphones. All subjects in all three structures wore a headset which consisted of a single speaker that covered one ear and a boom microphone. Even thought they were all in the same room, those in the collocated structure also wore headsets to both record their conversation and to decrease the chance that the headsets could act as a

confound. A headset with only one speaker was used to allow followers in the reachback configuration to easily hear their remote leader and collocated teammates simultaneously. In the collocated and virtual structures the VOIP application used was Ventrilo by Flagship Industries, Inc. Everyone's voice was recorded on a common audio channel using Ventrilo's internal recording capability. Communication in the reachback structure performed using using Skype which is now owned by eBay.

Ventrillo was the preferred application because all of the software and hardware used was fully controllable and able to be isolated. Skype on the other hand is an Internet based application so it relies on a very high quality and reliable internet connection which is based on factors which are usually uncontrollable. The reason it was used at all was because it was discovered during data collection that a 0.7 second communication delay existed using Ventriloa between when someone talked and when others heard it. While this was acceptable for the virtual configuration because everyone was in a different room, and for the collocated structure because everyone's headset's were disabled, it was not acceptable for the reachback structure. In this configuration, everyone's headsets needed to be activated to hear the remote leader but a 0.7 second communication delay would have created a severe echo effect in the room with the follower subgroup. Once this issue was discovered, several other industry leading VOIP applications were tested like TeamSpeak, but all were found to have the same 0.7 second delay. As a result, Skype was used to communicate between team members and HotRecorder was used to record the conversation. In the end, no problems materialized while using this application. It should be noted that each player's voice was also recorded on a separate audio channel using Jet Audio by Cowan America, Inc.

In this study the different structures will be dummy coded using the reachback team as the control group. This way all three groups can be compared to each other.

Leadership Style

One of the more difficult problems to overcome when performing lab experiments that investigate the effects of leadership behaviors is ensuring the desired behaviors are actually exhibited during the experiment. Two solutions for this problem involve either training participants to exhibit specific behaviors or using confederates. Confederates are covert agents of the researchers and are typically trained to perform a specific purpose in the group. As such, they represent a manipulation performed on the group. For example, confederates who have been trained to exhibit either a transactional or transformational and a participative or directive leadership style have been used in several laboratory experiments (Kahai, Sosik, & Avolio, 1997, 2004; Sosik, Avolio, & Kahai, 1997).

Training subjects is another common method used to examine the effects of leadership style. Using this approach, a subject is chosen to receive instruction that will teach them how to exhibit behaviors associated with a certain leadership style. This individual is then introduced into the group so that the effect of that style on the group can be studied. This approach was selected for this experiment for several reasons. First, training has been shown in previous studies to have an impact on leader behaviors. For example, training to increase the procedural justice exhibited by leaders was shown to have a definite relationship with the perceived procedural justice behaviors displayed by the leader (Skarlicki & Latham, 1997). More specific to leadership behaviors, it has been shown that training can increase the number of behaviors associated with transformational and charismatic leadership (Barling, Weber, & Kelloway, 1996; Dvir, Eden, Avolio, & Shamir, 2002; Towler, 2003). Of course, this approach relies on the

strength of the training to elicit the correct behaviors. Because of this it might be argued that behaviors can be changed only after extended training sessions and long exposure to the material. However, it has been shown that training to improve decision making that has only lasted three hours has been shown to have an effect on behavior over two years later (Ganzach, Pazy, Ohayun, & Brainin, 2002).

The training for this experiment began by randomly identifying a leader, subject to their ability to fluently speak English, from the group of people that attended each session. The leader was then given a 30 minute presentation which explained what types of behaviors they were expected to exhibit. This material was developed based on similar instructional information developed for previous studies (Dvir, Eden, Avolio, & Shamir, 2002; Kirkpatrick & Locke, 1996; Towler, 2003) and was consistent with previous studies that involved leadership training (Barling, Weber, & Kelloway, 1996; Dvir, Eden, Avolio, & Shamir, 2002). The training consisted of a Microsoft Powerpoint presentation, with a integrated soundtrack, that explained the type of leadership they had been asked to exhibit, what the different dimension of this style are, and general and specific examples of behaviors that are consistent with this style of leadership. General examples of behaviors included comments like "speak in a captivating voice" for transformational style. Specific comments (which were game dependent) included statements like "make it clear to each of your followers who is in charge of each action" for transactional leaders.

In order to keep them interested and engaged during the training several different contemporary movie clips were shown to demonstrate the dimensions of each style. To aid them in appearing transformational or transactional, they were given a summary of

the slides and a list of comments, similar to the quiz, which included both transformational and transactional comments specific to the task, both of which they could refer to during the game. Finally, they were given a statement to read before the games began which was intended to make them appear more transformational or transactional (Kirkpatrick & Locke, 1996). All of these items appear in Appendix B along with the soundtrack script for each type of training.

It was hoped that administering the training so temporally proximal to the manipulation would increase the number of specific behaviors each leaders would exhibit. For each session one leader exhibited a transformational style and the other exhibited a transactional style. Since transactional leadership is based on economic exchange principles and the contingent reward, leaders who were selected to exhibit transactional behaviors were asked to emphasize the financial incentives in the game but the transformational leader was not told to do this. Instead the trainer informed the transformational teams of the financial incentives before the games began. At the end of each data collection period, the team with the highest normalized offensive and defensive score was awarded $300. The second place team was awarded $200, and the third place team was given $100. There were three separate data collection periods used for this experiment so these incentives were paid out three separate times.

In this study, leadership style will be manipulated via a training program and coded as 0 for those who receive transactional leadership training and a 1 for those who receive transformational leadership training.

Task Complexity

The task complexity of the games where manipulated so that one game had a high complexity and the other had a low complexity. As mentioned earlier, a high complexity

environment is characterized by a functional structure, high team learning, and a high level of uncertainty. Each of these were intended to manipulate the three types of complexity discussed by Wood (1986) (component, coordinative, and dynamic) as shown in Table 1.

The structure was manipulated by changing the type of vehicles that each team member had. This was done to manipulate the dimension of component complexity. In the functional structure each team member had all the same type of vehicle. For example, one member had all the tanks, another had all the jets, and the other had all the helicopters. For the divisional structure each team member had one of each vehicle such that each member had one tank, one jet, and one helicopter.

The level of learning was modified by changing the number of unknown tracks in the game. This was done to manipulate the dimension of coordinative complexity. Again, unknown targets are targets which the players still do not know the status of even after they identified them so they must work together as a team to figure it out. In the high complexity task the number of unknown tracks was high while it was low in the simple task.

Finally, the level of uncertainty was manipulated by changing the location that the targets appeared on the screen. This was done to manipulate the dimension of dynamic complexity. In the high complexity environment the entrance of the tracks on the screen was completely random whereas for the low complexity task the tracks always entered from the same location.

To ensure that the order in which the teams received the tasks did not act as a confound the teams were counterbalanced by alternating task order. For example, odd

numbered teams were administered the high complexity task first while even numbered teams received it second.

In this study task environment was manipulated by having the teams play different games. The high task complexity environment was coded as a 1 and the low task complexity environment was coded as a 0.

Communication Quantity

Communication quantity is conceptualized as the amount of communication within the team and therefore could be measured by summing the temporal length of all comments made by all members of the team during a 30 minute game. A common instrument used to perform this measurement would be a stopwatch which is started when any member of the team speaks and ends when they finish. This process would be repeated throughout the entire 30 minute game each time a team member spoke. The final total amount of time that all members of the team spoke during the game would be considered as a measurement of team communication quantity. However, due to the constant string of pauses that people use while speaking it was deemed impractical to use human coders to make this measurement. If subjects frequently started and stopped speaking this strategy would overwhelm coders and made it nearly impossible to obtain a reliable measurement. Instead, a computer seemed well suited for this task given the very fast reactions that are necessary to obtain an accurate measurement. To provide input to the computer for this analysis each team member's voice was digitally recorded at 24 kHz and 16 bits. A common channel was also recorded that combines everyone's voice. The next problem of course was how to get a computer to recognize human speech and discriminate it from background noise or other non-speech related artifacts. Given that

all of the audio files used in this experiment were already digitally based, a technique known as a variable bit rate (VBR) encoding was selected to address this problem.

Often digital files are stored by sampling a time based signal at regular intervals and assigning the same number of bits to each sample, regardless of the amount of signal contained at that moment. As a result, the same numbers of bits are used to encode silence as are used to encode voice patterns. This is despite the fact that much fewer bits (if any) are required to represent silence. As a result, those bits which are assigned to encode periods of silence are "wasted". An alternative to this approach is variable bit rate encoding which senses the strength of the signal and applies fewer bits when silence is present and more bits when a signal is present. The stronger the signal, the more bits that are assigned and the larger the final file size will be. The number of bits that are assigned is based on the quantization error used in the encoding algorithm. This process is analogous to factor analysis continuing to search for factors if the Eigenvalue is above one. If the quantization error (eigenvalue) is above a certain present quality level more bits (factors) are applied until the quantization error falls below the predetermined quality level. As a result, an audio file in which a team spoke more will have a higher file size after VBR encoding than a team which spoke less. Therefore, it is the final file size, in bytes, after VBR encoding that will be used as a measure of communication quantity.

Given that this is a computerized process, it is not the reliability of the technique that needs to be examined but rather its concurrent criterion validity. In other words, the ability of the file size after VBR encoding to accurately represent the length of time all members of the team speak needs to be established. The most common procedure for doing this is to inspect the correlation between the predictor (file size) and the criterion

(length of all speech) (Binning & Barrett, 1989; Dooley, 1995; Nunnally, 1978). However, since all the games where 30 minutes, the predictor must also be shown to be invariant to periods of silence. Therefore, two questions need to be asked. First, does the file size have a high correlation to the length of time people speak and second, is the process able to accurately discriminate between people speaking and silence? If the results to the these questions are deemed satisfactory, than two more questions need to be asked regarding how invariant the technique is to less than perfect input data. The first of these questions is how invariant is this technique to heavy breathing, which was recorded on many of the audio files and second, how invariant is the process to changes in the amplitude, or loudness, in the input signal?

The first question was answered by selecting six people at random to read the same 650 word statement. The correlation between the length of time it took them to read it and the final file size was $r = 1.0$. To answer the second question four test files were created that were each four minutes long. In the first file a 1 minute statement was read, in the second the same statement was read twice, in the third it was read three times, and in the fourth it was read four times. The correlation between the final file size and the amount of speech in each file was $r = 0.98$. Having deemed these to be acceptable answers to the first two questions, the next two questions were asked. With regards to how invariant variable bit rate encoding is to breathing, two tests were preformed. First, three files were created that were each again four minutes long. One file contained two minutes of heavy breathing, one contained just background noise and the third contained nothing because the microphone was disconnected. The largest difference in the final size of these files after encoding was less than one percent. The second test to examine

the effects of breathing was performed using pilot test data. For this test two 30 minute audio files from two different teams were compared. One contained heavy breathing and the other did not. A direct comparison of the output could not be made between these files since the amount of communication was different in each so to overcome this problem the frequencies in both files that carried the heavy breathing were eliminated. After performing a spectral analysis, it was discovered that most all of the heavy breathing was contained in frequencies below 500Hz so any signal below this was minimized using a digital frequency equalizer. Since the frequency of human voice falls between 500-4000Hz this action did not have a major impact on the actual voice pattern data. The modified files were then encoded and compared to the same files before modification. If heavy breathing does indeed substantially increase the encoded files size, it was expected that the percentage difference between the size of the encoded files before and after the frequency modification would be much larger for the pair that contained the heavy breathing than for the pair that did not. However, this was not observed. In fact the difference was again less than one percent. These two tests provide strong evidence that the final size of a file after variable bit rate encoding is fairly invariant to heavy breathing. The last test examined how invariant VBR is to changes in amplitude. Some people speak louder than others so it is important that this technique is not heavily influenced by such changes. To test this, pilot test data of a subject reading the same 650 word statement mentioned above was used. In this case the subject read the statement very loudly. A copy of this file was then created in which the total audio level was decreased by 10 percent. Both files were then encoded. The final difference in file size was less than one percent. This test was later repeated with 28 30-minute audio

recordings. The difference in the games ranged between 0.3%-1.7% with an average of 1.5%. This test was repeated but with a 20 percent decrease instead of a 10 percent decrease. As expected, the difference in the games ranged between 0.6%-3.4% with an average of three percent. This suggests that a team which spoke twice as loud as another would only have a final encoded file size that is 7.5 percent larger. This is strong evidence that VBR encoding is invariant against amplitude changes.

The program used to perform all VBR encoding was LAME which is not only the industry standard to perform variable bit rate encoding but is also the most popular engine used to convert audio files into the Motion Pictures Expert Groups, Standard 1, Layer 3, commonly referred to as MP3. This application is used in most every commercial audio program that offers such a conversion option. LAME not only allows the maximum number of bits used during the VBR encoding process to vary but also allows the minimum number of bits and the quality of the encoding to be selected. It is a command line interface program with each setting being represented by a different software switch. It was determined that for this experiment, the switch settings which provided the highest variance, most linear output, and were the most invariant to unwanted audio artifacts such as breathing and changes in signal amplitude were a minimum bit rate of eight, a maximum variable bit rate of 112, and a quality level of seven. The final command line interface command for encoding was "-b 8 –V 7 –B 112"

Communication Quality

Communication quality is a team level construct which can be thought of as quality of the interaction between persons in a team based setting. This construct was measured using a 12 item communication competence instrument developed by Monge, Backman, Dillard, & Eisenberg (1994) is used. This was the first instrument designed to

examine competence from an organizational rather than an interpersonal perspective. Some of its strengths include an other-orientated evaluation of competence and a focus on both encoding and decoding skills. Examples of these items include, "My teammates are difficult to understand when they communicate" and "My teammates expresses their ideas clearly." Coefficient alpha was used to test the reliability of each self-reported continuous scale used as a variable in the study. For communication quality alpha was 0.93, ICC(1) was .18, and ICC(2) was .39

Two secondary measures of communication quality were also collected but not used to test the hypotheses. The purpose of these measures was to act as back-ups to the proposed measure. The second measure is task clarity which is the degree to which team members are satisfied with the task specific information that has been given to them. It is a four-item measure developed by Kirkpatrick and Locke (1996) to measure the effects of leadership in a group setting. Examples of these items include, "I knew exactly what to do on this task" and "I was not very sure how to complete the task (R)." The coefficient alpha for this scale was 0.72. The last measure examines the timeliness, accuracy, and usefulness of the communication. It is a four item measure that was developed by Frone and Major (1988). Examples of these items include, "To what extent is information you receive usually timely (you get information when you need it—not too early or too late)" and "To what extent is information you receive usually accurate (you can rely on the information – it is generally correct)." The coefficient alpha for this scale was 0.89.

Leader Centrality

Centrality relates to the number of connections an individual within a social network has (Klein, Lim, Saltz, & Mayer, 2004). As such, it reflects the extent to which interactions are concentrated in certain individuals rather than distributed equally among

all members (Sparrowe, Liden, Wayne, & Kraimer, 2001). For this study, network centrality was measured by using an instrument developed by Sparrowe et al., (2001) which is based on the work of Burt (1992) and Ibarra (1993). This measure was originally intended to measure the network centrality of each member in a team but since this study targets leaders it has been modified for this purpose by simply substituting the work "leader" in place of the team member names. Additionally two extra questions were also created based directly on the definition. The coefficient alpha for this scale was 0.88, ICC(1) was 0.19, and ICC(2) was 0.42

Objective Performance

As mentioned before, this construct is comprised of both speed and accuracy dimension. Therefore, both were measured and combined to form a composite measure of objective performance. Speed was measured by recording the final team defensive score in DDD. This is a very visible score to all members of the team throughout the game and in the past has been considered to have construct validity because how quickly individuals and teams are able to destroy incoming targets is directly related to their final defensive score.

Accuracy of performance was measured by recording the final team offensive score. This is also a very visible score to all members of the team throughout the game and in the past has been considered to have construct validity because how precisely the team attacks only enemy targets is directly related to their final offensive score. The final composite performance scores were created by standardizing the data within measure (game not complexity) and taking the mean of team offense and defense score.

Satisfaction with Team

This is the level of satisfaction each team member has of the team. It was measured using the four item quality of team interaction and three item satisfaction with team relationships measures developed by Wageman, Hackman, and Lehman (2005). The items from the first instrument include questions like, "There is a lot of unpleasantness among members of this team (R)" and "The Working together energizes and uplifts members of our team." The items from the second instrument include questions like, "My relations with other team members are strained (R)" and "I very much enjoy talking and working with my teammates." The coefficient alpha for this scale was 0.79, ICC(1) was 0.24, and ICC(2) was 0.48

Satisfaction with Leader

This is the level of satisfaction each team member has with the leader. It was measured by adopting a 14 item supervisor satisfaction scale developed by Scarpello and Vandenberg (1987). The items include questions like, "The way my leader listens when I have something important to say" and "The way my leader sets clear work goals." The coefficient alpha for this scale was 0.97, ICC(1) was 0.10, and ICC(2) was 0.25

Procedure

All subjects for this experiment signed up to participate on a website by selecting the session they wanted to attend. Two teams of four members could be run during each session. When this happened, both teams had the same structural configuration. Once all the subjects arrived at the laboratory they were asked to wait in the waiting room until all the subjects arrived. Random assignment to teams was then made and the team members were directed into one of two rooms for training. Random assignment to condition was satisfied because the subjects were not aware of which team configuration would be selected for their particular session before they sign up.

Once the subjects were in their seats, they were asked to electronically complete a consent form and a pre-training survey. Following this, the entire team was given a 20 minute electronic slide show presentation, which included a pre-recorded audio track, on how to operate the game. Training was only performed by qualified research staff members. Once this was completed the leaders were separated for their specific leadership training and the remaining members where given detailed hands on training using the simulation. It was thought that since the leaders were not given any vehicles to control, missing the hands-on training was not significant. Further, it was hoped that by removing the leader from the group, their role would be made more salient to the group.

Following the training, all subjects were assigned to their proper stations and prepared to play the game. After the first game the subjects were electronically administered the applicable instruments. To give the leader a chance to appear more transformational or transactional away for the game context, they were each asked to summarize the performance of the group at this point or make any other comments while exhibiting behaviors consisted with the leadership style they had been trained to use. After the second game subjects were again electronically administered the applicable instruments. They were then debriefed and thanked for their time.

Data Analysis Strategy

There are several techniques that were used to analyze these data. In each case the technique selected was based on the type of data being analyzed, the nature of the hypothesis, and an attempt to keep the analysis as parsimonious as possible. First, the means, standard deviations, and intercorrelations between all the variables were calculated and reported in Table 3 and 4. These variables were created by aggregating individual measures to the team level. Next the model presented in Figure 1 was tested

using a series of t-tests, and multiple regressions, hierarchical multiple regressions, and moderated regressions

The first set of analyses examined the direct effects between the independent variables and the mediators. Next, the proposed direct effects between the mediators and the final outcome variables were considered. Then, the direct effects between the independent variables and dependent variables were also reported. Moderation between all the independent variables was also calculated and reported in each of these steps.

A mediation analysis was also performed using the methodology presented by Baron and Kenny (1986). This is a four step procedure that first includes examining whether the relationship between the independent variables and the mediators is significant. Next, the relationship between the mediators and the dependent variables also must be shown to be significant. Third, the direct relationship between the independent variables and the dependent variables must be shown to be significant. Finally, this relationship must be shown to be non-significant when a regression is performed that includes the independent variables and the mediator, where the mediators are entered in a prior hierarchical step.

CHATPER 4 - RESULTS

Manipulation Checks

As mentioned, a major concern when performing experimental leadership studies is to ensure that the intended behaviors were exhibited and perceived by the followers. To ensure that this was accomplished, two manipulation checks were performed.

The first consisted of a 15 item quiz administered to the leader after the training (see Appendix B). Nine of the items were items from the transformational scale on the multifactor leadership questionnaire (MLQ) and six were items from the transactional scale on the MLQ. The MLQ is the most popular instrument for measuring transformational and transactional leadership behaviors (Antonakis, Avolio, & Sivasubramaniam, 2003; Lowe, Kroeck, & Sivasubramaniam, 1996). None of these items were previously presented in the training. The leaders were asked to circle those items which were consistent with the style of leadership they had been asked to demonstrate. Both types of leaders were administered the same test. The average on this test was 73.2% with a standard deviation of 2.67, a low of 4, and a high of 15. In the transformational condition, the mean number of transformational items identified as transformational behaviors was 0.90 while the mean number of transactional items identified as transformational behaviors was 0.30. A paired t-test showed that this difference was significant $t(41) = 17.191$ ($p<.05$). In the transactional condition, the mean number of transactional items identified as transactional behaviors was 0.72 while the mean number of transformational items identified as transactional behaviors was 0.42. A paired t-test showed that this difference was significant $t(37) = 5.008$ ($p<.05$).

The second manipulation check was performed by having everyone in the team rate the performance of the leader using the MLQ immediately after the experiment. A t-

test was then performed to compare the mean scores of leadership behaviors across the conditions. The purpose of this test was to determine if for each behavior, the scores where higher in the appropriate condition. This approach is consistent with that taken by Sosik, Avolio, and Kahai (1997) and showed that for each behavior there was a significantly higher score for the intended manipulation. Team members rated transformational behaviors higher in the transformational condition $t(84) = 2.710, p < .05$ and transactional behaviors higher in the transactional condition $t(84) = -1.807, p < .05$.

Scales, missing and deleted data

Communication quality, Leader centrality, Team Satisfaction and Leader Satisfaction scales were all standardized within game order (not task complexity) because of significant differences in the means of these variables between games. Communication quantity did not have such a difference so it was not standardized. These scales were created using follower responses only.

There were only two variables that had missing data; performance and communication quantity. To determine if the missing data points were missing completely at random (MCAR), they were each analyzed with respect to the independent variables. For the performance data there were only three missing data points. With respect to structure, these three data points were each from a different condition. With respect to leadership, two were from the transformational condition and one was from the transformational condition and with respect to complexity two were from the low complexity condition and one was from the high complexity condition. For communication quantity, there were 24 out of 169 (14.5%) missing data points. These points were missing because the team audio recorders did not activate properly during these games. With respect to structure, seven of these 24 where in the collocated

structure, eight were in the virtual structure, and nine were in the reachback structure. With respect to leadership, 11 were in the transformational condition and 13 were in the transactional condition. Finally, with respect to task complexity, 13 were in the low task complexity condition and 11 were in the high task complexity condition. Given that no discernable pattern was present with respect to any of the independent variables the missing performance and communication quantity values were treated as MCAR.

The only data removed from the analysis was the low complexity performance score of one team's second game. Their score was removed because several members of this team seemingly decided to stop participating after the first game was over. This was due to the fact that between games one member of the team realized that this was a military command and control simulation and asked the trainer if the data collected might help the United States military. The trainer confirmed that the simulation had come from the military and that they might be interested in the results. This evidently upset the individual because according to her, she was born and raised in Lebanon and this experimental session took place in the first few weeks of an Israeli Military Campaign into Southern Lebanon which some thought had the tacit approval of the United States. This individual, along with one other team member who seemingly sympathized with this person, where then intermittently observed not playing the simulation. These behaviors were thought to have led to this team having the lowest objective performance score, -2.645.

Test of Hypotheses

The following section presents the results for each hypothesis test. The first section examines the direct effects, the second looks as the proposed moderation, the third at mediation, and the fourth and other significant interactions which were found.

For each hypothesis, both the simple and complex task data was analyzed separately. All regression coefficients reported are the standardized beta values and all significance testes (p values) were based on a one-tailed alpha value of .05.

Direct Effects

Hypothesis 1 predicted that communication quantity will be higher in a collocated team compared to a reachback team and hypothesis 2 proposed that communication quantity will be higher in a reachback team compared to a virtual team. Both of these hypotheses were tested using hierarchical regression for both the simple and complex task. First, two dummy variables were coded as a 1 0 for collocated teams, a 0 1 for virtual teams and 0 0 for reachback teams (control). These were entered into a regression equation as independent variables with communication quantity as the dependent variable. If the first dummy variable was significant hypothesis 1 would be supported and if the second dummy variable was significant hypothesis 2 would be supported. As shown in the Tables 5 and 6, the dummy variable for the collocated groups were significant for both levels of complexity, B = .418, $t(71) = 3.276, p < 0.05$; B = .524, $t(71) = 4.805, p < 0.05$ and the dummy variable for the virtual groups were also significant in both cases but in the wrong direction, B = -0.534, $t(71) = -4.189, p < 0.05$; B = -0.683, $t(71) = -6.265, p < 0.05$. This model shows that team structure explained a significant proportion of variance in communication quantity for both types of tasks. For the simple tasks $R^2 = .310$, $F(3, 68) = 9.781, p < .05$ and for the complex tasks $R^2 = .472$, $F(3, 69) = 19.539, p < .05$. As a result hypothesis 1 is supported but hypothesis 2 is not supported. Figures 9 and 10 below show the mean level of communication quantity for each of the three types of structure in both the simple and complex tasks.

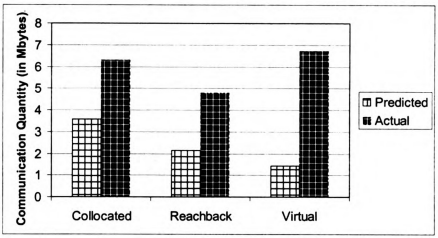


Figure 9. Predicted and results for hypotheses 1 and 2 (simple)

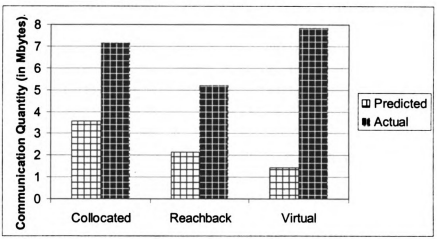


Figure 10. Predicted and results for hypothesis 1 and 2 (complex)

Next, hypothesis 3 predicted that communication quality will be higher in a collocated team compared to a reachback team and hypothesis 4 stated that communication quality will be higher in a reachback team compared to a virtual team. As above, both of these hypotheses were tested using hierarchical regression for both the simple and complex task. As shown in the Table 7 and 8, the dummy variable for a collocated team was not significant in either case, B = -0.119 $t(84) = -0.929$, $p = .178$; B = -0.079, $t(84) = -0.617$, $p = .270$ and the dummy variable for a virtual team was also not significant in either case, B = -0.138, $t(84) = -1.080$, $p = .142$; B = -0.156, $t(84) = -1.212$,

$p = .115$. As a result hypotheses 3 and 4 are not supported. Figures 11 and 12 below show the mean level of communication quality for each of the three types of structure in both the simple and complex games. The large difference between actual and predicted data is due to the fact that the original prediction was based on raw data whereas the actual data is standardized within game (first versus second game played by the team).

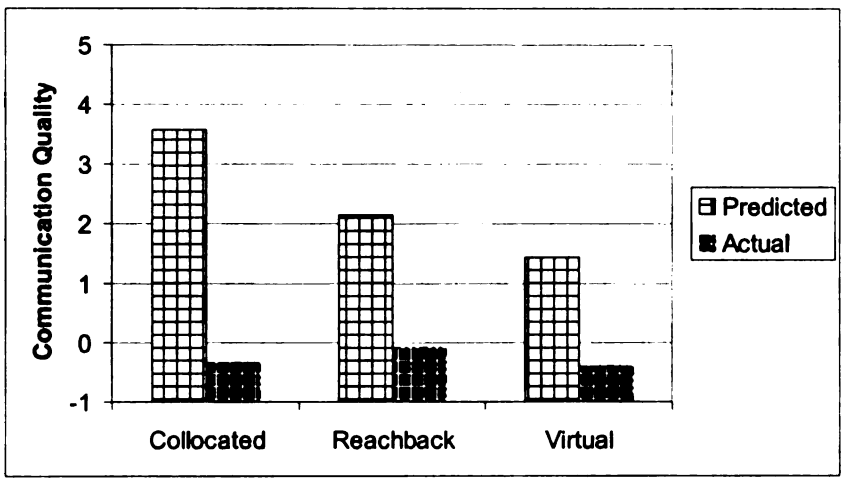


Figure 11. Predicted and results for hypotheses 3 and 4 (simple)

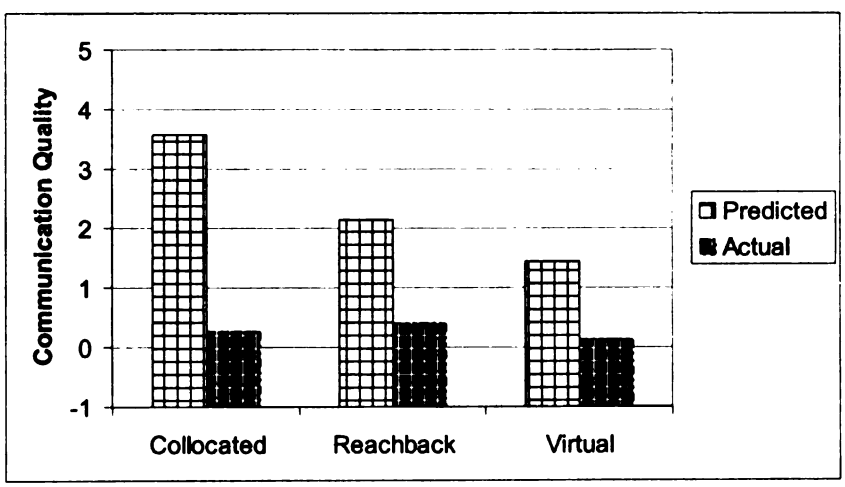


Figure 12. Predicted and results for hypotheses 3 and 4 (complex)

Hypothesis 5 suggested that teams whose leaders were taught a transformational leadership style will make more comments than teams whose leader were taught a transactional style for each structural configuration. This was tested by performing a t-

test on the mean number of comments made in the transformational and transactional conditions for each structure. As shown in Table 9, hypothesis 5 was fully supported in both simple and complex games for collocated ($t(24) = 1.864$, $p < .05$; $t(24) = 2.256$, $p < .05$) and reachback ($t(19) = 1.971$, $p < .05$; $t(22) = 1.801$, $p < .05$) structures and marginally supported in a virtual structure ($t(23) = 1.635$, $p = .058$; $t(20) = 1.636$, $p = .059$). Therefore, hypothesis 5 is supported Figure 13 and 14 shows the mean value of communication quantity in transformational and transactional conditions across structures for both simple and complex tasks.

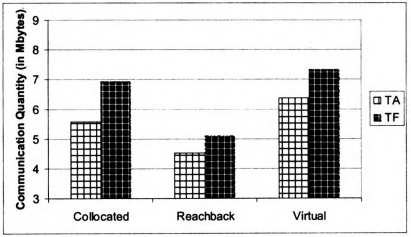


Figure 13. Predicted and results for Hypothesis 5 (simple)

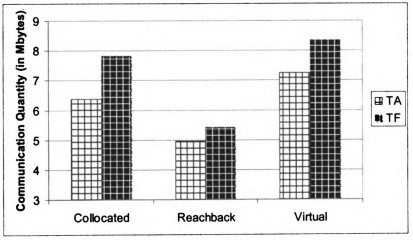


Figure 14. Predicted and results for Hypothesis 5 (complex)

Hypothesis 6 states that communication quality will be higher in a collocated transformational team than a transactional team. This hypothesis was tested by performing a moderated regression. To do this a dummy variable representing leadership style was created. This variable was coded as "1" for the transformational condition and a "0" for the transactional condition. Two interaction terms were then created between this variable and the two structure dummy variables from hypothesis 1 and 2. The leadership dummy variable and the resulting interaction variables were then each loaded into the regression equation in a separate hierarchical regression step, allowing for an examination of the change in R^2 between the each of the direct and the interaction effects. The hypothesis was tested by examining the significance of the interaction terms. As shown in Tables 7 and 8, there was no significant interaction between collocated and reachback or virtual and reachback teams for simple tasks, B = -0.221, $t(84) = -1.052$, p =.148, B = -0.040, $t(84) = -0.204$, p =.42 or complex tasks, B = 0.033, $t(83) = 0.159$, p =.44, B = -0.236, $t(83) = -1.169$, p =.123. Therefore hypothesis 6 is not supported.

Hypothesis 7 predicted that a positive relationship exists between task complexity and overall team communication quantity. This hypothesis was tested by using an independent t-test. For this test, the mean number of comments made during the high complexity game was shown to be significantly higher than it was during the low complexity game. For this test, only data from the first game were used, to ensure that the measures used were independent. Results show that hypothesis 7 was supported, $t(72) = 2.967$, $p < .05$.

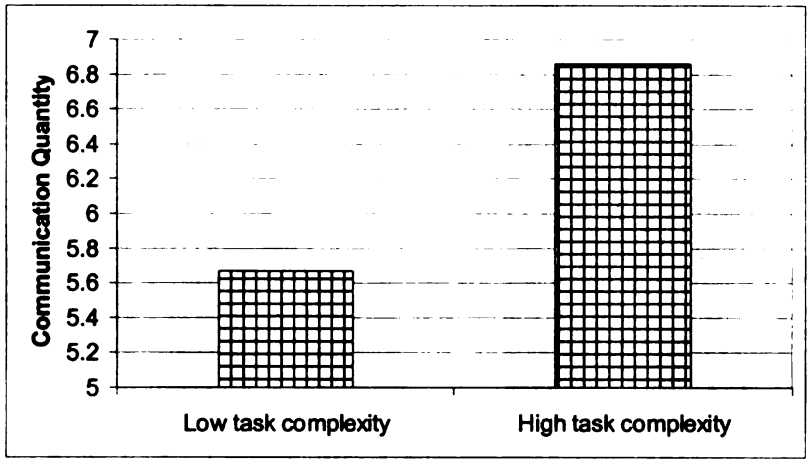


Figure 15. Results for Hypothesis 7

Hypothesis 8 states that team member perceptions of leader centrality will be higher in a collocated team than a reachback team and hypothesis 9 states that team member perceptions of leader centrality will be lower in a virtual team than a reachback team. Both of these hypotheses were tested by using hierarchical regression for both the simple and complex task. As before two dummy variables were coded to represent collocated teams, reachback teams, and virtual teams. These were entered into a regression equation as independent variables with leader centrality as the dependent variable. If the first dummy variable was significant hypothesis 8 would be supported and if the second dummy variable was significant hypothesis 9 would be supported. As shown in the Tables 10 and 11, the dummy variable for the collocated groups was not significant in either case, B = –0.160, $t(84) = -1.252$, $p = .107$; B = 0.148, $t(83) = 1.159$, $p = .125$. The dummy variable for the virtual groups were also not significant, B = -0.161, $t(84) = -1.267$, $p = .105$; B = -0.053, $t(83) = -0.420$, $p = .338$. As a result both hypotheses 8 and 9 are not supported. Figures 16 and 17 shows the mean level of leader centrality for each of the three types of structure in both the simple and complex games. Again, the large difference between actual and predicted data is due to the fact that the original

prediction was based on raw data whereas the actual data is standardized within game (first versus second game played by the team).

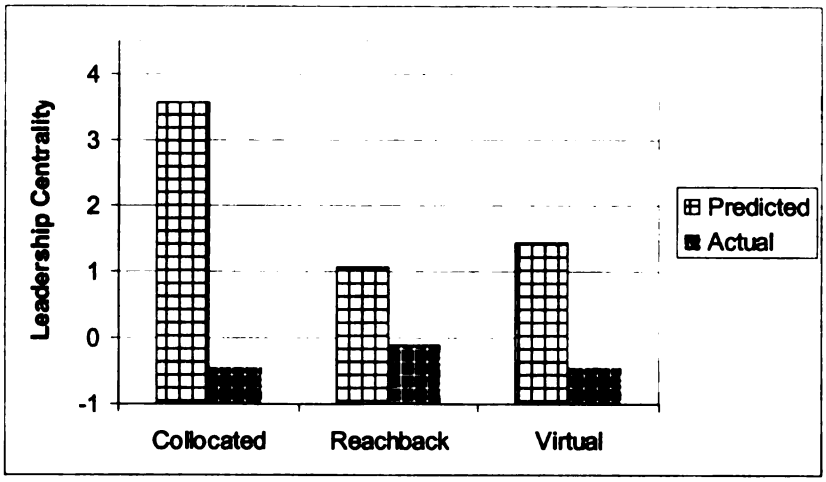


Figure 16. Predicted and results for Hypothesis 8 and 9 (simple)

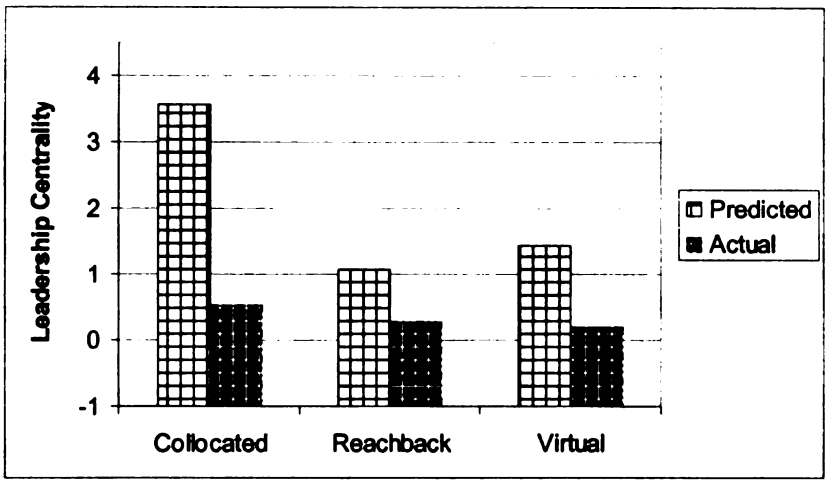


Figure 17. Predicted and results for Hypothesis 8 and 9 (complex)

Hypothesis 10 states that leader centrality will be higher in a collocated transformational team than a transactional team. This hypothesis was tested using the same methodology explained above for hypothesis 6 except that the dependent variable was leader centrality. As shown in Tables 10 and 11, there is also no significant interaction between collocated and reachback or virtual and reachback teams for simple tasks, B = -0.062, $t(84) = -0.299$, $p = .383$, B = 0.096, $t(84) = 0.490$, $p = .313$ or complex

tasks, B = -0.002, $t(83) = -0.010$, $p = .496$, B = -0.226, $t(83) = -1.140$ $p = .129$. Therefore, hypothesis 10 is not supported.

Regarding the relationships with the outcome variables, hypothesis 11 proposes a positive relationship exists between communication quality and effectiveness variables. This hypothesis was tested by using multiple regression after segregating the data based on complexity. To test this, and next two hypotheses, communication quality, communication quantity (see hypothesis12) and leadership centrality (see hypothesis 13) were used as independent variables against objective performance, team satisfaction leader satisfaction in separate regression equations. As shown in Tables 12 - 17, significant relationships were found in the simple game for objective performance B = 0.385, $t(69) = 2.175$, $p < .05$, team satisfaction B = 0.616, $t(71) = 4.715$, $p < .05$, and leader satisfaction B = 0.234, $t(71) = 1.980$, $p < .05$. For the complex game significant relationships were found for team satisfaction B = 0.501, $t(71) = 4.378$, $p < .05$ and leader satisfaction B = 0.429, $t(71) = 3.813$, $p < .05$. Therefore, hypothesis 11 is mostly supported.

Hypothesis 12 proposes a positive relationship exists between communication quantity and effectiveness constructs. This hypothesis was tested by using multiple regression after segregating the data based on complexity. As shown in Tables 12 - 17, no significant relationships were found. Therefore, hypothesis 12 is not supported

Hypothesis 13 proposes a positive relationship exists between perceived leader centrality and performance elements. Again, this hypothesis was tested by using multiple regression after segregating the data based on complexity. As shown in Tables 12 - 17, significant relationships were found in the simple game for leader satisfaction B = .594,

$t(71) = 4.990, p < .05$ and in the complex game for objective performance B = 0.433, $t(71) = 3.021, p < .05$, team satisfaction B = 0.248, $t(71) = 2.145, p < .05$, and leader satisfaction B = 0.345, $t(71) = 3.033, p < .05$. Therefore, hypothesis 13 is mostly supported

Moderation effects

Regarding the hypotheses that test for interactions, hypothesis 14 proposes that the relationship between structure and communication quality is contingent on leadership style, such that a transformational style leads to higher scores in collocated contexts, but a transactional style leads to higher scores in reachback and virtual contexts. This hypothesis was tested using moderated regression. First a structure dummy variable coded as a "1" for collocated teams and a "0" for all others was entered into a regression equation as an independent variable with communication quality as a dependent variable. Next a dummy variable coded as "1" for the transformational condition and a "0" for the transactional condition were loaded into the same equation as a second independent variable. Finally, an interaction term which was the product of the first two dummy variables was loaded into the equation in a separate step. The moderation was tested by examining the significance of this interaction term. However, this term was not significant for simple or complex tasks, B = -.201, $t(84) = -1.123, p = .132$, B = 0.158, $t(83) = 0.894, p = .187$. Further, as shown in Tables 7 and 8, there is also no support for interaction between collocated and reachback or virtual and reachback teams for simple tasks, B = -.221, $t(84) = -1.052, p = .148$, B = -.040, $t(84) = -0.204, p = .420$ or complex tasks, B = 0.033, $t(72) = 0.159, p = .436$, B = -0.236, $t(72) = -1.169, p = .123$. Therefore, hypothesis 14 is not supported. Figures 18, 19 and 20 show predicted and actual mean level of communication quality for each of the three types of structure in both the simple

and complex games. The large difference between actual and predicted data is due to the fact that the original prediction was based on raw data whereas the actual data is standardized within game (first versus second game played by the team).

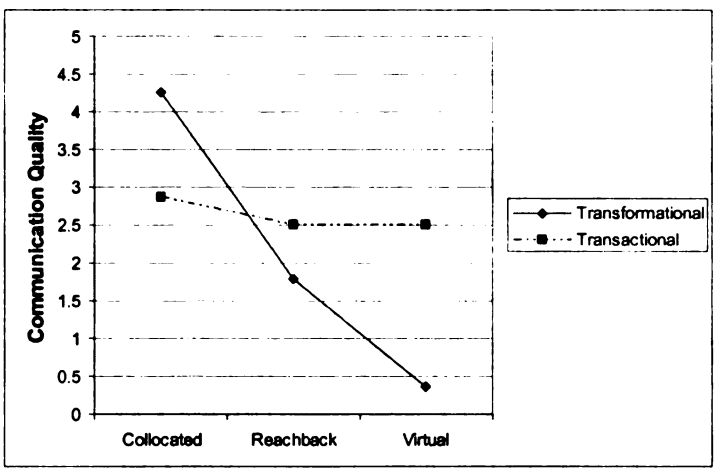


Figure 18. Predicted Hypothesis 14

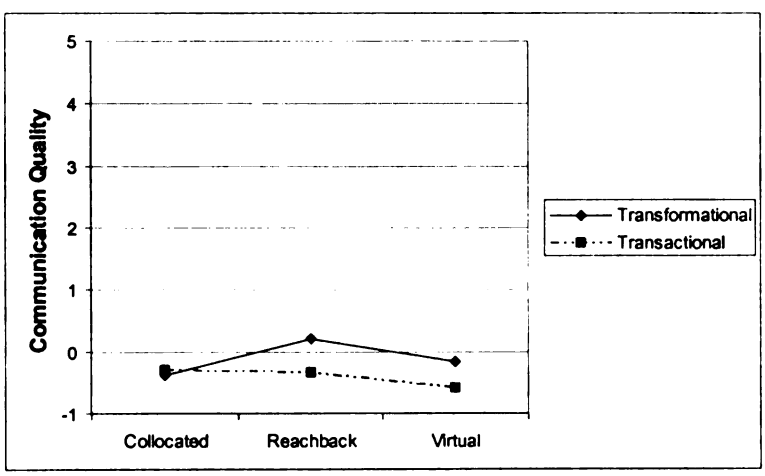


Figure 19. Results for Hypothesis 14 (simple)

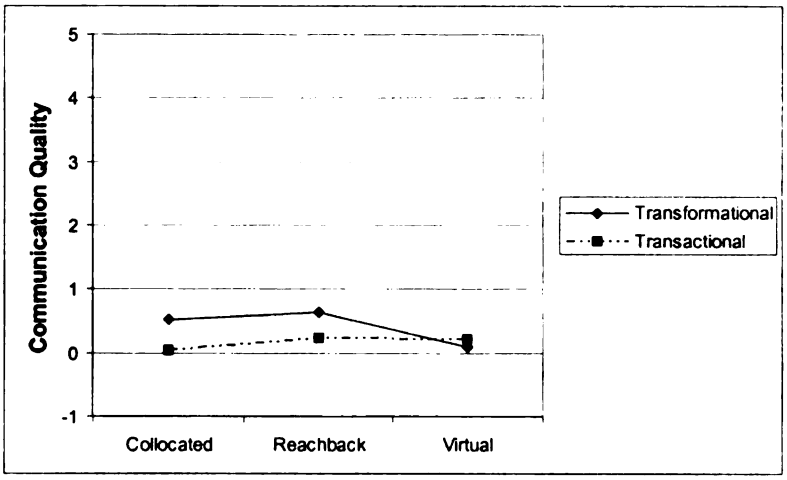


Figure 20. Results for Hypothesis 14 (complex)

Hypothesis 15 suggests that the relationship between leadership style and leadership centrality is contingent on task complexity, such that a high task complexity leads to higher scores for a transactional leadership style, but low task complexity leads to higher scores for a transformational leadership style. An examination of Tables 10 and 11 show that the unstandardized B weights of leadership centrality are almost identical for both types of task. This suggests that there was no moderation present. This hypothesis was also tested using moderated regression. For this test, only data from the first game were used to ensure that the measures used were independent. First a leadership dummy variable coded a as "1" for the transformational conditions and a "0" for transactional conditions was entered into a regression equation as an independent variable with leader centrality as a dependent variable. Next a dummy variable coded as "1" for the high complexity game and a "0" for the low task complexity game were loaded into the same equation as a second independent variable. Finally, an interaction term which was the product of the first two dummy variables was loaded into the equation. The moderation was tested by examining the significance of this interaction term. However, the term was not significant, B = .026, $t(82) = -.012$, $p = .44$, so

hypothesis 15 is not supported. This hypothesis was also unsupported when examining just game 1, game 2. It was also unsupported after testing all team structures in isolation.

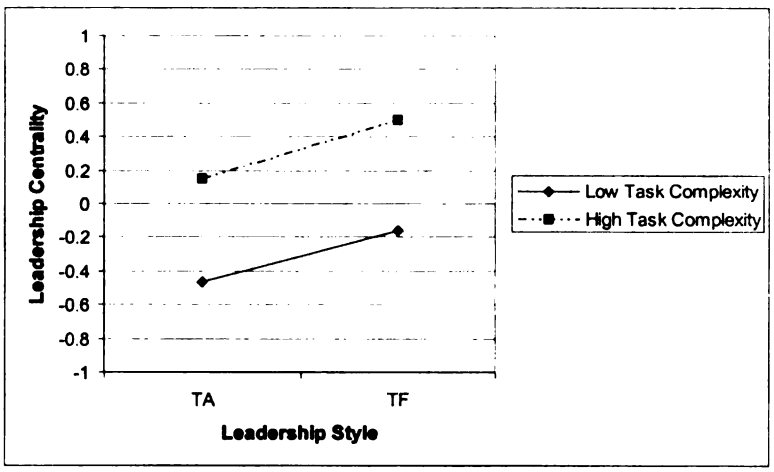


Figure 21. Results for Hypothesis 15

Finally, hypothesis 16 suggests that the relationship between structure and leader centrality is contingent on leadership style such that a transformational style enhances centrality in collocated contexts, but that a transactional style enhances centrality in reachback and virtual contexts. This was tested using the moderated regression. First a structure dummy variable coded as a "1" for collocated teams and a "0" for all others was entered into a regression equation as an independent variable with leader centrality as a dependent variable. Next a dummy variable coded as "1" for the transformational condition and a "0" for the transactional condition were loaded into the same equation as a second independent variable. Finally, an interaction term which was the product of the first two dummy variables was loaded into the equation. The moderation was tested by examining the significance of this interaction term. However, the term was not significant for simple or complex tasks, B = -.117, $t(84) = -0.658$, $p = .257$; B = 0.77, $t(83) = 0.675$, $p = .250$. Further, as shown in Tables 10 and 11, there is also no support for interaction between collocated and reachback or virtual and reachback teams for

simple tasks, B = -.062, $t(84) = -0.299$, $p = .383$; B = 0.096, $t(84) = -0.490$, $p = .313$ or complex tasks, B = -0.002, $t(83) = -0.010$, $p = .496$; B = -0.226, $t(83) = -1.140$, $p = .129$. Therefore, hypothesis 16 is not supported. Figures 22, 23 and 24 show predicted and actual mean level of communication quality for each of the three types of structure in both the simple and complex games. The large difference between actual and predicted data is due to the fact that the original prediction was based on raw data whereas the actual data is standardized within game (first versus second game played by the team).

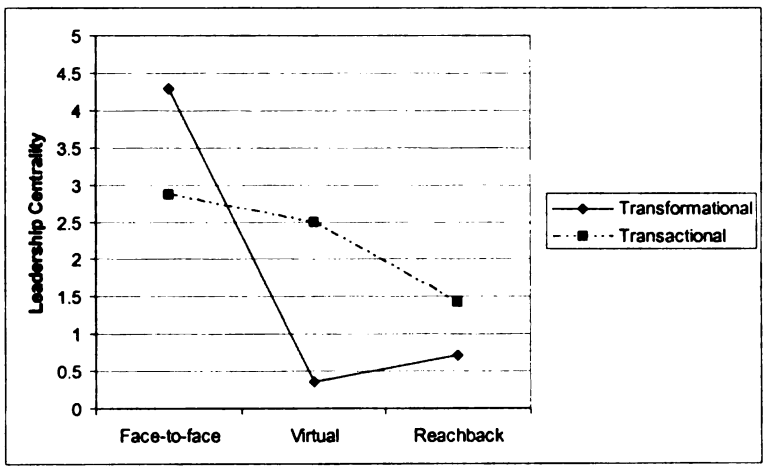


Figure 22. Predicted Hypothesis 16

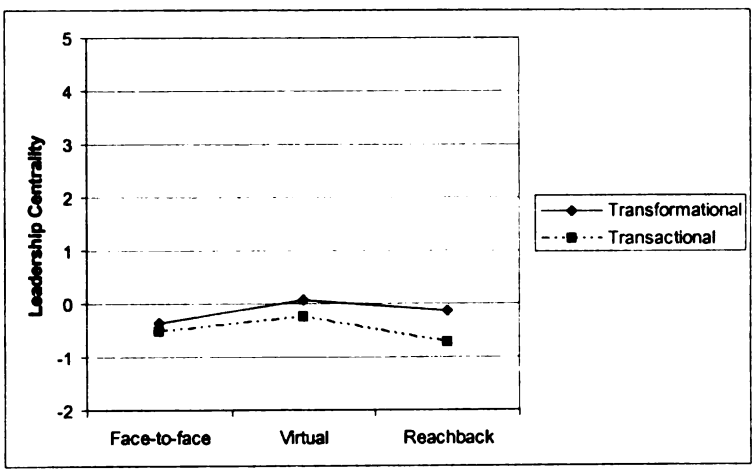


Figure 23. Results for Hypothesis 16 (simple)

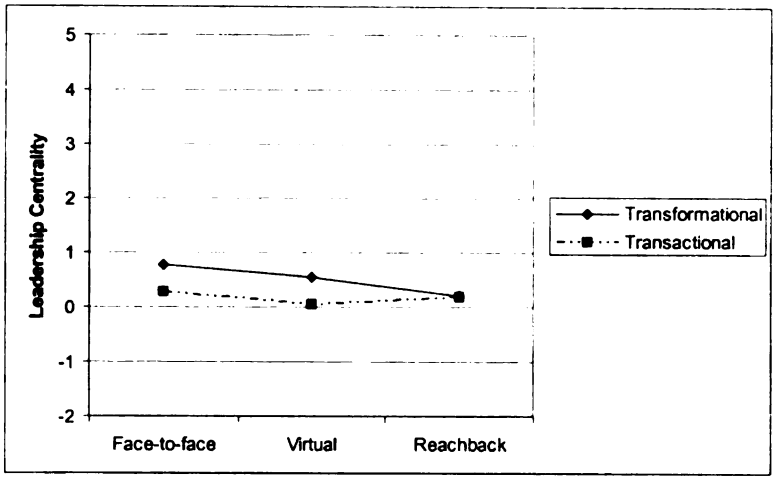


Figure 24. Results for Hypothesis 16 (complex)

All the above hypothesized moderations were between the independent variables and the mediators. However, there were some interesting interactions between the mediators and the distal effectiveness outcomes. For example, Table 12 shows that the interaction term between communication quality and leader centrality when compared to performance is significant in a simple task. This relationship is plotted in Figure 25. It suggests that when communication quality is low, performance is actually higher when leader centrality is low. However when communication quality is higher, a greater level of leader centrality leads to higher performance. What is perhaps most interesting about this interaction is the degree to which the high leadership centrality condition changes so drastically from the low communication quality condition to the high one. One potential reason for this is that leaders with high levels of centrality might be acting as an information bottleneck when communication quality is low. In this situation, leaders who are perceived to have a high level of influence might be restricting the amount of information in the group. Such a situation might be the result of the leader acting as an information gatekeeper and simply not being able to single-handedly manage all of the group communication. However, when leader centrality is low, the communication

between followers is more distributed so the information bottleneck no longer exists. In contrast, when communication quality is high, leaders with high centrality are able to better mange information flows among group members. Such improvements would increase the probably that followers would be exposed to the important information they need in order to do their jobs better.

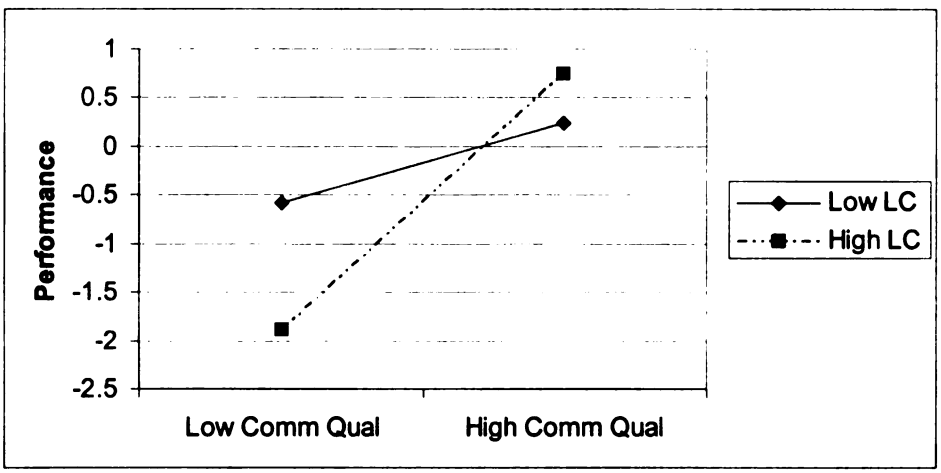


Figure 25. Communication Quality x Leader Centrality and its effect on Performance (simple task)

Tables 13 and 15 show that communication quality and communication quantity interact when compared to performance and team satisfaction in a complex task. Figures 26 and 27 show that when communication quality is low, low communication quantity leads to higher performance and team satisfaction but when communication quality is high, high communication quantity is more effective. This might be explained by the fact that when communication quality is high, teams that communicate more do better. What is perhaps more interesting is that the opposite also appears to be true. When communication quality is low, teams that communicate less do better. One reason why this might only be true for complex tasks, and not simple tasks, is that there is a greater need for coordination in more complex tasks. When coordination requirements are high,

teams will need to work together more in order to perform well. As a result, they will be more sensitive to team communication quality. Therefore, they will be more likely to be damaged by poor communication quality. Such a theory is supported by Kacmar, Witt, Zivnuska, and Gully (2003) who found that communication frequency moderates the relationship between LMX (communication quality) and performance ratings. They show that when LMX is high, employee performance ratings were greatest when communication frequency between supervisor and subordinate was higher but when LMX was low, performance ratings where highest when communication frequency was low.

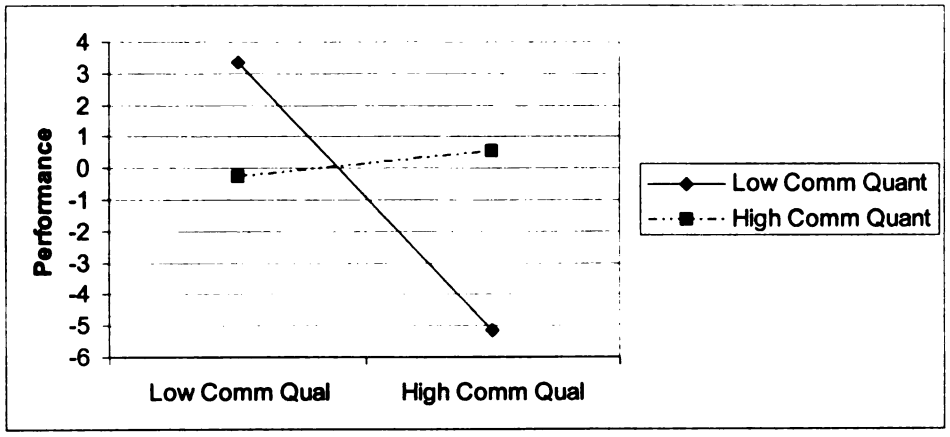


Figure 26. Communication Quality x Communication Quantity and its effect on Performance (complex task)

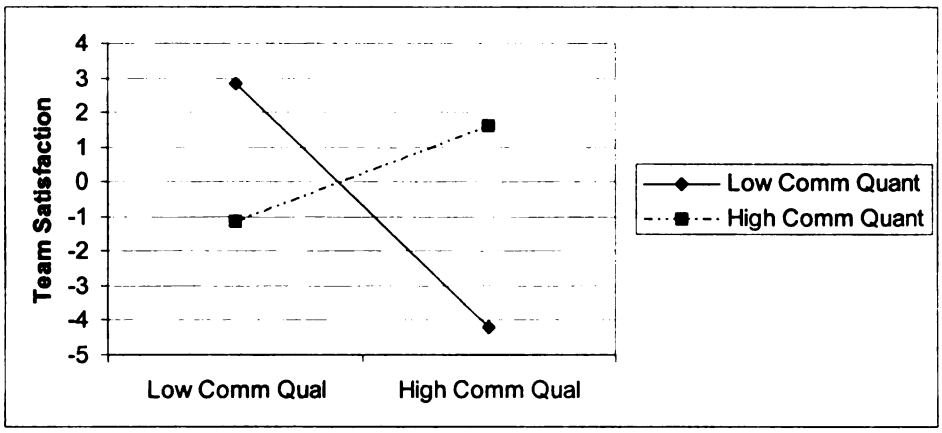


Figure 27. Communication Quality x Communication Quantity and its effect on Team Satisfaction (complex task)

Another interesting set of interactions from Table 13 and 15 is between communication quantity and leader centrality for complex tasks. Here, when leader centrality is low, higher performance and team satisfaction is realized from higher communication quantity. However, when leader centrality is high lower communication quantity is associated with higher effectiveness. These relationships are plotted in Figure 28 and 29 and suggest that when teams do not communicate very much it is important to have a central leader. In this situation, leaders with high levels of centrality might use their influence to direct team members. On the hand, when the level of communication is high, the importance of a central leader is diminished. In this scenario, the team is able to manage their own communication and the need for a central figure to coordinate between members is reduced. Again, the reason this might be true only in a complex task is because of the need for increased coordination and interdependence among team members. When the task is simple, there is not as much of a need for a highly central figure to coordinate actions. If this were true we would also expect that in a simple game there would be no direct relationship between leader centrality or communication quantity and performance, and according to Table 12, that is exactly what was observed.

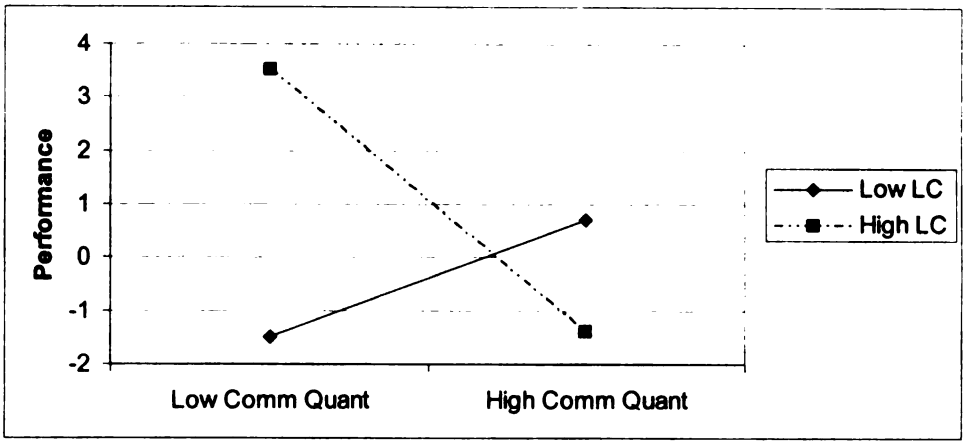


Figure 28. Communication Quantity x Leader Centrality and its effect on Performance (complex task)

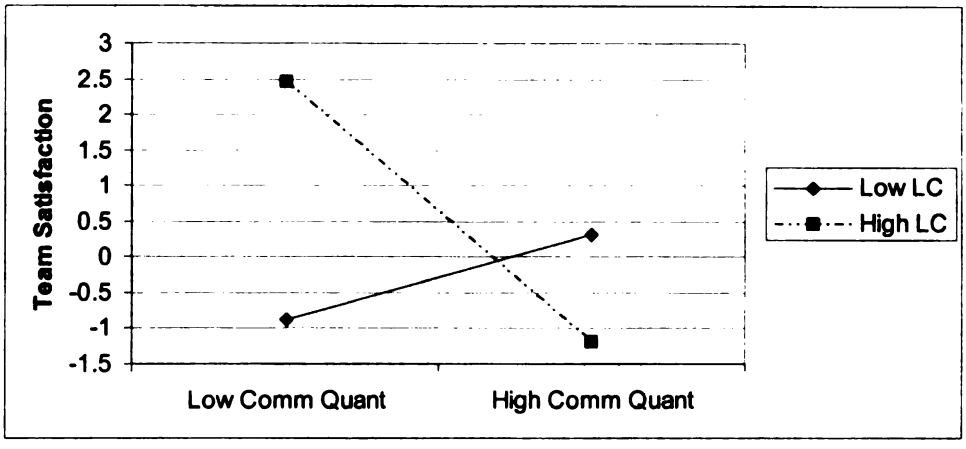


Figure 29. Communication Quantity x Leader Centrality and its effect on Team Satisfaction (complex task)

The data from Figure 30 also comes from Table 15 but this time the interaction is not crossed. In this situation a higher level of leader centrality leads to greater team satisfaction when communication quality is high. However, when communication quality is low there is little difference between high or low leader centrality.

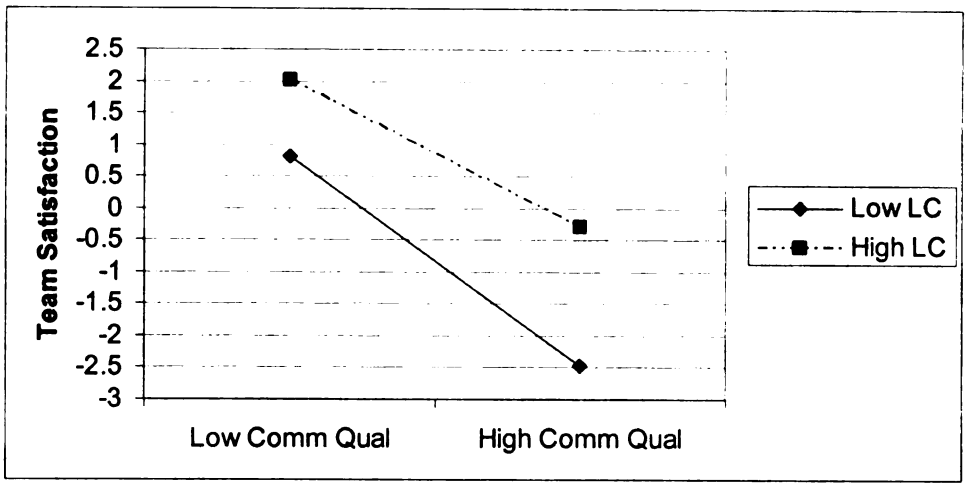


Figure 30. Communication Quality x Leader Centrality and its effect on Team Satisfaction (complex task)

Table 16 shows a small significant ($p < .10$) interaction between communication quality and leader centrality as it relates to leader satisfaction in a simple task. As shown in Figure 31, when communication quality is low, high leader centrality leads to a much higher leader satisfaction score, compared to low leader centrality, than when communication quality is high. This is primarily because the amount of growth in leader satisfaction scores for leaders with low centrality is much larger between low and high communication quality conditions than it is for leaders with high centrality. What is perhaps most interesting here is that, as shown in Figure 32, the same interaction is present ($p < .05$) for complex tasks almost with the opposite direction. Instead of a larger difference between leader satisfaction scores for leaders with a high and low level of centrality when communication quality is low, there is no difference and instead of this difference getting smaller when communication quality is greater it gets larger. A potential explanation for this must then address two issues. First, why there is such a large difference in leader satisfaction scores for different levels of leader centrality for a simple task but not a complex task when communication quality is low. Second, why is

there such a large difference in leader satisfaction scores for different levels of leader centrality for complex tasks but not simple tasks when communication quality it high. One potential explanation for the first question might be that when the task is simple and communication quality is low, followers expect leaders to display a high level of centrality and influence. In these situations, it is the leader who, despite a lack of team communication quality, is able to display a high level of centrality and influence which is rewarded with a higher satisfaction score. However, in a complex task there is not as much of an expectation that leaders will exhibit a high level of centrality when communication quality is low. In this situation the data shows that leaders are neither rewarded nor punished based on their level of centrality. Here, the standardized scores for both types of leaders is nearly zero. However, when leader centrality is low and communication quality is high, followers might feel that the leader did not display the proper amount of leadership and influence which they were expected to and subsequently rate their scores lower. In total this shows that the expectation of followers for leaders in simple and complex tasks is different depending on the quality of the communication.

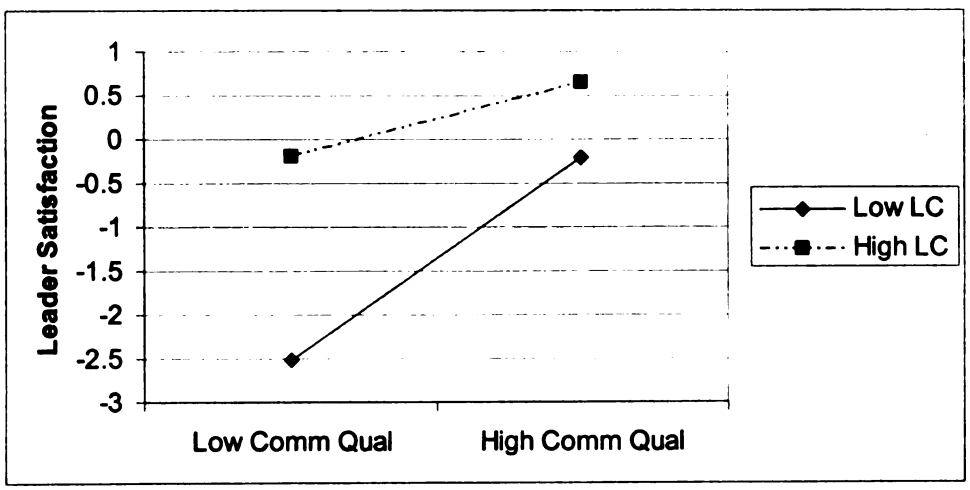


Figure 31. Communication Quality x Leader Centrality and its effect on Leader Satisfaction (simple task)

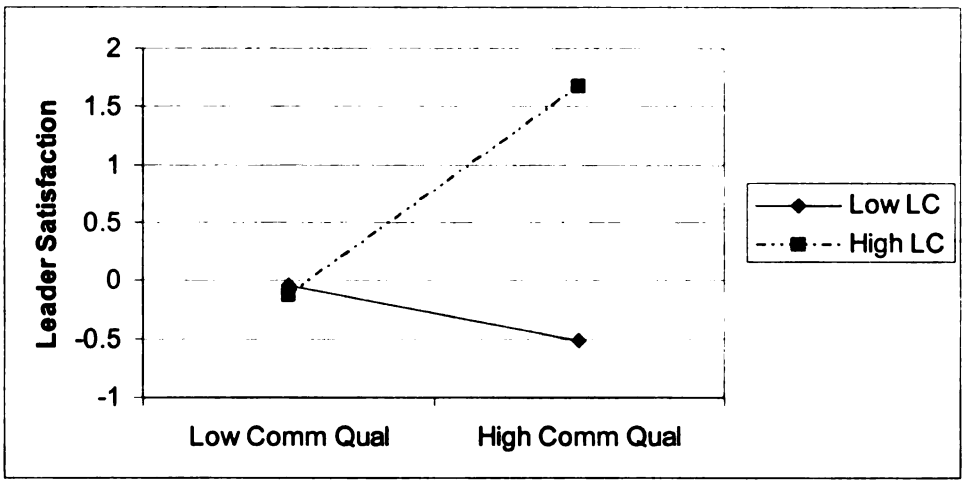


Figure 32. Communication Quality x Leader Centrality and its effect on Leader Satisfaction (complex task)

Mediation effects

As mentioned, a mediation analysis was also performed using the four step procedure explained by Baron and Kenny (1986). The first step is to examine whether the relationship between the independent variables and the mediators is significant. The second step is to determine if the relationship between the mediators and the dependent variables is also significant. The third step is to determine if the direct relationship between the independent variables and the dependent variables is significant. Finally, this previous relationship must be shown to be non-significant when a regression is performed that includes the independent variables and the mediator, where the mediators are entered in a prior hierarchical step.

An examination of the hypothesized paths between the independent variables and the mediators shows that only the relationship between team structure and communication quantity was significant. However, the only significant hypothesized relationships between the mediators and the dependent variables were between communication quality, leader centrality and the effectiveness variables. Given that no

continuous path exists between the independent variables, mediators, and dependent variables, mediation can not occur based on the hypothesized relationships.

However, in the interest of being as thorough as possible, any significant relationships between the initial independent and the final dependent variables were examined to determine if their effects significantly decreased when the effects of the proposed mediators were partialed out. Any interactions between the mediators were also partialed out to ensure that any remaining variance was indeed attributable to the independent variables.

Table 25 shows that the significant relationship reported in Table 18 between leadership style and performance for a simple task was no longer significant after controlling for the mediators. For the complex game Table 26 shows that the significant relationship reported for the first structure dummy variable in Table 19 is also no longer present after controlling for the mediators.

With regards to team satisfaction, Table 27 shows that the significant effect with the structural variables reported in Table 20 persists for simple tasks. For the complex task, no direct significant effects were reported in Table 21 so it is not surprising that Table 28 also shows no significant effects between the independent and dependent variables. With regards to leader satisfaction, Table 29 shows that the first dummy variable for structure is no longer significant for a simple task, as reported in Table 22 and for complex tasks, the significant effect reported in Table 23 with leadership style disappears, however, the effect with the first dummy variable persists

Additionally, other non-hypothesized significant relationships form continuous paths between the independent variables, mediators, and dependent variables so

mediation might occur though these paths. For example, as seen in Table 8 the relationship between leadership style and communication quality was mildly significant for a complex game. Also, as shown in Tables 10 and 11, the relationship between leadership style and leader centrality was also significant for both simple and complex games. Finally, Table 24 suggests that complexity also had a significant relationship with each of the other constructs. Therefore, communication quality and leader centrality were examined as potential mediators which sit between the independent variables of leadership style and task complexity and the dependent variables of performance, team satisfaction, and leader satisfaction. Specifically, there are 6 potential paths listed below:

1. Leadership Style → Leader Centrality → Performance (complex)
2. Leadership style → Communication Quality → Team Satisfaction (complex)
3. Leadership style → Leader Centrality → Team Satisfaction (complex)
4. Leadership style → Communication Quality → Leader Satisfaction (complex)
5. Leadership style → Leader Centrality → Team Satisfaction (simple)
6. Leadership style → Leader Centrality → Team Satisfaction (complex)

To examine whether this mediation existed, hierarchical regression was again used to partial out the effects of the mediators from the relationship between the independent and dependent variables for both simple and complex games. As shown in Tables 31-33 the relationships between the independent variables and the dependent variables were no longer significant after partialing out the effects of the mediators for each of the paths listed above. Therefore, it can be claimed that communication quality and leader centrality fully mediate the paths above. Table 2 is a summary of all the hypotheses testing.

Table 2. Summary of test results

	Simple	Complex
H1	**Fully Supported**	**Fully Supported**
H2	**Not Supported**	**Not Supported**

H3	**Not Supported**	**Not Supported**
H4	**Not Supported**	**Not Supported**
H5	**Mostly Supported**	**Mostly Supported**
H6	**Not Supported**	**Not Supported**
H7	**Fully Supported**	
H8	**Not Supported**	**Not Supported**
H9	**Not Supported**	**Not Supported**
H10	**Not Supported**	**Not Supported**
H11	**Fully Supported**: 3/3	**Mostly**: 2/3 (not obj perf)
H12	**Not Supported**	**Not Supported**
H13	**Partially Supported:** 1/3 (only leader)	**Fully Supported:** 3/3
H14	**Not Supported**	**Not Supported**
H15	**Not Supported**	**Not Supported**
H16	**Not Supported**	**Not Supported**
Mediation	**Not Supported**	**Not Supported**

Effects of Structure and Leadership on Distal Outcomes

While none of the proposed moderation was significant, there were other interaction terms that were significant. Perhaps the most interesting characteristic of this entire study is that leadership style does indeed moderate the direct relationship between structure and performance outcomes. The crux of this study was to determine how modern team structures impact modern conceptualizations of leadership. If just these dimensions are isolated along with performance outcomes, we see a strong moderation effect based on leadership styles. For example, using the same procedure to test for moderation as was used in hypothesis 14 but switching the dependent variable from communication quality to objective performance, leadership style significantly moderated the relationship. For example, in the low complexity condition B = .516, $t(82) = 1.96$, $p < .05$, $\Delta R^2 = .044$, $p < .05$ for the interaction term. In the collocated group each of these variables was significantly higher for a transformational condition, as the literature would predict. However, there was no difference in non-collocated groups. A similar result is

seen for the second game as well B = .429, $t(82) = 2.18$, $p < .05$, $\Delta R^2 = .052$, $p < .05$. Figure 33 shows this interaction.

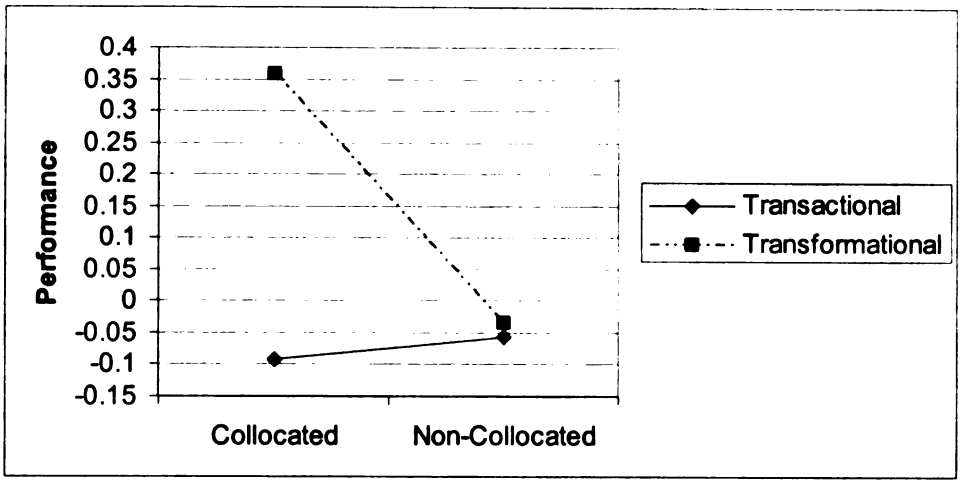


Figure 33. Structure x Leadership Style and its effect on Performance (second game)

Based on this, it can be claimed that while a transformational leadership style is indeed preferable in a collocated group, it does not lead to similar benefits in a non-collocated team structure. This then represents a heretofore unknown boundary condition to the benefits enjoyed by the transformational leadership style. This is a very interesting conclusion given that so much literature has concluded that a transformational style is seemingly always preferable.

Results using a modified leadership coding scheme

As an interesting exploratory analysis all the hypotheses related to leadership style were retested using the MLQ as the measure of the leader behavior instead of the dichotomous manipulation. For this analysis the data were not coded based on which manipulation group they came from but rather on the transformational or transactional scales collected during the manipulation check. Specifically, if the transformational scale was higher than the transactional scale, the team was coded as being transformational and

vice versa. Given that such a modified coding scheme would only impact the hypotheses that examine the effects of leadership style, only hypothesis 5, 6, 10, 14, 15, and 16 were retested.

For hypothesis 5, the original coding scheme showed that the amount of communication quantity was significantly higher in almost every structure for both the simple and complex games. However, this was not entirely the case when using the new coding scheme. The modified scheme showed that for the simple game the difference in the amount of communication quantity was not significant for the collocated ($t(24) = 1.120, p = .14$), reachback ($t(19) = 0.778, p = .22$) or virtual structures ($t(23) = 1.275, p = .108$). However, for the complex game it was significant for the collocated ($t(24) = 1.749, p < .05$), and virtual team ($t(21) = 2.866, p = .22$) but not for the reachback structure ($t(22) = 0.033, p = .50$). Therefore, hypothesis 5 is partially supported using the new coding scheme

For hypothesis 6, the original coding scheme showed that the amount of communication quality was not significantly higher in a collocated transformational team compared to a transactional team. Originally, no significant interaction was found between leadership style and the dummy variables representing the difference between collocated and reachback or virtual and reachback teams for either the simple or complex tasks. Almost the same results were obtained when using the modified coding scheme. However, the new coding scheme did reveal a weak interaction between leadership style and the dummy variable representing the difference between virtual and reachback teams for complex tasks, $B = 0.535$, $t(84) = 1.305$, $p < .1$. Therefore, hypothesis 6 is partially supported using the new coding scheme

For hypothesis 10, the original coding scheme showed that the level of leader centrality was not significantly higher in a collocated transformational team than in a transactional team. The results obtained for the new coding scheme were the same as they were for the old scheme for simple tasks and the dummy variable representing the difference between virtual and reachback structures for complex tasks. However, there was a significant effect between leadership style and the dummy variable representing difference between collocated and reachback teams for the complex game, B = -0.671, $t(83) = -1.702, p < .05$. This shows that the level of leader centrality is significantly higher in a collocated transformational team than in a transactional team. Therefore, hypothesis 10 is partially supported using the new coding scheme

Regarding the hypotheses that test for interactions, hypothesis 14 proposed that the relationship between structure and communication quality is contingent on leadership style, such that a transformational style leads to higher scores in collocated contexts, but a transactional style leads to higher scores in reachback and virtual contexts. This was not found to be true using the original coding scheme. It was also found not to be true using the new coding scheme for either the simple or complex tasks, B = -.133, $t(84) = -0.419$, $p = .34$, B = 0.0, $t(83) = 0.0, p = .5$. However, unlike the results obtained with the original coding, after categorizing the data based on specific structural configuration, there was a significant interaction between the dummy variable representing the difference between virtual and reachback teams and leadership style for the simple task B = .535, $t(84) = 1.305, p < .1$. This partially supports hypothesis 14.

Hypothesis 15 suggested that the relationship between leadership style and leadership centrality is contingent on task complexity, such that a high task complexity

leads to higher scores for a transactional leadership style, but low task complexity leads to higher scores for a transformational leadership style. Using the original coding scheme this was not shown to be true. Hypothesis 15 was also not supported when the modified coding scheme was used, B = -0.246, $t(82) = -1.175$, $p = .12$.

Finally, hypothesis 16 suggested that the relationship between structure and leader centrality was contingent on leadership style such that a transformational style enhances centrality in collocated contexts, but that a transactional style enhances centrality in reachback and virtual contexts. Using the original coding scheme and moderated regression this hypothesis was not supported. It was also not supported using the modified coding scheme for either simple or complex tasks, B = 0.055, $t(84) = 0.183$, $p = .43$; B = -0.362, $t(83) = -1.214$, $p = .12$. However, unlike the results obtained with the original coding, after categorizing the data based on specific structural configuration, there was a significant interaction between the dummy variable representing the difference between collocated and reachback teams and leadership style for the complex task B = -.671, $t(83) = -1.702$, $p < .05$. This partially supports hypothesis 16.

CHAPTER 5 - DISCUSSION

Review of results

The underlying crux of this study was to determine how modern team structures impact popular conceptualizations of leadership. Most studies which have examined leadership have done so using collocated teams. However, modern computer and communication systems now allow teams to more easily form across time and space. No longer do teams need to exist in the same room or even at the same time in order to effectively function. Given the benefits that such *virtual* teams offer, and the increasing ubiquity of the technologies that power them, their popularity has recently surged. This is a trend which shows no sign of abating. As a result, it is imperative that a serious effort be made to examine how such structures impact leadership processes.

Another interesting feature of this study is the introduction of a reachback team. A reachback team is one in which all the members are collocated but the leader is virtual. Examining such a structure responds to a recent call made by some to study differences between partially distributed teams rather than on simply concentrating on how purely virtual teams differ from collocated teams (Martins, Gilson, & Maynard, 2004). A reachback team is a particularly important type of partially distributed team to study because of its prevalence and growing popularity in organizations as well the demanding contexts it is used within such as those involving disaster response teams and the military.

Given that communication processes are such an important characteristic of leadership, and perhaps the only observable manifestation of it when the leader is not collocated, it figured prominently in this study. Hypothesis 1 suggested that communication quantity would be lower in a reachback team compared to a collocated

team and hypothesis 2 suggested that communication quantity would be lower in virtual team compared to a reachback team. While hypothesis 1 was supported for both simple and complex tasks, hypothesis 2 was not. In fact, the exact opposite relationship was supported. Their were so many comments made in the virtual team that when communication quantity was regressed on a dummy variable representing collocated vs. virtual teams, the result was nearly significant after controlling for complexity, B = .153, $t(99) = 1.586$, p = .058. This suggests that there were almost a significantly higher number of comments made in the virtual teams than the collocated teams. This result is surprising given that several other studies have shown the opposite to be true (Martins, Gilson, & Maynard, 2004). As a result, it is possible that moderators exits which might account for this difference. Given that a few other studies have also received results similar to those obtained by this study (Jessup & Tansik, 1991) it might be fruitful to search for similarities between them in an effort to find these potential moderators.

One potential moderator that might exist is the nature of the task. For example, Bell and Kozlowski (2002) have proposed that the task might lead to substantial differences in outcome. In fact, when these data are segregated based on high and low complexity games, the significant difference in communication quantity between structures disappears for a low complexity game $t(49) = .865$, $p = .195$ but is still partially present in a high complexity game $t(47) = 1.390$, $p < .1$.

The next set of hypotheses suggested that the quality of communication changes based on the team structure. However, no significant changes in quality were observed across the three structures. This was true for both the primary as well as two secondary measure of communication quality. This result was interesting given the large changes in

communication quantity across structures. Perhaps most notable is the fact that the reachback team had the lowest communication quantity but exhibited a higher level of communication quality when compared to the two other structures. If overall communication quantity goes down but quality tends to rise than a reachback team might prove to be a very efficient structure combining the "best of both worlds." In fact, in unstructured exit interviews with a limited number of subjects who participated in the experiment as a member of reachback team and a collocated or virtual team, many stated that they enjoyed working in the reachback configuration over the virtual and collocated structures. A few of them made the unexpected comment that when they were part of the collocated subgroup in a reachback team they were better able to "understand who was saying what" compared to when they were in a fully collocated team. When asked why this was true, they suggested that it was because the headsets, which they used to communicate with their leader and each other in a reachback team, made all team communication more structured and therefore easier to process.

Another interesting outcome of this study was the correlation between communication quantity and quality. In a collocated and reachback team the bivariate correlation was rather low in both the simple ($r(26)=.206$, $p=.157$ and $r(21)=.073$, $p=.377$) and complex tasks ($r(26)=.099$, $p=.315$ and $r(24)=.026$, $p=.451$). However, in a virtual team this number climbs dramatically, ($r(25)=.355$, $p=.06$ and $r(23)=.450$, $p=.228$). This suggests that in situations with a large number of collocated individuals, a higher level of communication might not lead to a higher level of communication quality. However, when everyone is remote this relationship might become more important.

Hypothesis 5 saw the introduction of leadership orientated hypotheses. It proposed that for each structural configuration, transformational teams will exhibit a greater number of comments compared to transactional teams. This was suggested due to the fact that transformational leaders need to attend a greater number of leadership behaviors and because a transformational style will lead to greater cooperation and therefore more comments by followers. This hypothesis was supported for both collocated and reachback teams. However, it was not significant for virtual teams but only because the standard error was so much larger in this structure.

Hypothesis 6 proposed that communication quality will be higher in a collocated transformational team than in a transactional team. This hypotheses was not supported with the regression results, however, when the data is segregated based on structure and only the collocated teams are examined, the correlation between transformational leadership scale in the MLQ and communication quantity is nearly significant for the simple ($r(26)=0.266$ $p=0.056$) and complex r(26)=0f.189 p=0.177)task. Further, the correlation between transformational leadership and quality is significant for the simple ($r(30)=0.464$ $p<.05$) and complex ($r(29)=0.406$ $p<.05$) task.

The most unexpected aspect of this two relationship is that they extend to the virtual teams as well. In the reachback teams the relationship between the same measure of transformational leadership and communication quality is $r(27)=0.550$ ($p<.05$) for simple tasks and $r(27)=0.485$ ($p<.05$) for complex tasks. In a virtual team it is $r(28)=0.628$ ($p<.05$) for simple tasks and $r(28)=0.506$ ($p=.142$) for complex tasks. Perhaps most interesting is the fact that this relationship is stronger in a virtual and reachback teams compared to the collocated teams. This suggests any transformational

behaviors which are manifest in a non-collocated team might actually be more important to overall communication quality than they are in a collocated team.

Hypothesis 7 predicted that a positive relationship exists between task complexity and overall team communication quantity. This relationship was fully supported which suggests that when task complexity increases teams are more likely to engage in more communication. These results are especially significant given that the low complexity condition had a higher task scope which is characterized by the amount of objective work required. In this condition the task complexity was low (as conceptualized by component, coordinative and dynamic complexity) but the number of targets was actually greater by 47%. Therefore, it is not the level of task scope that matters to communication but rather the level of task complexity. In these high complexity situations teams need to work smarter to understand and process the action and information cues which are presented to them. They also need to work smarter to coordinate information between each other. When a task is complex, the ordering and sequencing of information and actions becomes critical. Therefore, teams need to work together more and as a result communicate to a higher degree in order to make this happen. Further, high task complexity environments are also those in which the situation is dynamic. In these situations action and information cues might be either hidden or change over time. Therefore, teams need to communicate more with each other in order to discover the true nature of these cues.

Hypothesis 8 and 9 introduced the idea of leader centrality. This concept was presented as a way to capture how the experimental manipulations impacted leadership processes. Hypothesis 8 suggested that team member perceptions of leader centrality will

be lower in a reachback team than a collocated team and hypothesis 9 proposes that team member perceptions of leader centrality will be lower in a reachback team than a virtual team. Neither hypothesis was supported.

Originally, it was suspected that leader centrality would fall due to the formation of faultlines. It was theorized that leader centrality would be lower in a reachback team due to the formation of salient subgroups since the presence of diverse subgroups would keep the centrality of the leader low. However, it is now suspected that while diversity might still play a role in this process it might do so in a very different way. It is now suspected that in a reachback team, primary diversity dimensions such as gender, height, and attractiveness are masked or at least not made as salient. Such individual traits as these have been found to have an impact on perceived leadership ability (Anderson, Lievens, van Dam, & Born, 2006; Hogg et al., 2006; Kirkpatrick & Locke, 1991; Lewis, 2000) so if they are unavailable, other traits which are available become a more influential indicator of leader centrality. The implication here is that if an individual trait has a negative effect on perceived leadership ability in a collocated team it may not have the same effect in a non-collocated team since the trait is blocked by the communication medium. This means that for the purposes of leadership, individual traits associated with social category diversity may not mean as much in non-collocated teams as they do in collocated teams.

Hypotheses 11, 12 and 13 tested whether the mediators had a significant relationship with the dependent variables. Communication quantity (hypothesis 12) was not found to be significant with any of the dependent variables. This might be interesting given that intuitively it would seem that more communication leads to higher team

performance. However, communication quality and leadership centrality did have strong effects with team satisfaction and leader satisfaction.

The relationship between communication quality and team satisfaction was expected given that positive attributes and outcomes have been linked to communication quality in the past. For example, high quality communication and competence has been shown to be based on information giving, information seeking, information verifying and socioemotional communication (Cegala, Coleman, & Turner, 1998) as well as the quality of a performance (Almeida, 2004). Communication quality has also been linked to several positive organizational related outcomes such as higher performance for teams working on innovative projects (Hoegl & Gemuenden, 2001) and higher rating for managers (Penley, 1991). It has also been shown to have a positive influence on attitudes towards instruction (Bolls & Tan, 1996), productivity, and job satisfaction (Campion, Medsker, & Higgs, 1993; Campion, Papper, & Medsker, 1996). Therefore it was expected that high communication quality would lead to high team satisfaction.

An explanation for the relationship between communication quality and leader satisfaction is provided by leader member exchange (LMX) theory (Graen & Uhlbien, 1995). This theory suggests that differences in the quality of the communication and relationship between supervisor and subordinates impacts performance. This theory is based on the social exchange perspective (Blau, 1964) which states that if one party is perceived to act in the best interest of another they will be rewarded for it later. Communication quality has been shown to be a dimension of LMX (Graen & Ginsburgh, 1977) as well as an outcome of it (Fairhurst, 1993). From this it can be seen that high levels of communication quality will lead to, and result from, high levels of LMX which

itself is characterized by a strong and satisfying relationship with leaders. Therefore, we can expect that teams with high level of communication quality to have high levels of LMX and as a result a high level of leader satisfaction.

As mentioned earlier, leader centrality was also shown to have a significant relationship with team and leader satisfaction. Centrality can be considered the degree to which individuals in a team are thought to exist at the nexus of activity within a network. Leader centrality is therefore the degree to which team leaders are thought to hold such a position and as a result can be thought of as the amount of influence they have over team members. Therefore, leaders who have a high level of centrality can be thought of as being at the center of the action and fully engaged in team operations. It is suspected that when leaders have such an attribute, followers will tend to feel better and more complete about their experience and as a result have a higher team satisfaction. This process becomes even more pronounced if leaders, due to their superior location in organizational hierarchies, have important information that other team members do not have. If this information helps teams perform their task, as it did in this experiment, then followers will be even more likely to view their experiences favorably if this information is shared and used.

Given that the behavior of the leader can impact the team satisfaction ratings we can expect that such behavior would correlate even stronger with leader satisfaction ratings and in fact, this is exactly what was observed. The relationship between leader centrality and leader satisfaction was more than twice as strong as it is with team satisfaction. This is evidence that while leader behavior might impact team satisfaction, it impacts leader satisfaction even more.

Finally with regards to hypotheses 11-13, it is interesting to note that communication quality had a significant relationship with performance when task complexity was low but not when it was high, however, leader centrality had a significant relationship with performance when task complexity was high but not when it was low. One possible explanation for the first result is that when task complexity is low, high levels of communication quality can be taken advantage of and processed so as to lead to higher objective scores. However, when complexity is high team members might not be able to capitalize on high levels of communication quality and as a result, a significant relationship with the outcome variables will not exist. In this situation team members are so cognitively challenged by the situation that the level of communication quality in the group is discounted. This is consistent with the Resource Allocation Model which suggests that goals have a much stronger relationship on performance when perceived task complexity is low (Kanfer & Ackerman, 1989). This model suggests that when the task is complex or novel, attentional resources are applied more towards mastering basic task functions rather than achieving goals. In the same way it is possible that when task complexity is high, team members are not able to effectively process and capitalize on high levels of communication quality. Only when working on low complexity tasks are members able to focus on, and effectively utilize, high levels of communication quality.

One possible explanation for why leader centrality had a significant relationship with performance when task complexity was high but not when it was low is that when it is low team members don't rely as much on the leader. In this situation, they might feel as though they can complete the objective on their own so they don't need leader input to help them execute the task. Given that the low complexity task did not require any

learning, had a functional structure, and very predictable targets this becomes even more of a possibility. Given that no learning was required, members did not need to communicate with anyone in order to better understand the task, therefore, they did not need a leader with a high degree of centrality that would help everyone learn from everyone else. A functional structure meant that they all had the same vehicles so that a leader with high centrality was not required to coordinate resource allocation and usage between members. Finally, since all the targets were predictable each member knew in advance from which direction all the targets would come from. Therefore, they did not require a leader which was able to detect targets sooner, as was the case in the experiment.

Mediators

As already shown the proposed mediators did not perform as expect. Such an outcome begs the question as to what constructs might actually explain why the proposed proximal independent variables impact the distal outcome variables. Not performing such a retrospective examination would be to irresponsibly ignore all that has been learned while performing this study. Therefore, this section will attempt to identify these constructs. To do so it is perhaps best to consider the training given to the leaders. By identifying the exact behaviors each type of leader was trained to exhibit a better understanding of the potential individual and team level responses may be achieved.

As previously mentioned, the transformational leadership training tended to focus on the affective dimensions of leadership, while the transactional leadership training tended to focus on the more rational or cognitive aspects of it. For example, the transformational dimension of idealized influence has to do with the leader speaking

about their most important values and beliefs, instilling a sense of pride, purpose or mission, and building respect. Similarly, individual consideration is based on the leader acting as a coach or mentor, developing strengths and considering everyone's needs, abilities, and aspirations. In contrast, the transactional dimension of contingent reward and management-by-exception tends to focus on mistakes, exceptions, deviations from standards. This style of leadership is based more on developing and utilizing a contractual exchange relationship.

As a result, these two types of leadership might differentially impact the affective dimension of an individual or team. At the individual level we might expect that these two leadership styles would differentially impact state based affective dimension such as mood and emotions. For example, transformational leadership has been linked to such individual level constructs as increased levels of pride, optimism, enthusiasm, and decreased levels of frustration (Küpers & Weibler, 2006; McColl-Kennedy & Anderson, 2002) which have been linked to performance (Barsade, Brief, & Spataro, 2003). Transformational leadership has also been linked to increases in subordinate creativity (Shin & Zhou, 2003). This relationship might have particularly profound implications for virtual team leaders since in this environment, subordinates may be required to solve problems on their own due to a lack of access to superiors or advice structures. Individuals who are more creative might be at an advantage in this situation due to their ability to develop multiple unique solutions to a problem independent of outside influence. However, if leaders are unable to effectively exhibit transformational behaviors in a virtual environment the amount of team member creativity may not be maximized. This means that when creativity is needed the most it has the smallest

chance of being increased by the leader. In contrast, we can expect that a transactional leadership style would not have as much of a positive influence on such affective components. The behaviors associated with this style of leadership are not based on emotional aspects but instead are based on a more impersonal and calculating contractual form of leadership.

At the team level, transformational leadership might increase the strength of shared vision or organizational commitment. A stronger shared vision in a team might be realized given that transformational leaders focus on the emotional health of the team, rapport building, and empathetic language. These behaviors might also result in increased levels of organizational commitment as leaders provide an exciting image of the organizational vision or by getting followers to put in extra effort and go beyond what they thought possible. On the other hand transactional leadership might lead to a decrease in organizational commitment due to the leaders focus on mistakes and deviations from standards. As a result, transformational leadership might positively impact affective team mechanisms while transactional leadership negatively impacts these same mechanisms.

In addition to differentially impacting emotional dimensions, these leadership styles might also impact cognitive motivational differences at the individual and team level as well. At the individual level self-efficacy might be raised. For example, inspirational motivation has to do with expressing confidence that goals will be achieved and disseminating a compelling vision of the future. Such behaviors might make subordinates feel as though they can transcend their current limitations and transform themselves to be more capable. This might increase their self-efficacy and make them

feel as though they are more capable than they originally thought they were. Such a process might also extend to the team level. Leaders might cause the entire team to believe that they are more potent and are able to transcend the sum of their abilities, work, or output. As a result, this might increase the collective self efficacy, or potency, of the team. In a similar way inspirational motivation might also increase empowerment which is defined as, "increased intrinsic task motivation manifested in a set of four cognitions reflecting and individual's orientation to his or her work role: competence, impact, meaning, and self-determination." (G. M. Spreitzer, 1995, p. 1443). Given both the cognitive and motivational aspects of this construct it seems particularly relevant when examining the cognitive aspects of inspirational motivation. Based on this definition it might be suggested that by increasing team self-efficacy, reminding teams of the importance of their task and goals, focusing on the larger context of their mission, and giving team members a certain degree of autonomy, transformational leaders are able to increase empowerment to a level that transactional leaders are unable to.

Finally, by exhibiting behaviors consistent with the transformational dimension of intellectual stimulation, leaders might be able to increase the amount of positive conflict within the team and decrease the amount of negative conflict. As mentioned earlier, intellectual stimulation relates to the ability of leaders to stimulate followers to be creative and innovative, and to challenge their own beliefs. As such we can expect that leader's who exhibit a high level of intellectual stimulation to seek differing perspectives, suggest new ways of how to look at problems, and encourage novel thinking. This has the potential to increase substantive, task orientated conflict within a team. This type of conflict is characterized by team members considering different viewpoints pertaining to

a task. It includes debate related to different ideas, opinions, or strategy on how to complete a particular task. As such, this type of conflict is a key defense against group-think and has been repeatedly shown to have a positive relationship with task-related outcomes (Dirks & McLean Parks, 2003). Others have proposed that exercising the type of conflict might actually strengthen relationships between team members and as a result, lower the level of unhealthy team conflict (Dirks & McLean Parks, 2003). By increasing the amount of positive conflict, healthy team attitudes, norms and processes on how to handle conflict within the team might start to form. This has the potential to improve the ability to a team to handle future conflict constructively.

Limitation and future studies

Of course as with any study there are limitations. The first limitation is that only one task was used. As already mentioned, it appears that task might moderate the link between structure and communication quantity. Therefore, it would be important to examine this possible interaction in the future. Another limitation is that the low complexity task in this experiment had a larger scope. In other words, there were more targets in the low complexity condition than there were in the high complexity condition. Future research might want to keep complexity or scope constant while only manipulating the other. Another extension of this study might be to examine different mediators. While several elements of mediation are present, it was not firmly established that the proposed mediators explain why the independent variables impact the dependent variables. A future study might attempt to probe other reasons why these relationship exit. For example, a newly published study also uses faultlines to explain why levels of conflict and trust in a team might change depending on virtual team structure (Polzer, Crisp, Jarvenpaa, & Kim, 2006). This study found that reachback like structures have

high levels of conflict and lower levels of trust compared to fully virtual teams. This is similar to the unsupported theory presented here that leader centrality would be lower in a reachback team compared to a virtual team due to the presence of faultlines. Therefore, while the impact of structure on performance is not mediated by leader centrality it might be by the level of conflict and trust in the team.

A final idea for a follow-on study would be to examine the effects of leader presence. This construct can be thought of as the percentage of followers which are collocated with a leader. In this experiment, leader presence was low in the reachback team so it would be interesting to conduct an experiment in which leader presence was high and compare the results. It is possible that the relationship between such structural changes and performance might also be moderated by individual traits like personality or task complexity. For example, it might be that when leader presence is low, followers with high conscientiousness might not be effected very much. However, followers with low conscientiousness might have lower performance because they don't feel the need to work as hard if their leader is not in the room. Further, if task complexity is high performance might be better when leader presence is high because a majority of the followers will feel more connected to the leader.

Another limitation of this paper is the use of the MLQ to measure transformational and transactional leadership. While the MLQ is still considered the most popular measure to access transformational and transactional behaviors (Heinitz, Liepmann, & Felfe, 2005) there have always been questions regarding its validity. For example, Den Hartog, Van Muijen and Koopman (1997) found that the MLQ cannot discriminate between different sub-factors of transformational and transactional

leadership. They also found there is not discriminate validity between the sub-dimensions of laissez-fair and passive management-by-exception. Later, in a meta-analysis, Lowe, Kroeck, and Sivasubramaniam (1996) showed that average correlation between the transformational sub-dimensions of charisma and individual consideration was 0.74. In a separate study, Bass and Avolio (1997) reported the same correlation was even higher at 0.81. However, for the present study there were no hypotheses that differentiated between the sub-dimensions of transformational and transactional leadership so the inability of the instrument to discriminate between them is of little consequence here. What is much more relevant to this study is the tendency of transactional contingent reward scale to correlate with those associated with transformational leadership. This is more of an issue because it might cause a transactional leader to be measured as a transformational leader. Lowe, et al. (1996) reported that average correlation between the transactional dimension of contingent reward and the transformational dimensions of charisma and individual consideration was 0.68 and 0.70, respectively. Similar results have been obtained by others (Tejeda, Scandura, & Pillai, 2001; Vandenberghe, Stordeur, & D'Hoore, 2002). In fact, two different exploratory factor analyses have confirmed that contingent reward loads with the transformational scales rather then the transactional scales (Heinitz, Liepmann, & Felfe, 2005; J. C. Wofford, Goodwin, & Whittington, 1998). These results bring the discriminate validity of transformational and transactional leadership, as measured by the MLQ, into serious question.

In addition to the discriminate validity of the MLQ, a question regarding its construct validity has also emerged over time. The question here is whether or not the

MLQ is truly measuring transactional leadership. If as suspected the MLQ is not measuring transactional leadership but some variant of laissez faire leadership then it is possible that the measured transactional leadership scores will not be valid. This would be a particularly acute issue for the transactional condition of the present study since the transactional leadership scale was the primary measure used to determine the strength of leaders in this situation. If this scale was measuring something other than transactional leadership, we would never truly know the actual level or transactional leadership exhibited by those individuals.

Initially, Burns conceptualized transactional leadership as a style of leadership that promotes cohesion and consensus while reducing conflict. He felt that this could occur at both the organizational and small group level. In fact, his chapter titled, "Group Leadership" is in the transactional part of his book. To him transactional leadership is a positive and legitimate form or leadership which has the potential to consider the values, attitudes, beliefs and emotions of follows. It is not a style which is naturally predisposed to colder or stoic aspects of leadership. For example, he writes that transactional leaders "know how to personalize their influence" (J. M. Burns, 1978, p. 263). These sentiments are echoed later by those who suggest that the actions of transactional leaders are "in the best interest of their followers" and that such leaders "must regularly fulfill the expectations of their followers" (Kuhnert & Lewis, 1987, p. 649). However, it has been noted that this can be accomplished by using either a high or low quality exchange relationship. A high quality relationship is based on the interpersonal bond between leaders and followers (Landy, 1985). Such a relationship focuses on the exchanges of trust, commitment, and respect. In contrast, a low quality relationship is based on the

exchange of goods or rights. In this type or relationship leaders are more interested in the extrinsic motivating forces of rewards and pay. Not surprisingly, higher quality relationships have been shown to relate more strongly to positive organizational outcomes compared to low quality relationships (Ferris, 1985). Therefore, it is the high quality relationships that the MLQ should be measuring. Unfortunately, the opposite seems to be true. In fact, the transactional leadership scale in the MLQ seems to be measuring a form of laissez faire leadership or anti-leadership. In fact, every question in both the active and passive management-by-exception leadership scales, a full two-thirds of all transactional items, asks followers to either rate the degree to which leaders only concentrate on follower mistakes and failures or identify the lack of involvement by the leader. Perhaps the most egregious example is the item, "Fails to interfere until problems become serious". It seems rather odd to expect that anyone would rate or characterize any type or strong leader as a 'failure'.

For those who might suggest that the true nature of transactional leadership is irrelevant in this experiment because the training was based on the MLQ itself, three things need to be stressed. First, the training was built around the concepts contained in the MLQ and not the pejorative comments made in it. In fact, leaders where even told in the training that they do not need to be mean or nasty to exhibit transactional behaviors. Second, even if the leaders thought they were supposed to behave in an unappealing way, followers would probably have been unwilling to provide accurate feedback confirming this. It has been shown in other studies that followers are much less likely to give feedback that they perceived as negative especially when there is little temporal scope within the team (Audia & Locke, 2003). Third and finally, because most leadership

training today is based on positive behaviors, we can expect that if the training was ineffectual for any of the transactional leaders, they would probably revert to more of the transformational behaviors which they have been taught are the more valid forms of leadership. This would especially be true of undergraduate students who probably have a high social desirability bias.

In conclusion, while this was a very rich study that examined many aspects of virtual teams and leadership, it only the scratched the surface of what needs to be examined when it comes to the interaction between these constructs. Future studies should continue to examine this relationship as these structures become more common and grow in importance.

SUPPLEMENTAL TABLES

Table 3. Means, Standard Deviations, and Intercorrelations (simple task)

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
1. Team structure (Dummy 1) [a]	0.35	0.48	1										
2. Team structure (Dummy 2) [b]	0.33	0.47	-.52**	1									
3. Leadership style [c]	0.49	0.5	0.06	-0.04	1								
4. Task Complexity [d]	0	0	(a)	(a)	(a)	(a)							
5. Communication quantity	6020221	1742314	0.13	.31**	.29**	(a)	1						
6. Communication quality	-0.27	1.07	-0.05	-0.08	0.13	(a)	0.13	1					
7. Leader centrality	-0.34	1.06	-0.08	-0.08	0.17	(a)	0.18	.80**	1				
8. Performance (low complexity)	0.04	0.91	0.10	-0.14	.19*	(a)	0.06	.36**	.26**	1			
9. Performance (high complexity)	.	.	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)		
10. Team Satisfaction	-0.18	1.03	-0.08	-0.14	-0.05	(a)	0.01	.71**	.60**	.37**	(a)	1	
11. Leader Satisfaction	-0.24	1.05	-0.16	0.03	0.05	(a)	0.11	.73**	.76**	.28**	(a)	.69**	1

N= 72 to 85

(a) cannot be computed because at least one variable is a constant; *p<.05; **p<.01

[a] Dummy coded: D1=collocated vs. reachback (1= collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

[d] Dummy coded: 1 is complex and 0 is simple

Table 4. Means, Standard Deviations, and Intercorrelations (complex task)

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
1. Team structure (Dummy 1) [a]	0.35	0.48	1										
2. Team structure (Dummy 2) [b]	0.33	0.48	-.51**	1									
3. Leadership style [c]	0.5	0.5	0.03	0	1								
4. Task Complexity [d]	1	0	(a)	(a)	(a)	(a)							
5. Communication quantity	6727464	1808164	0.18	.42**	.30**	(a)	1						
6. Communication quality	0.28	0.83	0.001	-0.12	0.16	(a)	0.06	1					
7. Leader centrality	0.34	0.8	0.18	-0.13	.22*	(a)	0.16	.65**	1				
8. Performance (low complexity)	.	.	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)			
9. Performance (high complexity)	0	0.85	.27**	-.22*	0.10	(a)	0.15	.30**	.40**	(a)	1		
10. Team Satisfaction	0.18	0.93	-0.003	-0.09	0.07	(a)	0.08	.61**	.54**	(a)	.35**	1	
11. Leader Satisfaction	0.25	0.88	-0.15	0.001	.20*	(a)	0.08	.62**	.66**	(a)	.24*	.49**	1

N= 73 to 84

(a) cannot be computed because at least one variable is a constant; *p<.05; **p<.01

[a] Dummy coded: D1=collocated vs. reachback (1= collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

[d] Dummy coded: 1 is complex and 0 is simple

Table 5. Regression results between independent variables and communication quantity (simple task)

	Communication quantity		
	Unstandardized B	Beta	ΔR^2
Constant	4802643**		.215**
Team Structure (D1) [a]	1505020**	0.418	
Team Structure (D2) [b]	1941403**	0.534	
Leadership Style (D3) [c]	1020314**	0.295	.086**
D1xD3	772875.8	0.177	.008
D2xD3	490594.5	0.102	

N=71 teams; *p<.1 **p<.05

[a] Dummy coded: D1=collocated vs. reachback (1= collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

Table 6. Regression results between independent variables and communication quantity (complex task)

	Communication quantity		
	Unstandardized B	Beta	ΔR^2
Constant	5196108**		.380**
Team Structure (D1) [a]	1964123**	0.524	
Team Structure (D2) [b]	2640078**	0.683	
Leadership Style (D3) [c]	1013666**	0.282	.079**
D1xD3	983600.6	0.216	.013
D2xD3	609059.3	0.126	

N=83 teams; *p<.1 **p<.05

[a] Dummy coded: D1=collocated vs. reachback (1= collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

Table 7. Regression results between independent variables and communication quality (simple task)

	Communication quality		
	Unstandardized B	Beta	ΔR^2
Constant	-0.078		.016
Team Structure (D1) [a]	-0.265	-0.119	
Team Structure (D2) [b]	-0.313	-0.138	
Leadership Style (D3) [c]	0.282	0.133	.018
D1xD3	-0.602	-0.221	.015
D2xD3	-0.118	-0.040	

N=84 teams; *p<.1 **p<.05

[a] Dummy coded: D1=collocated vs. reachback (1=collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

Table 8. Regression results between independent variables and communication quality (complex task)

	Communication quality		
	Unstandardized B	Beta	ΔR^2
Constant	0.417**		.018
Team Structure (D1) [a]	-0.138	-0.079	
Team Structure (D2) [b]	-0.274	-0.156	
Leadership Style (D3) [c]	0.258*	0.156	.024*
D1xD3	0.071	0.033	.026
D2xD3	-0.524	-0.236	

N=83 teams; *p<.1 **p<.05

[a] Dummy coded: D1=collocated vs. reachback (1= collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

Table 9. Structure x Leadership style x Task Complexity as they relate to Comm quantity (Hypotheses 5)

	Collocated	Reachback	Virtual
	Simple		
Transformational	6,928,135	5,101,990	7,338,808
Transactional	5,583,780	4,530,511	6,276,734
Mean difference	1,344,355	571,479	1,062,074
t statistic	1.864	1.971	1.635
df	24	19	23
Sig.	p<.05	p<.05	p=.058
	Complex		
Transformational	7,832,240	5,432,318	8,353,416
Transactional	6,376,220	4,959,898	7,271,936
Mean difference	1,456,021	472,420	1,081,749
t statistic	2.256	1.801	1.670
df	24	22	21
Sig.	p<.05	p<.05	P=.055

Table 10. Regression results between independent variables and leader centrality (simple task)

	Leadership Centrality		
	Unstandardized B	Beta	ΔR^2
Constant	–0.096		.025
Team Structure (D1) [a]	–0.351	–0.160	
Team Structure (D2) [b]	–0.361	–0.161	
Leadership Style (D3) [c]	0.358*	0.170	.029*
D1xD3	–0.167	–0.062	.009
D2xD3	0.280	0.096	

N=84 teams; *p<.1 **p<.05

[a] Dummy coded: D1=collocated vs. reachback (1= collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

Table 11. Regression results between independent variables and leader centrality (complex task)

	Leadership Centrality		
	Unstandardized B	Beta	ΔR^2
Constant	0.287**		.033
Team Structure (D1) [a]	0.248	0.148	
Team Structure (D2) [b]	-0.090	-0.053	
Leadership Style (D3) [c]	0.342**	0.214	.046**
D1xD3	-0.004	-0.002	.020
D2xD3	-0.484	-0.226	

N=83 teams; *p<.1 **p<.05

[a] Dummy coded: D1=collocated vs. reachback (1= collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

Table 12. Regression results between mediator variables and performance (simple task)

	Performance		
	Unstandardized B	Beta	ΔR^2
Constant	0.157		.156**
Communication Quantity	0.00	0.014	
Communication Quality	0.251**	0.415	
Leadership Centrality	-0.028	-0.030	
Comm Qual x Comm Quant	0.00	-0.028	.088**
LC x Comm Quant	0.00	-0.004	
Comm Qual x LC	0.152**	0.351	

N=69 teams; *p<.1 **p<.05

Table 13. Regression results between mediator variables and performance (complex task)

	Performance		
	Unstandardized B	Beta	ΔR^2
Constant	-0.177		.191**
Communication Quantity	0.00	0.055	
Communication Quality	-0.001	-0.003	
Leadership Centrality	0.140**	0.427	
Comm Qual x Comm Quant	0.00**	1.176	.046
LC x Comm Quant	0.00**	-1.175	
Comm Qual x LC	0.042	0.135	

N=71 teams; *p<.1 **p<.05

Table 14. Regression results between mediator variables and team satisfaction (simple task)

	Team Satisfaction		
	Unstandardized B	Beta	ΔR^2
Constant	0.369		.526**
Communication Quantity	0.00	-0.098	
Communication Quality	0.653**	0.616	
Leadership Centrality	0.150	0.144	
Comm Qual x Comm Quant	0.00	0.397	.017
LC x Comm Quant	0.00	-0.414	
Comm Qual x LC	-0.095	-0.127	

N=71 teams; *p<.1 **p<.05

Table 15. Regression results between mediator variables and team satisfaction (complex task)

	Team Satisfaction		
	Unstandardized B	Beta	ΔR^2
Constant	-0.080		.475**
Communication Quantity	0.00	0.011	
Communication Quality	0.550**	0.501	
Leadership Centrality	0.290**	0.248	
Comm Qual x Comm Quant	0.00**	1.234	.040*
LC x Comm Quant	0.00*	-0.797	
Comm Qual x LC	0.169*	0.153	

N=71 teams; *p<.1 **p<.05

Table 16. Regression results between mediator variables and leader satisfaction (simple task)

	Leader Satisfaction		
	Unstandardized B	Beta	ΔR^2
Constant	0.109		.614**
Communication Quantity	0.00	-0.028	
Communication Quality	0.241**	0.234	
Leadership Centrality	0.601**	0.594	
Comm Qual x Comm Quant	0.00	-0.054	.012
LC x Comm Quant	0.00	-0.021	
Comm Qual x LC	-0.09*	-0.123	

N=71 teams; *p<.1 **p<.05

Table 17. Regression results between mediator variables and leader satisfaction (complex task)

	Leader Satisfaction		
	Unstandardized B	Beta	ΔR^2
Constant	-0.320		.493**
Communication Quantity	0.000	-0.002	
Communication Quality	0.475**	0.429	
Leadership Centrality	0.406**	0.345	
Comm Qual x Comm Quant	0.00	0.216	.075**
LC x Comm Quant	0.00	-0.233	
Comm Qual x LC	0.404**	0.363	

N=71 teams; *p<.1 **p<.05

Table 18. Regression results between independent variables and performance (simple task)

	Performance		
	Unstandardized B	Beta	ΔR^2
Constant	0.127		.014
Team Structure (D1) [a]	0.056	0.030	
Team Structure (D2) [b]	-0.239	-0.124	
Leadership Style (D3) [c]	0.217**	0.183	.033**
D1xD3	.0.711**	0.474	.081**
D2xD3	0.373	0.221	

N=83 teams; *p<.1 **p<.05

[a] Dummy coded: D1=collocated vs. reachback (1= collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

Table 19. Regression results between independent variables and performance (complex task)

	Performance		
	Unstandardized B	Beta	ΔR^2
Constant	-0.081		.078**
Team Structure (D1) [a]	0.098*	0.181	
Team Structure (D2) [b]	-0.076	-0.140	
Leadership Style (D3) [c]	0.034	0.066	.004
D1xD3	-0.001	-0.002	.010
D2xD3	-0.109	-0.159	

N=83 teams; *p<.1 **p<.05

[a] Dummy coded: D1=collocated vs. reachback (1= collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

Table 20. Regression results between independent variables and team satisfaction (simple task)

	Team Satisfaction		
	Unstandardized B	Beta	ΔR^2
Constant	0.167		.054*
Team Structure (D1) [a]	-0.458**	-0.214	
Team Structure (D2) [b]	-0.555**	-0.255	
Leadership Style (D3) [c]	-0.096	-0.047	.002
D1xD3	0.232	0.089	.008
D2xD3	-0.202	-0.071	

N=83 teams; *p<.1 **p<.05

[a] Dummy coded: D1=collocated vs. reachback (1= collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

Table 21. Regression results between independent variables and team satisfaction (complex task)

	Team Satisfaction		
	Unstandardized B	Beta	ΔR^2
Constant	0.298*		.010
Team Structure (D1) [a]	-0.122	-0.063	
Team Structure (D2) [b]	-0.229	-0.116	
Leadership Style (D3) [c]	0.126	0.068	.050
D1xD3	-0.179	-0.074	.013
D2xD3	-0.515	-0.207	

N=83 teams; *p<.1 **p<.05

[a] Dummy coded: D1=collocated vs. reachback (1= collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

Table 22. Regression results between independent variables and leader satisfaction (simple task)

	Leader Satisfaction		
	Unstandardized B	Beta	ΔR^2
Constant	-0.037		.030
Team Structure (D1) [a]	-0.435*	-0.200	
Team Structure (D2) [b]	-0.158	-0.071	
Leadership Style (D3) [c]	0.116	0.056	.003
D1xD3	-0.053	-0.02	.010
D2xD3	-0.476	-0.165	

N=83 teams; *p<.1 **p<.05

[a] Dummy coded: D1=collocated vs. reachback (1= collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

Table 23. Regression results between independent variables and leader satisfaction (complex task)

	Leader Satisfaction		
	Unstandardized B	Beta	ΔR^2
Constant	0.433**		.028
Team Structure (D1) [a]	-0.364*	-0.196	
Team Structure (D2) [b]	-0.186	-0.100	
Leadership Style (D3) [c]	0.365**	0.20	.043**
D1xD3	0.184	0.08	.008
D2xD3	-0.189	-0.08	

N=83 teams; *p<.1 **p<.05

[a] Dummy coded: D1=collocated vs. reachback (1= collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

Table 24. Comparison between all dependent variables

	Simple		Complex		
	Mean	Std Dev	Mean	Std Dev	t-test
Communication Quantity	6020221	1742314	6727464	1808164	$t(143) = -2.398$, $p<.05$
Communication Quality	-0.25	1.07	0.28	0.84	$t(167) = -3.734$, $p<.05$
Leader Centrality	-0.34	1.06	0.34	0.80	$t(167) = -4.714$, $p<.05$
Performance	0.10	0.91	-0.07	0.85	$t(164) = 2.420$, $p<.05$
Team Satisfaction	-0.18	1.03	0.18	0.94	$t(167) = -2.364$, $p<.05$
Leader Satisfaction	-0.24	1.05	0.25	0.89	$t(167) = -3.268$, $p<.05$

Table 25. Regression for Mediation (simple)

		Performance	
Step		Beta	ΔR^2
1	Communication Quality	.530**	.171**
	Leader Centrality	-.044	
	Comm Qual x LC	.168	
2	Team Structure (D1) [a]	0.074	.024
	Team Structure (D2) [b]	-0.038	
	Leadership Style (D3) [c]	0.114	
3	D1xD3	0.569**	.082**
	D2xD3	0.242*	

N=82 teams; *p<.1 **p<.05

[a] Dummy coded: D1=collocated vs. reachback (1= collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

Table 26. Regression for Mediation (complex)

		Performance	
Step		Beta	ΔR^2
1	Communication Quantity	0.06	.227**
	Communication Quality	-0.97*	
	Leader Centrality	1.45**	
	Comm Qual x Comm Quant	.996*	
	LC x Comm Quant	-1.075**	
2	Team Structure (D1) [a]	-.087	.114**
	Team Structure (D2) [b]	-.436**	
	Leadership Style (D3) [c]	-.109	
3	D1xD3	.166	.008
	D2xD3	.037	

N=71 teams; *p<.1 **p<.05

[a] Dummy coded: D1=collocated vs. reachback (1= collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

Table 27. Regression for Mediation (simple)

		Team Satisfaction	
Step		Beta	ΔR^2
1	Communication Quality	.708**	.501**
2	Team Structure (D1) [a]	-0.123*	.040**
	Team Structure (D2) [b]	-0.159**	
	Leadership Style (D3) [c]	-0.141**	
3	D1xD3	0.250**	.028**
	D2xD3	-0.042	

N=84 teams; *p<.1 **p<.05

[a] Dummy coded: D1=collocated vs. reachback (1= collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

Table 28. Regression for Mediation (complex)

		Team Satisfaction	
Step		Beta	ΔR^2
1	Communication Quantity	-.037	.502**
	Communication Quality	-.483	
	Leader Centrality	.904**	
	Comm Qual x Comm Quant	1.015**	
	LC x Comm Quant	-.681*	
2	Team Structure (D1) [a]	-.119	.011
	Team Structure (D2) [b]	-.027	
	Leadership Style (D3) [c]	-.045	
3	D1xD3	-.008	.000
	D2xD3	.022	

N=72 teams; *p<.1 **p<.05

[a] Dummy coded: D1=collocated vs. reachback (1= collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

Table 29. Regression for Mediation (simple)

		Leader Satisfaction	
Step		Beta	ΔR^2
1	Communication Quality	.262**	.617**
	Leader Centrality	.489**	
	Comm Qual x LC	-.106	
2	Team Structure (D1) [a]	-0.084	.017
	Team Structure (D2) [b]	0.044	
	Leadership Style (D3) [c]	-0.061	
3	D1xD3	0.112	.029**
	D2xD3	-0.192*	

N=84 teams; *p<.1 **p<.05

[a] Dummy coded: D1=collocated vs. reachback (1= collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

Table 30. Regression for Mediation (complex)

		Leader Satisfaction	
Step		Beta	ΔR^2
1	Communication Quality	.221**	.530**
	Leader Centrality	.307**	
	Comm Qual x LC	.329**	
2	Team Structure (D1) [a]	-.217**	.042**
	Team Structure (D2) [b]	-0.014	
	Leadership Style (D3) [c]	0.009	
3	D1xD3	0.032	.002
	D2xD3	0.080	

N=83 teams; *p<.1 **p<.05

[a] Dummy coded: D1=collocated vs. reachback (1= collocated)

[b] Dummy coded: D2=virtual vs. reachback (1=virtual)

[c] Dummy coded: 1 is transformational and 0 is transactional

Table 31. Regression for Mediation (performance)

		Performance			
		Simple		Complex	
Step		Beta	ΔR^2	Beta	ΔR^2
1	Communication Quality	0.489**	.110**	0.037	.163**
	Leader Centrality	-0.057		0.357**	
	Comm Qual x LC	0.136		0.039	
2	Leadership Style (D1) [a]	0.127	.015	-0.005	.000

N=82 teams; *p<.1 **p<.05

[a] Dummy coded: 1 is transformational and 0 is transactional

Table 32. Regression for Mediation (team satisfaction)

		Team Satisfaction			
		Simple (n=84)		Complex(n=83)	
Step		Beta	ΔR^2	Beta	ΔR^2
1	Communication Quality	0.666**	.504**	0.412	.412**
	Leader Centrality	0.081		0.232	
	Comm Qual x LC	0.037		0.079	
2	Leadership Style (D1) [a]	-0.160**	.024	-0.078	.005

*p<.1 **p<.05

[a] Dummy coded: 1 is transformational and 0 is transactional

Table 33. Regression for Mediation (leader satisfaction)

		Leader Satisfaction			
		Simple (n=84)		Complex(n=83)	
Step		Beta	ΔR^2	Beta	ΔR^2
1	Communication Quality	0.262**	.617**	.221**	.530**
	Leader Centrality	0.489**		.307**	
	Comm Qual x LC	-0.106		.329**	
2	Leadership Style (D1) [a]	-0.069	.004	.009	.000

*p<.1 **p<.05

[a] Dummy coded: 1 is transformational and 0 is transactional

Appendix A MEASUREMENT INSTRUMENTS

PRE-TRAINING SURVEY:

Team Name _____
DM# _____
ID# _____

Demographic Information

Age: _____
GPA: _____

Gender

Male
Female

Ethnicity

White / Caucasian
- ❍ African-American
- ❍ Hispanic / Latin-American
- ❍ Asian / Pacific Islander
- ❍ Arab / Middle-Eastern
- ❍ Other _____
- ❍ Prefer not to answer

General Computer Self-efficacy

Often in our jobs we are told about software packages that are available to make work easier. For the following questions, imagine that you were given a new software package for some aspect of your work. It doesn't matter specifically what this software package does, only that it is intended to make your job easier and that you have never used it before.

The following questions ask you to indicate whether you could use this unfamiliar software package under a variety of conditions. For each of the conditions, please rate your confidence about your first judgment, where 1 indicates "Not at all confident," 3 indicates "moderately confident," and 5 indicates "totally confident."

	1	2	3	4	5
...if there was no one around to tell me what to do as I go	❍	❍	❍	❍	❍

...if I had never used a package like it before	O	O	O	O	O
...if I had only the software manuals for reference	O	O	O	O	O
...if I had seen someone else using it before trying it myself	O	O	O	O	O
...if I could call someone for help if I got stuck	O	O	O	O	O
...if someone else had helped me get started	O	O	O	O	O
...if I had a lot of time to complete the job for which the software was provided	O	O	O	O	O
...if I had just the built-in help facility for assistance	O	O	O	O	O
...if someone showed me how to do it first	O	O	O	O	O
...if I had used similar packages before this one to do the same job	O	O	O	O	O

Computer Affect

For each of the condition, please rate your confidence about your first judgment, where 1 indicates "Not at all confident," 3 indicates "moderately confident," and 5 indicates "totally confident."

	1	2	3	4	5
I like working with computers	O	O	O	O	O
I look forward to those aspects of my job that require me to use a computer	O	O	O	O	O
Once I start working on the computer, I find it hard to stop	O	O	O	O	O
Using a computer is frustrating for me	O	O	O	O	O
I get bored quickly when working on a computer	O	O	O	O	O

How skilled are you in using computers?

- O Unskilled
- O Low Skill
- O Somewhat Skilled
- O Moderately Skilled

- O Very Skilled

How skilled are you in using a mouse?

- O Unskilled
- O Low Skill
- O Somewhat Skilled
- O Moderately Skilled
- O Very Skilled

How often do you play video games?

- O Rarely
- O Occasionally
- O Sometimes
- O Fairly Often
- O Very Often

Have you ever played DDD before?

- O Yes
- O No

NEO-FFI

This section contains 60 statements. Read each statement carefully. For each statement, choose the option that best represents your opinion.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I am not a worrier.	O	O	O	O	O
I like to have a lot of people around me.	O	O	O	O	O
I don't like to waste my time daydreaming.	O	O	O	O	O
I try to be courteous to everyone I meet.	O	O	O	O	O
I keep my belongings clean and neat.	O	O	O	O	O
I often feel inferior to others.	O	O	O	O	O
I laugh easily.	O	O	O	O	O
Once I find the right way to do something, I stick to it.	O	O	O	O	O
I often get into arguments with my family and co-workers.	O	O	O	O	O
I'm pretty good about pacing myself so as to get things done on time.	O	O	O	O	O
When I'm under a great deal of stress, sometimes I feel like I'm	O	O	O	O	O

going to pieces.					
I don't consider myself especially "light-hearted."	O	O	O	O	O
I am intrigued by the patterns I find in art and nature.	O	O	O	O	O
Some people think I'm selfish and egotistical.	O	O	O	O	O
I am not a very methodical person.	O	O	O	O	O
I rarely feel lonely and blue.	O	O	O	O	O
I really enjoy talking to people.	O	O	O	O	O
I believe letting students hear controversial speakers can only confuse and mislead them.	O	O	O	O	O
I would rather cooperate with others than compete with them.	O	O	O	O	O
I try to perform all the tasks assigned to me conscientiously.	O	O	O	O	O
I often feel tense and jittery.	O	O	O	O	O
I like to be where the action is.	O	O	O	O	O
Poetry has little or no effect on me.	O	O	O	O	O
I tend to be cynical and skeptical of others' intentions.	O	O	O	O	O
I have a clear set of goals and work toward them in an orderly fashion.	O	O	O	O	O
Sometimes I feel completely worthless.	O	O	O	O	O
I usually prefer to do things alone.	O	O	O	O	O
I often try new and foreign foods.	O	O	O	O	O
I believe that most people will take advantage of you if you let them.	O	O	O	O	O
I waste a lot of time before settling down to work.	O	O	O	O	O
I rarely feel fearful or anxious.	O	O	O	O	O
I often feel as if I'm bursting with energy.	O	O	O	O	O
I seldom notice the moods or feelings that different environments produce.	O	O	O	O	O
Most people I know like me.	O	O	O	O	O
I work hard to accomplish my	O	O	O	O	O

goals.					
I often get angry at the way people treat me.	O	O	O	O	O
I am a cheerful, high-spirited person.	O	O	O	O	O
I believe we should look to our religious authorities for decisions on moral issues.	O	O	O	O	O
Some people think of me as cold and calculating.	O	O	O	O	O
When I make a commitment, I can always be counted on to follow through.	O	O	O	O	O
Too often, when things go wrong, I get discouraged and feel like giving up.	O	O	O	O	O
I am not a cheerful optimist.	O	O	O	O	O
Sometimes when I am reading poetry or looking at a work of art, I feel a chill or wave of excitement.	O	O	O	O	O
I'm hard-headed and tough-minded in my attitudes.	O	O	O	O	O
Sometimes I'm not as dependable or reliable as I should be.	O	O	O	O	O
I am seldom sad or depressed.	O	O	O	O	O
My life is fast-paced.	O	O	O	O	O
I have little interest in speculating on the nature of the universe or the human condition.	O	O	O	O	O
I generally try to be thoughtful and considerate.	O	O	O	O	O
I am a productive person who always gets the job done.	O	O	O	O	O
I often feel helpless and want someone else to solve my problems.	O	O	O	O	O
I am a very active person.	O	O	O	O	O
I have a lot of intellectual curiosity.	O	O	O	O	O
If I don't like people, I let them know it.	O	O	O	O	O
I never seem to be able to get organized.	O	O	O	O	O

At times I have been so ashamed I just wanted to hide.	O	O	O	O	O
I would rather go my own way than be a leader of others.	O	O	O	O	O
I often enjoy playing with theories or abstract ideas.	O	O	O	O	O
If necessary, I am willing to manipulate people to get what I want.	O	O	O	O	O
I strive for excellence in everything I do.	O	O	O	O	O

MLQ

This section contains 51 statements. Read each statement carefully. For each statement, choose the option that best represents your opinion of yourself.

	Not at all	Once in a while	Sometimes	Fairly often	Frequently, if not always
I provide others with assistance in exchange for their effort	O	O	O	O	O
I re-examine critical assumptions to question whether they are appropriate	O	O	O	O	O
I fail to interfere until problems become serious	O	O	O	O	O
I focus attention on irregularities, mistakes, exceptions, and deviations from standards	O	O	O	O	O
I avoid getting involved when important issues arise	O	O	O	O	O
I talk about my most important values and beliefs	O	O	O	O	O
I am absent when needed	O	O	O	O	O
I seek differing perspectives when solving problems	O	O	O	O	O
I talk optimistically about the future	O	O	O	O	O
I stay informed of mistakes, complaints, and failures	O	O	O	O	O
I instill pride in others for being associated with me	O	O	O	O	O
I discuss in specific terms who is responsible for achieving performance targets	O	O	O	O	O
I wait for things to go wrong	O	O	O	O	O

before taking action					
I explain what incentives can be expect in exchange for effort	O	O	O	O	O
I talk enthusiastically about what needs to be accomplished	O	O	O	O	O
I specify the importance of having a strong sense of purpose	O	O	O	O	O
I spend time teaching and coaching	O	O	O	O	O
I make clear what one can expect to receive when performance goals are achieved	O	O	O	O	O
I draw attention to missed opportunities	O	O	O	O	O
I show that I am a firm believer in "If it ain't broke, don't fix it."	O	O	O	O	O
I go beyond self-interest for the good of the group	O	O	O	O	O
I treat others as individuals rather than just as a member of a group	O	O	O	O	O
I make clear what economic rewards one can expect to receive when performance goals are achieved	O	O	O	O	O
I demonstrate that problems must become chronic before I take action	O	O	O	O	O
I act in ways that built others' respect for me	O	O	O	O	O
I focus my followers when they didn't meet standards	O	O	O	O	O
I concentrate my full attention on dealing with mistakes, complaints, and failures	O	O	O	O	O
I consider the moral and ethical consequence of decisions	O	O	O	O	O
I keep track of all mistakes	O	O	O	O	O
I display a sense of power and confidence	O	O	O	O	O
I articulate a compelling vision of the future	O	O	O	O	O
I directe my attention toward failures to meet standards	O	O	O	O	O
I do not act until problems needed attention	O	O	O	O	O

I avoid making decisions	O	O	O	O	O
I consider an individual as having different needs, abilities, and aspiration from others	O	O	O	O	O
I get others to look at problems from many different angles	O	O	O	O	O
I help others to develop their strengths	O	O	O	O	O
I suggest new ways of looking at how to complete assignments	O	O	O	O	O
I delay responding to urgent questions	O	O	O	O	O
I emphasize the importance of having a collective sense of mission	O	O	O	O	O
I express satisfaction when others meet expectations	O	O	O	O	O
I express confidence that goals will be achieved	O	O	O	O	O
I am effective in meeting others' job-related needs	O	O	O	O	O
I use methods of leadership that are satisfying	O	O	O	O	O
I get others to do more than they expected to do	O	O	O	O	O
I am effective in representing others to higher authority	O	O	O	O	O
I work with others in a satisfactory way	O	O	O	O	O
I heighten others' desire to succeed	O	O	O	O	O
I am effective in meeting organizational requirements	O	O	O	O	O
I increase others' willingness to try harder	O	O	O	O	O
I lead a group that is effective	O	O	O	O	O

Current Mood Questionnaire

This scale has several statements that can describe someone's mood. Please respond to each statement by indicating how much the statement describes how you are feeling right now.

	Describes me not at all	Describes me a little	Describes me moderately	Describes me well	Describes me very well
I'm full of energy and tension.	O	O	O	O	O
I'm keyed up.	O	O	O	O	O
I am stirred up.	O	O	O	O	O
I'm feeling placid, low in energy.	O	O	O	O	O
My internal engine is running slow and smoothly.	O	O	O	O	O
My body is in a quiet, still state.	O	O	O	O	O
My mind and body are resting, near sleep.	O	O	O	O	O

PANAS

Like the previous scale, this one also asks about how you are feeling right now. Please Indicate to what extent you are feeling each of these emotions right now.

	Very slightly or not at all	A little	Moderately	Quite a bit	Very much
Interested	O	O	O	O	O
Distressed	O	O	O	O	O
Excited	O	O	O	O	O
Upset	O	O	O	O	O
Strong	O	O	O	O	O
Guilty	O	O	O	O	O
Scared	O	O	O	O	O
Hostile	O	O	O	O	O
Enthusiastic	O	O	O	O	O
Proud	O	O	O	O	O
Irritable	O	O	O	O	O
Alert	O	O	O	O	O
Ashamed	O	O	O	O	O
Inspired	O	O	O	O	O
Nervous	O	O	O	O	O
Determined	O	O	O	O	O
Attentive	O	O	O	O	O
Jittery	O	O	O	O	O

Active	○	○	○	○	○
Afraid	○	○	○	○	○
Sleepy	○	○	○	○	○
Still	○	○	○	○	○
Quiet	○	○	○	○	○
Emotionally aroused	○	○	○	○	○

Leader post game 2 survey:

This is the survey taken by the leader after game 2. The only difference between the post game 1 and post game 2 leader surveys is that the second included the MLQ and exit questions related to their satisfaction with the experiment itself.

Team Name _____
DM# _____
ID# _____

Current Mood Questionnaire

This scale has several statements that can describe someone's mood. Please respond to each statement by indicating how much the statement describes how you felt during the game.

	Describes me not at all	Describes me a little	Describes me moderately	Describes me well	Describes me very well
I'm full of energy and tension.	O	O	O	O	O
I'm keyed up.	O	O	O	O	O
I am stirred up.	O	O	O	O	O
I'm feeling placid, low in energy.	O	O	O	O	O
My internal engine is running slow and smoothly.	O	O	O	O	O
My body is in a quiet, still state.	O	O	O	O	O
My mind and body are resting, near sleep.	O	O	O	O	O

PANAS

Like the previous scale, this one also asks about your feelings. Please Indicate to what extent you felt these emotions during the game.

	Very slightly or not at all	A little	Moderately	Quite a bit	Very much
Interested	O	O	O	O	O
Distressed	O	O	O	O	O
Excited	O	O	O	O	O
Upset	O	O	O	O	O

Strong	O	O	O	O	O
Guilty	O	O	O	O	O
Scared	O	O	O	O	O
Hostile	O	O	O	O	O
Enthusiastic	O	O	O	O	O
Proud	O	O	O	O	O
Irritable	O	O	O	O	O
Alert	O	O	O	O	O
Ashamed	O	O	O	O	O
Inspired	O	O	O	O	O
Nervous	O	O	O	O	O
Determined	O	O	O	O	O
Attentive	O	O	O	O	O
Jittery	O	O	O	O	O
Active	O	O	O	O	O
Afraid	O	O	O	O	O
Sleepy	O	O	O	O	O
Still	O	O	O	O	O
Quiet	O	O	O	O	O
Emotionally aroused	O	O	O	O	O

MLQ (Leader self-report)

This section contains 51 statements. Read each statement carefully. For each statement, choose the option that best represents your opinion of yourself.

	Not at all	Once in a while	Sometimes	Fairly often	Frequently, if not always
I provided others with assistance in exchange for their effort	O	O	O	O	O
I re-examined critical assumptions to question whether they were appropriate	O	O	O	O	O
I failed to interfere until problems became serious	O	O	O	O	O
I focused attention on irregularities, mistakes, exceptions, and deviations from standards	O	O	O	O	O
I avoided getting involved when important issues arose	O	O	O	O	O
I talked about my most important values and beliefs	O	O	O	O	O

I was absent when needed	O	O	O	O	O
I sought differing perspectives when solving problems	O	O	O	O	O
I talked optimistically about the future	O	O	O	O	O
I stayed informed of mistakes, complaints, and failures	O	O	O	O	O
I instilled pride in others for being associated with me	O	O	O	O	O
I discussed in specific terms who is responsible for achieving performance targets	O	O	O	O	O
I waited for things to go wrong before taking action	O	O	O	O	O
I explained what incentives can be expect in exchange for effort	O	O	O	O	O
I talked enthusiastically about what needs to be accomplished	O	O	O	O	O
I specified the importance of having a strong sense of purpose	O	O	O	O	O
I spent time teaching and coaching	O	O	O	O	O
I made clear what one can expect to receive when performance goals are achieved	O	O	O	O	O
I drew attention to missed opportunities	O	O	O	O	O
I showed that I am a firm believer in "If it ain't broke, don't fix it."	O	O	O	O	O
I went beyond self-interest for the good of the group	O	O	O	O	O
I treated others as individuals rather than just as a member of a group	O	O	O	O	O
I make clear what economic rewards one can expect to receive when performance goals are achieved	O	O	O	O	O
I demonstrated that problems must become chronic before I	O	O	O	O	O

take action					
I acted in ways that built others' respect for me	O	O	O	O	O
I focused my followers when they didn't meet standards	O	O	O	O	O
I concentrated my full attention on dealing with mistakes, complaints, and failures	O	O	O	O	O
I considered the moral and ethical consequence of decisions	O	O	O	O	O
I kept track of all mistakes	O	O	O	O	O
I displayed a sense of power and confidence	O	O	O	O	O
I articulated a compelling vision of the future	O	O	O	O	O
I directed my attention toward failures to meet standards	O	O	O	O	O
I did not act until problems needed attention	O	O	O	O	O
I avoided making decisions	O	O	O	O	O
I consider an individual as having different needs, abilities, and aspiration from others	O	O	O	O	O
I got others to look at problems from many different angles	O	O	O	O	O
I helped others to develop their strengths	O	O	O	O	O
I suggested new ways of looking at how to complete assignments	O	O	O	O	O
I delayed responding to urgent questions	O	O	O	O	O
I emphasized the importance of having a collective sense of mission	O	O	O	O	O
I expressed satisfaction when others met expectations	O	O	O	O	O
I expressed confidence that goals would be achieved	O	O	O	O	O
I was effective in meeting others' job-related needs	O	O	O	O	O
I used methods of leadership	O	O	O	O	O

that were satisfying					
I got others to do more than they expected to do	O	O	O	O	O
I was effective in representing others to higher authority	O	O	O	O	O
I worked with others in a satisfactory way	O	O	O	O	O
I heightened others' desire to succeed	O	O	O	O	O
I was effective in meeting organizational requirements	O	O	O	O	O
I increased others' willingness to try harder	O	O	O	O	O
I lead a group that was effective	O	O	O	O	O

Task Complexity

Read each statement carefully. For each statement, choose the option that best represents your opinion of the last game you played

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I found this to be a complex game	O	O	O	O	O
I peformed a high number of actions while playing this game	O	O	O	O	O
During the game, I had to coordinate my actions with others	O	O	O	O	O
It was difficult to learn the power of all the targets	O	O	O	O	O
This game was mentally demanding	O	O	O	O	O
This game required a lot of thought and problem-solving	O	O	O	O	O
There were a large number of information cues in this game	O	O	O	O	O
Sequencing my actions with others was important in this game	O	O	O	O	O
The targets were unpredictable in this game	O	O	O	O	O
I found this to be a challenging game	O	O	O	O	O

Communication Quality

Communication Competence
Read each statement carefully. For each statement, choose the option that best represents your opinion of your team.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
My teammates have a good command of the language	O	O	O	O	O
My teammates are sensitive to others' needs of the moment	O	O	O	O	O
My teammates typically get right to the point	O	O	O	O	O
My teammates pay attention to what other people say to them	O	O	O	O	O
My teammates deal with others effectively	O	O	O	O	O
My teammates are good listeners	O	O	O	O	O
My teammates are difficult to understand when they communicate	O	O	O	O	O
My teammates express their ideas clearly	O	O	O	O	O
My teammates are difficult to understand when they speak	O	O	O	O	O
My teammates generally state the right thing at the right time	O	O	O	O	O
My teammates are easy to dialog with	O	O	O	O	O
My teammates usually respond quickly	O	O	O	O	O

Task Clarity
Read each statement carefully. For each statement, choose the option that best represents your opinion.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I knew exactly what to do on this task	O	O	O	O	O
I was not very sure how to complete the task	O	O	O	O	O
I knew how I was supposed to complete the task	O	O	O	O	O
I was not clear about how the task was to be done	O	O	O	O	O

Information timeliness, accuracy, and usefulness
Read each statement carefully. For each statement, choose the option that best represents your opinion.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I got information when I need it	O	O	O	O	O
I could rely on the information	O	O	O	O	O
I could use the information	O	O	O	O	O
The information was not too late or too early	O	O	O	O	O
The information was generally correct	O	O	O	O	O
The information was useful	O	O	O	O	O

Satisfaction

Satisfaction with Team
Read each statement carefully. For each statement, choose the option that best represents your opinion of your team.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
There is a lot of unpleasantness among members of this team	O	O	O	O	O
The longer we work together as a team the less well we do	O	O	O	O	O
Working together energizes and uplifts members of our team	O	O	O	O	O
Every time someone attempts to correct a team member whose behavior is not acceptable things seem to get worse rather than better	O	O	O	O	O
My relations with other team members are strained	O	O	O	O	O
I very much enjoy working with my teammates	O	O	O	O	O
The chance to get to know my teammates is one of the best parts of working on this team	O	O	O	O	O

DDD Knowledge

If you had unknown targets in your last game, please anwser the following question as best as you can. If you did not have unknown targets in your last game, please just click on any answer and hit "Submit".

Based on your own knowledge, please indicate the power levels of the different U-targets:

	A0	A1	A3	A5
UX	○	○	○	○
U+	○	○	○	○
U-	○	○	○	○
U#	○	○	○	○

1. If the target moves diagonally across the screen without stopping, which of the following targets is most potentially damaging to your defensive score?
   - ○ G1
   - ○ A3
   - ○ Enemy U target
   - ○ All of the above are equally damaging

2. If the target moves diagonally across the screen without stopping, which of the following targets is least potentially damaging to your defensive score?
   - ○ G3
   - ○ A5
   - ○ G1
   - ○ All of the above are equally damaging

3. Which of these vehicles is most important to launch before your team needs it to attack a target?
   - ○ Tank
   - ○ AWACS
   - ○ Jet
   - ○ Helicopter

4. If you want to figure out the power level of a U target, which vehicle should your team attack it with first?
   - ○ Tank
   - ○ AWACS
   - ○ Jet
   - ○ Helicopter

5. Which team member(s) have the capability of successfully attacking A5 targets? (check all that apply)
   - ☐ DM1
   - ☐ DM2

- ❑ DM3
- ❑ DM4

6. Which team member(s) have the capability of successfully attacking G3 targets? (check all that apply)
   - ❑ DM1
   - ❑ DM2
   - ❑ DM3
   - ❑ DM4

7. Which team member(s) have the capability of successfully attacking A1 targets? (check all that apply)
   - ❑ DM1
   - ❑ DM2
   - ❑ DM3
   - ❑ DM4

Satisfaction with Experiment

Read each statement carefully. For each statement, choose the option that best represents your opinion of your leader.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
This Teamlab experience was well-organized.	O	O	O	O	O
The Teamlab researcher who provided the training was professional in his/her behavior.	O	O	O	O	O
The Teamlab researcher who provided the training was courteous to the participants.	O	O	O	O	O
Overall, I was satisfied with my experience in the Teamlab today.	O	O	O	O	O

Team post game 2 survey:

This is the survey taken by the team member after game 2. The only difference between the post game 1 and post game 2 leader surveys is that the second included the MLQ and exit questions related to their satisfaction with the experiment itself.

Team Name _____
DM# _____
ID# _____

Current Mood Questionnaire

This scale has several statements that can describe someone's mood. Please respond to each statement by indicating how much the statement describes how you felt during the game.

	Describes me not at all	Describes me a little	Describes me moderately	Describes me well	Describes me very well
I'm full of energy and tension.	O	O	O	O	O
I'm keyed up.	O	O	O	O	O
I am stirred up.	O	O	O	O	O
I'm feeling placid, low in energy.	O	O	O	O	O
My internal engine is running slow and smoothly.	O	O	O	O	O
My body is in a quiet, still state.	O	O	O	O	O
My mind and body are resting, near sleep.	O	O	O	O	O

PANAS

Like the previous scale, this one also asks about your feelings. Please Indicate to what extent you felt these emotions during the game.

	Very slightly or not at all	A little	Moderately	Quite a bit	Very much
Interested	O	O	O	O	O
Distressed	O	O	O	O	O
Excited	O	O	O	O	O
Upset	O	O	O	O	O
Strong	O	O	O	O	O
Guilty	O	O	O	O	O

Scared	O	O	O	O	O
Hostile	O	O	O	O	O
Enthusiastic	O	O	O	O	O
Proud	O	O	O	O	O
Irritable	O	O	O	O	O
Alert	O	O	O	O	O
Ashamed	O	O	O	O	O
Inspired	O	O	O	O	O
Nervous	O	O	O	O	O
Determined	O	O	O	O	O
Attentive	O	O	O	O	O
Jittery	O	O	O	O	O
Active	O	O	O	O	O
Afraid	O	O	O	O	O
Sleepy	O	O	O	O	O
Still	O	O	O	O	O
Quiet	O	O	O	O	O
Emotionally aroused	O	O	O	O	O

Task Complexity

Read each statement carefully. For each statement, choose the option that best represents your opinion of the last game you played

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I found this to be a complex game	O	O	O	O	O
I peformed a high number of actions while playing this game	O	O	O	O	O
During the game, I had to coordinate my actions with others	O	O	O	O	O
It was difficult to learn the power of all the targets	O	O	O	O	O
This game was mentally demanding	O	O	O	O	O
This game required a lot of thought and problem-solving	O	O	O	O	O
There were a large number of information cues in this game	O	O	O	O	O
Sequencing my actions with others was important in this game	O	O	O	O	O
The targets were unpredictable in this game	O	O	O	O	O
I found this to be a challenging game	O	O	O	O	O

MLQ (team)

This section contains 51 statements. Read each statement carefully. For each statement, choose the option that best represents your opinion of your leader. Remember that all of your answers are 100% anonymous so please provide your honest answer.

	Not at all	Once in a while	Sometimes	Fairly often	Frequently, if not always
Provided me with assistance in exchange for my effort	O	O	O	O	O
Re-examined critical assumptions to question whether they were appropriate	O	O	O	O	O
Failed to interfere until problems become serious	O	O	O	O	O
Focused attention on irregularities, mistake, exceptions, and deviations from standards	O	O	O	O	O
Avoided getting involved when important issues arose	O	O	O	O	O
Talked about their most important values and beliefs	O	O	O	O	O
Was absent when needed	O	O	O	O	O
Sought differing perspectives when solving problems	O	O	O	O	O
Talked optimistically about the future	O	O	O	O	O
Stayed informed of mistakes, complaints, and failures	O	O	O	O	O
Instilled pride in me for being associated with him/her	O	O	O	O	O
Discussed in specific terms who was responsible for achieving	O	O	O	O	O

performance targets					
Waited for things to go wrong before taking action	O	O	O	O	O
Explained what incentives I could expect in exchange for my efforts	O	O	O	O	O
Talked enthusiastically about what needed to be accomplished	O	O	O	O	O
Specified the importance of having a strong sense of purpose	O	O	O	O	O
Spent time teaching and coaching	O	O	O	O	O
Made clear what one can expect to receive when performance goals were achieved	O	O	O	O	O
Drew attention to missed opportunities	O	O	O	O	O
Showed that he/she is a firm believer in "If it ain't broke, don't fix it."	O	O	O	O	O
Went beyond self-interest for the good of the group	O	O	O	O	O
Treated me as an individual rather than just as a member of a group	O	O	O	O	O
Made clear what economic rewards one can expect to receive when performance goals were achieved	O	O	O	O	O
Demonstrated that problems must become chronic before they take action	O	O	O	O	O
Acted in ways that built my respect	O	O	O	O	O
Focused me when I didn't meet standards	O	O	O	O	O
Concentrated his/her full attention on dealing with	O	O	O	O	O

mistakes, complaints, and failures					
Considered the moral and ethical consequence of decisions	O	O	O	O	O
Kept track of all mistakes	O	O	O	O	O
Displayed a sense of power and confidence	O	O	O	O	O
Articulated a compelling vision of the future	O	O	O	O	O
Directed my attention toward failures to meet standards	O	O	O	O	O
Did not act until problems needed attention	O	O	O	O	O
Avoided making decisions	O	O	O	O	O
Considered me as having different needs, abilities, and aspiration from others	O	O	O	O	O
Got me to look at problems from many different angles	O	O	O	O	O
Helped me to develop my strengths	O	O	O	O	O
Suggested new ways of looking at how to complete assignments	O	O	O	O	O
Delayed responding to urgent questions	O	O	O	O	O
Emphasized the importance of having a collective sense of mission	O	O	O	O	O
Expressed satisfaction when I meet expectations	O	O	O	O	O
Expressed confidence that goals would be achieved	O	O	O	O	O
Was effective in meeting my job-related needs	O	O	O	O	O
Used methods of leadership that are	O	O	O	O	O

satisfying					
Got me to do more than I expected to do	○	○	○	○	○
Was effective in representing others to higher authority	○	○	○	○	○
Worked with me in a satisfactory way	○	○	○	○	○
Heightens my desire to succeed	○	○	○	○	○
Was effective in meeting organizational requirements	○	○	○	○	○
Increased my willingness to try harder	○	○	○	○	○
Led a group that was effective	○	○	○	○	○

Task Complexity

Read each statement carefully. For each statement, choose the option that best represents your opinion of the last game you played

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I found this to be a complex game	○	○	○	○	○
I peformed a high number of actions while playing this game	○	○	○	○	○
During the game, I had to coordinate my actions with others	○	○	○	○	○
It was difficult to learn the power of all the targets	○	○	○	○	○
This game was mentally demanding	○	○	○	○	○
This game required a lot of thought and problem-solving	○	○	○	○	○
There were a large number of information cues in this game	○	○	○	○	○
Sequencing my actions with others was important in this game	○	○	○	○	○
The targets were unpredictable in this game	○	○	○	○	○
I found this to be a challenging game	○	○	○	○	○

Communication Quality

Communication Competence
Read each statement carefully. For each statement, choose the option that best represents your opinion of your team.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
My teammates have a good command of the language	O	O	O	O	O
My teammates are sensitive to others' needs of the moment	O	O	O	O	O
My teammates typically get right to the point	O	O	O	O	O
My teammates pay attention to what other people say to them	O	O	O	O	O
My teammates deal with others effectively	O	O	O	O	O
My teammates are good listeners	O	O	O	O	O
My teammates are difficult to understand when they communicate	O	O	O	O	O
My teammates express their ideas clearly	O	O	O	O	O
My teammates are difficult to understand when they speak	O	O	O	O	O
My teammates generally state the right thing at the right time	O	O	O	O	O
My teammates are easy to dialog with	O	O	O	O	O
My teammates usually respond quickly	O	O	O	O	O

Task Clarity
Read each statement carefully. For each statement, choose the option that best represents your opinion.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I knew exactly what to do on this task	O	O	O	O	O
I was not very sure how to complete the task	O	O	O	O	O
I knew how I was supposed to	O	O	O	O	O

complete the task					
I was not clear about how the task was to be done	O	O	O	O	O

Information timeliness, accuracy, and usefulness
Read each statement carefully. For each statement, choose the option that best represents your opinion.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I got information when I need it	O	O	O	O	O
I could rely on the information	O	O	O	O	O
I could use the information	O	O	O	O	O
The information was not too late or too early	O	O	O	O	O
The information was generally correct	O	O	O	O	O
The information was useful	O	O	O	O	O

Leader Centrality

Read each statement carefully. For each statement, choose the option that best represents your opinion.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It is easy to ask my leader for help	O	O	O	O	O
I communicate with my leader	O	O	O	O	O
My leader makes it difficult for me to do my job	O	O	O	O	O
My leader is "well connected" in our team	O	O	O	O	O
Everyone communicates with my leader	O	O	O	O	O

Satisfaction

Satisfaction with Team
Read each statement carefully. For each statement, choose the option that best represents your opinion of your team.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
There is a lot of unpleasantness among members of this team	O	O	O	O	O
The longer we work together	O	O	O	O	O

as a team the less well we do					
Working together energizes and uplifts members of our team	O	O	O	O	O
Every time someone attempts to correct a team member whose behavior is not acceptable things seem to get worse rather than better	O	O	O	O	O
My relations with other team members are strained	O	O	O	O	O
I very much enjoy working with my teammates	O	O	O	O	O
The chance to get to know my teammates is one of the best parts of working on this team	O	O	O	O	O

Satisfaction with Leader
Read each statement carefully. For each statement, choose the option that best represents your opinion of your leader.

	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
The way my leader listens when I have something important to say	O	O	O	O	O
The way my leader sets clear work goals	O	O	O	O	O
The way my leader treats me when I make a mistake	O	O	O	O	O
My leader's fairness in appraising my job performance	O	O	O	O	O
The way my leader is consistent in his/her behavior toward subordinates	O	O	O	O	O
The way my leader helps me to get the job done	O	O	O	O	O
The way my leader gives me credit for my ideas	O	O	O	O	O
The way my leader gives me clear instruction	O	O	O	O	O
The way my leader informs me about work changes ahead of time	O	O	O	O	O
The way my leader follows through to get problems	O	O	O	O	O

resolved					
The way my leaders understands the problems I might run into doing my job	O	O	O	O	O
The frequency with which I get a pat on the back for doing a good job	O	O	O	O	O
The technical competence of my leader	O	O	O	O	O
The way my job responsibilities are clearly defined	O	O	O	O	O

DDD Knowledge

If you had unknown targets in your last game, please answer the following question as best as you can. If you did not have unknown targets in your last game, please just click on any answer and hit "Submit".

Based on your own knowledge, please indicate the power levels of the different U-targets:

	A0	A1	A3	A5
UX	O	O	O	O
U+	O	O	O	O
U-	O	O	O	O
U#	O	O	O	O

1. If the target moves diagonally across the screen without stopping, which of the following targets is most potentially damaging to your defensive score?
   - O G1
   - O A3
   - O Enemy U target
   - O All of the above are equally damaging

2. If the target moves diagonally across the screen without stopping, which of the following targets is least potentially damaging to your defensive score?
   - O G3
   - O A5
   - O G1
   - O All of the above are equally damaging

3. Which of these vehicles is most important to launch before your team needs it to attack a target?
   - O Tank
   - O AWACS
   - O Jet

- ○ Helicopter

4. If you want to figure out the power level of a U target, which vehicle should your team attack it with first?
   - ○ Tank
   - ○ AWACS
   - ○ Jet
   - ○ Helicopter

5. Which team member(s) have the capability of successfully attacking A5 targets? (check all that apply)
   - ☐ DM1
   - ☐ DM2
   - ☐ DM3
   - ☐ DM4

6. Which team member(s) have the capability of successfully attacking G3 targets? (check all that apply)
   - ☐ DM1
   - ☐ DM2
   - ☐ DM3
   - ☐ DM4

7. Which team member(s) have the capability of successfully attacking A1 targets? (check all that apply)
   - ☐ DM1
   - ☐ DM2
   - ☐ DM3
   - ☐ DM4

Satisfaction with Experiment

Read each statement carefully. For each statement, choose the option that best represents your opinion of your leader.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
This Teamlab experience was well-organized.	○	○	○	○	○
The Teamlab researcher who provided the training was professional in his/her behavior.	○	○	○	○	○
The Teamlab researcher who provided the training was courteous to the participants.	○	○	○	○	○
Overall, I was satisfied with	○	○	○	○	○

my experience in the Teamlab today.					

Appendix B TRAINING MATERIAL

Transactional Leadership Statements

To the reader: Remember to read this statement a normal even voice.

Statement to be read at the beginning of the game
It is important that we try to get the highest score that we can in this exercise. We will do this attacking as many enemy targets as possible without killing any friendly targets. We will also be responsible for determining what the unknown targets are. Remember that unknown targets are targets that, even after you identify them, you still don't know what they are. They're the UX, U-, U+, and U#. They correspond to G0, G1, G3, and G5 (but not necessarily in that order), so we'll have to figure out which is which in order to perform well. However, these targets do not change power so once we figure out what they are we can continue to use that information. There is scrap paper if you want to write anything down.

In order to keep our motivation up it's important for all of us to remember the reward structure. If we are the highest performing team this semester we will win $300. If we are the second highest performing team we will win $200 and if we are the third we will get $100. Therefore, the better team score that we get the more money that we each make. Does everyone understand this payout system? Please always remember that we are playing for this cash prize.

Also, remember that we are getting course credit for our participation here today. Therefore, it's important that we try as hard as we can in this simulation.

[In the practice game each person had one type of vehicle]

I also want to make sure that each person is aware of their assignments. **One** of the games we will play will be just like the training game. However, the **other** game is a little different. Instead of everyone having one type of vehicle as they did in the practice game, everyone will have 3 of the same type of vehicle. For example, DM1 will have 3 jets but no other vehicles. Jets have a power level of 1 but can move very fast and see a fairly long distance. DM2 will be in charge of the tanks. Tanks have a power level of 5 but move very slowly and cannot see very far. DM3 will be in charge of helicopters. Helicopters have a power level of 3, move quicker then tanks but slower then jets and can see almost as far as a jet. It is important that everyone know their assignments. When you open your launch window, then, you will only see one vehicle type at your base. Make sure when you launch your vehicles that they say "Yes" in the aboard column. As long as everyone understands their assignments, and works to keep our scores high I will be satisfied.

My job as leader will be to focus on any actions which do not help us achieve our goals. Once we all start to execute our strategy I do not plan to interfere until problems become serious.

Now let's talk a little about the strategy. First I want to make sure that we know how to properly communicate the status of targets to each other. After you have identified a target make sure that you communicate three pieces of information. First let everyone know what target you are referring to. You can use the targets identification number to do this. This number will always be between 200 and 399. Second, tell everyone what type of target it is. In other words let them know if it is an a, g or u target and what power it has. Third, tell them were it is. To do this, use the coordinates at the left and at the top of the game playing area to direct your teammates. So a final communication would state something like "number 200 is a G1 and it is at .40 and .40."

We are ready to start the game. When everyone pushes the start button, the game will begin.

STOP

Statement you can tailor and use between games
Currently, our score *is [state amount]*. It is important that we try to get the highest score that we can in this exercise so we have the chance to get the most money. Remember that we will do this attacking as many enemy targets as possible without killing any friendly targets. Killing friendly targets takes is -25 offensive points so we need to avoid doing this. I think I saw a few people doing this so let's try to avoid that in the future.

[Mention anything else you saw that you didn't like during the game and would like to see the followers do differently]

Transformational Leadership Statement

To the reader: Remember to read this statement using a captivating and dynamic voice. Vary your loudness and pace.

Thank you for all being here today. I am very excited about this exercise and being your leader here today. I think that our team has a real chance to play this game better than anyone else has in the past. In order for us to do this I think it is important that we have a vision. I think that our team vision should be that "we will all work together as a team in order to achieve the highest possible score while enjoying the entire process" This means that we will not only try to maximize our score on the game but that we will all have fun doing it. It is my hope that we all enjoy this game.

COLLOCATED TEAMS ONLY: Before we go any farther, I thought that we would go around the room and introduce ourselves. At a minimum, please say your name, degree, and where you are from. Also, let's write our names on the placards in front of us so we don't just have to keep refereeing to each other by number. *[wait for everyone to finish]*

VIRTUAL TEAMS ONLY: Before we go any farther, I thought that we introduce ourselves. At a minimum, please say your name, degree, and where you are from.

REACHBACK TEAMS ONLY: Before we go any farther, I thought that we introduce ourselves. At a minimum, please say your name, degree, and where you are from. Also, please write your names on the placards in front of you so you can refer to each other by name. *[wait for everyone to finish]*

Great, OK...I think that it's also important that we have some specific team goals. Having reviewed all the training material for this task I think that we should have four different goals. First, I think that we should try to get the highest team offensive and defensive team score as possible. This is the most visible measure of success to us and the researchers. Second, it is important that we don't shoot down any friendly targets. Each time we shoot down one friendly it is minus 25 points which is like erasing the gains we made by shooting down 5 enemy targets. Third, I think that we should avoid inadvertently killing any friendly targets. Shooting these targets down is wrong and should be avoided. Fourth and finally, I think that we need to learn what the unknown targets are. I have been told that we will be tested on this after the game so we need to try our best to learn their identity. Remember that unknown targets are targets that, even after you identify them, you still don't know what they are. They're the UX, U-, U+, and U#. They correspond to G0, G1, G3, and G5 (but not necessarily in that order), so we'll have to figure out which is which in order to perform well. However, these targets do not change power so once we figure out what they are we can continue to use that information. There is scrap paper if you want to write anything down.

[In the practice game each person had one type of vehicle]

I also want to let you know that one of the games will be playing today is a little different than the practice game you just played. **One** of the games will be just like the training game you just played **but** the other one is a little different. Instead of everyone having one type of vehicle as they did in the practice game, everyone will have 3 of the same type of vehicle. For example, DM1 will have 3 jets but no other vehicles. DM2 will be in charge of the tanks. DM3 will be in charge of helicopters. When you open your launch window, then, you will only see one vehicle type at your base. Make sure when you launch your vehicles that they say "Yes" in the aboard column.

Also, I think that it is important that we all think of as many new ideas on how we can improve our strategy during the game as possible. If at any time you think you have a good suggestion or idea on how we can do things better, please don't hesitate to let me know. I think that we can all learn from each other.

I also want to let everyone know that if at any time you are having trouble with the game please just ask me for help and I will do my best to answer your question. If I can't answer it, I'll find someone in the lab that can.

Now let's talk a little about the strategy. I think it is important that as a team we all understand how to properly communicate the status of targets to each other. After you have identified a target I think we should communicate three pieces of information to each other. First, to make sure that we all know which target you are talking about please use the targets identification number to reference it. This number will always be between 200 and 399. Second, let everyone know what type of target it is. In other words let them know if it is an a, g or u target and what power it has. Third, tell them were it is. To do this, I think it would be a good idea to use the coordinates at the left and at the top of the game playing area to direct each other. So a final communication would state something like "number 200 is a G1 and it is at .40 and .40." Does anyone have any ideas on how to do this better? *[pause for response]* OK, before we start the game is does anyone else have any ideas on how we can improve our strategy? *[listen and consider commnets]*

I know some of you might be thinking that this task might be difficult, but I really think that each of you can do well. I have been informed by the researchers that students like us pick up this task pretty quickly and are able to score very high. I'm counting on you, and I think you'll do a super job. Just remember. We will succeed!! Good luck!!

We are ready to start the game. When everyone pushes the start button, the game will begin.

STOP

Statement you can tailor and use between the games

To the reader: Remember to read this statement using a captivating and dynamic voice. Vary your loudness and pace.

You may also want to stand and walk around during this period

Potential comment you could use during these intermissions:

- "So far I think that we are doing *[insert your own words here]"*
- "So far how does everyone think we are doing?"
- "Does anyone think we can do anything better?"
- "I really think we need to remember our vision. Remember our vision is to work together as a team in order to achieve the highest possible score while enjoying the entire process"
- "Does anyone need any help?"

Transactional quiz

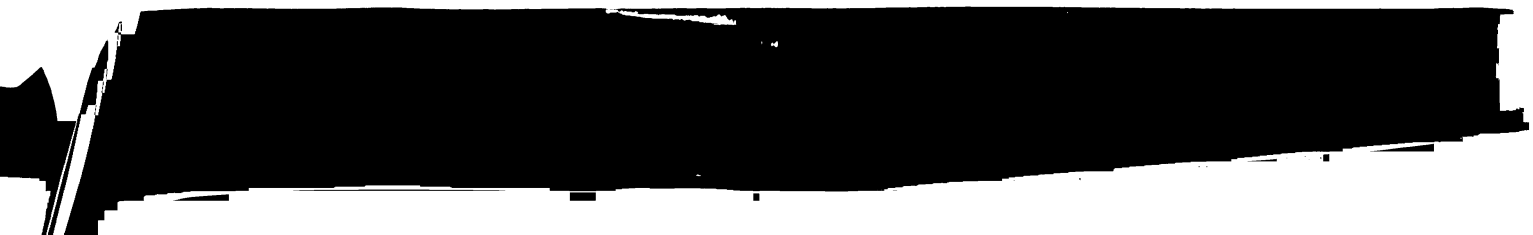
Below is a list of phrases. Please circle those phrases which describe a transactional leader.

- Displays a sense of power and confidence
- Talks enthusiastically about what needs to be accomplished
- Specifies the importance of having a strong sense of purpose
- Waits for things to go wrong before taking action
- Re-examines the critical assumptions to question whether they are appropriate
- Treats others as individuals rather than just as a member of a group
- Concentrates their full attention on dealing with mistakes, complaints, and failures
- Considers the moral and ethical consequence of decisions
- Helps others to develop their strengths
- Keep track of all mistakes
- Seeks differing perspectives when solving problems
- Provide others with assistance in exchange for their effort
- Talks optimistically about the future
- Makes clear what one can expect to receive when performance goals are achieved
- Demonstrates that problems must become chronic before taking action

Transformational quiz

Below is a list of phrases. Please circle those phrases which describe a transformational leader.

- Displays a sense of power and confidence
- Talks enthusiastically about what needs to be accomplished
- Specifies the importance of having a strong sense of purpose
- Waits for things to go wrong before taking action
- Re-examines the critical assumptions to question whether they are appropriate
- Treats others as individuals rather than just as a member of a group
- Concentrates their full attention on dealing with mistakes, complaints, and failures
- Considers the moral and ethical consequence of decisions
- Helps others to develop their strengths
- Keep track of all mistakes
- Seeks differing perspectives when solving problems
- Provide others with assistance in exchange for their effort
- Talks optimistically about the future
- Makes clear what one can expect to receive when performance goals are achieved
- Demonstrates that problems must become chronic before taking action



TRANSACTIONAL NOTES

Contingent Reward

- General examples
  - A manager explaining to his sales force how much more money they could make by having more sales
  - Discuss in specific terms who is responsible for achieving performance targets
  - Express satisfaction when others meet expectations
- Specific examples you can use in the simulation
  - Set criteria level using transactional leadership statement
  - Make it clear to each of your followers who is in charge of each action

Management-by-exception

- General examples
  - Focus attention on irregularities, mistake, exceptions, and deviations from standards
  - Direct attention toward failures to meet standards
  - Don't interfere until problems become serious
  - Show that I am a firm believer in "If it ain't broke, don't fix it."
- Specific examples you can use in the simulation
  - Warn team if they are getting close to a specific level of performance
  - Read transactional leader statement

Identifying and Transferring

- **Identifying**
  1. Right click on the target and then choosing Identify. Now another window will pop up. This window will appear every time you want to identify a target.
  2. You always do the same thing to identify a target using this window – first click on "Fused" and then go down and click on "ok."
- **Transferring**
  1. Right click on the target again and go down to "Transfer Info."
  2. Then click on "all linked DMs" in the next box that appears.

TRANSFORMATIONAL NOTES

Idealized influence

- Specific examples you can use in the simulation
  - Speak with a captivating voice tone by:
    - Varying the pace and loudness of speaking
    - Pausing to emphasize points
  - Repeatedly emphasize purpose
  - Consider the moral and ethical consequence of decisions

Inspirational Motivation

- Specific examples you can use in the simulation
  - Articulate a compelling vision of the future
  - Have a powerful, confident, and dynamic interaction style by:
  - Shaking hands, alternating between sitting and walking between participants, making eye contact, using hand gestures for emphasis while speaking, displaying animated facial expressions
  - Express confidence that goals will be achieved

Intellectual Stimulation

- General examples
  - I get others to look at problems from many different angles
  - I suggest new ways of looking at how to complete assignments
- Specific examples you can use in the simulation
  - Ask teammates for suggestions
  - Ask teammates to look for new ways of doing their job
  - Update strategy as necessary

Individual Consideration

- Specific examples you can use in the simulation
  - Recognize individual accomplishments
  - Providing individual support
  - Spend time teaching and coaching
  - Consider an individual as having different needs, abilities, and aspiration from others

Identifying and Transferring

- **Identifying**
    3. Right click on the target and then choosing Identify. Now another window will pop up. This window will appear every time you want to identify a target.
    4. You always do the same thing to identify a target using this window – first click on "Fused" and then go down and click on "ok."
- **Transferring**
    3. Right click on the target again and go down to "Transfer Info."
    4. Then click on "all linked DMs" in the next box that appears.

Potential comments you can use in DDD

About half of the following comments relate to the leadership style you have jut been trained on. To help you during the simulation you may now circle those comments which you think relate to your leadership style and refer to them during the game.

"Remember the specific reward structure we discussed"

"We need to make sure we keep the purpose of the game in mind"

"Let's try not to make so many mistakes."

"Good job meeting expectations."

"Does anyone need help?"

"Do we need to update our strategy?"

"Is there anything I can do for you" (communicated to one person only)

"Are we using the right strategy?"

"I really like our chances of succeeding"

"Does anyone need some help with the game?"

"The harder you work the more money I can give you"

"I we stay above or current performance level we will make more money"

"Remember your assignments"

"We are getting close to a specific level of performance"

"I really fell like we can achieve our goals"

"Does anyone have any suggestions on how we can do better?"

"Remember you can be rewarded with money for your effort"

"Let's all try to make as much money as possible"

"Are there other ways we can do our job?"

"I think we can do better meeting our goals"

"Do we have any serious problems?"

"Let's make sure we keep the mistakes to a minimum"

"Killing those friendly targets really hurts our score"

"Remember the purpose of the game"

"Try not to kill friendly target's -- that would be wrong"

"That was a really great job!"

"Remember our vision to get that high score and have fun"

Transactional leadership training script

Slide #1: Introduction

Congratulations on your selection as team leader. As leader, it will be your job to help your team achieve its maximum potential by facilitating their tasks using a transactional leadership style. Since you play such an important role as the team leader you will need to exhibit as many transactional leadership behaviors as possible. There will be a short quiz following the training to ensure that you understand what behaviors you need to exhibit.

You will be leading a team that is responsible for identifying and attacking enemy targets in two 30 minute simulations. There are only a few functions on the computer that you will need to perform in this simulation so you don't need the in-depth, hands on training that your team is currently receiving but you will be responsible for leading them using a transactional leadership style which is what this presentation teaches how to do. All the game functions which you need to know for the simulation will be taught to you in this presentation.

Overview

You and your team will play two 30 minute simulations and answer several questions after they are over. Throughout the game you should exhibit the same leadership style. It cannot be overstressed that it is critical to the success of this experiment that you only exhibit those leadership behaviors which you have been asked to demonstrate. If you exhibit other types of leadership behavior it could negatively impact the efficacy of this experiment.

To help remind you of what you learned in this presentation and increase your chances of exhibiting the required leadership behaviors, you have been given notes of this presentation that you can reference during the simulation. These behaviors are associated with transactional leadership. Please feel free to refer to these sheets during the training or write any notes on them. They are yours to keep and use during the simulation.

Also, some of the comments or behaviors that will be suggested to you might seem somewhat foreign or unusual to say in front of a group of people you don't know. Just do your best to find a time to exhibit as many of the suggested behaviors as possible. You don't have to say all the comments or exhibit all the behaviors but try your best to include as many as possible. Also, feel free to repeat as many comments or behaviors as you would like. In fact, the more times you repeat something the better so long as you don't just dwell on one or two items.

Alright, let's begin...

Slide #2: What is leadership?

Leadership is the process of influencing a team to achieve specific goals. There are many different styles or conceptualizations of leadership but transactional leadership is currently one of the most popular. Transactional leadership is reward and mistake orientated. It has to do with the leader establishing specific levels of expected performance that team members must meet and then monitoring whether or not those levels have been achieved or not.

Slide #3: Transactional Leadership

Transactional leadership views the relationships between leaders and followers as an exchange process in which followers' needs can be met if their performance is

adequate. Transactional leadership is based more on directing followers to initiate and execute specific tasks rather then forming an emotional tie with them. It is based on leaders setting a specific performance level and comparing follower output to that level.

Examples of this type of leadership include when a supervisor explains that higher performers make more pay, when a coach tells the team which play to run and they are rewarded by winning the game, or when a military General explains his strategy to his troops and they are rewarded by winning the battle.

Transactional leadership has two dimensions: contingent reward and management by exception

Let's now watch a view video clip of a transactional leader at work.

Slide #4: Transactional Leadership

The following clip is from the movie Apollo 13 which was the third mission to the moon. In April of 1970 Apollo 13 experienced a nearly catastrophic malfunction that almost killed all three astronauts while they were on their way to the moon. If it wasn't for the heroic efforts of the crew and ground team they surly would have perished. The ground team was lead by the flight director Gene Krantz who is played by Ed Harris in the movie.

[First Apollo 13 clip]

Slide #5: Contingent reward

The first dimension of transactional leadership is contingent reward which refers to an exchange process between leaders and followers. When leaders use this type of leadership they try to obtain agreement from followers on what needs to be done and what the payoffs will be for doing it. Therefore, contingent reward is simply rewarding

followers contingent on their performance. In other words, leaders reward high performance more than low performance. Leaders provide tangible or intangible support and resources to followers in exchange for their efforts and performance

General examples of contingent reward include a manager explaining to his sales force how much more money they could make by making more sales. Leaders who exhibit contingent reward also discuss in specific terms who is responsible for achieving performance targets and express satisfaction when others meet expectations.

When playing the simulation, the biggest thing you will be able to do to increase your perceived level of contingent reward is to set specific performance criteria for your team. On the last page of the handout you have been given is a statement that you should read to the entire team before you begin the game. The first part of this statement provides details regarding the reward structure used in this game. For example, you will inform your team that if they are the highest performing team this semester they will win $300. If we are the second highest performing team they will win $200 and if we are third they will get $100. It is important that throughout the simulation you remind your team mates what the performance criteria are and tell them how they are doing compared to them. Make certain that your teammates always remember that they are playing for a cash prize

Another specific reward that you can remind your team of during the simulation is that that they are getting course credit for their participation here today. Make sure that everyone remembers that they are performing this game for credit. This information is also contained in the leader statement so you don't forget it.

A final specific behavior that you can use in the simulation to increase your level of contingent reward is it to discuss who is responsible for achieving performance targets. For example, you will want to make it very clear to each of your followers who is in charge of what actions

It was clear in the previous movie clip that this is exactly the type of behavior Gene Krantz was exhibiting. He first clearly set the success criteria and made sure that everyone knew exactly what the penalty was if they did not achieve it.

Slide #6: Contingent reward clip

So now let's watch another movie clip that exemplifies this type of behavior. The following scene is from the movie Coach Carter. Samuel L. Jackson's character of Ken Carter has just become the coach of an underperforming high school basketball team. In order to motivate his players he has them sign contracts to keep their grades up. He is very clear that if they live up to their end of the bargain they will succeed and win. Unfortunately, the team breaks the agreement and he is forced to act.

[Coach carter video clip]

As in the previous Apollo 13 clip, we can see that Coach Carter clearly defines what the expected level of performance is and what will occur if it is not met. After the team fails to meet these criteria, Coach Carter does not allow the team to practice or play despite their unprecedented perfect record and first place ranking in their conference. However, once the team is exceeding the required level of performance he reinstates their playing privileges.

Slide #7: Management by Exception

The second and last transactional dimension is management by exception. Leaders with a high level of management by exception focus on events that are not normal or expected to happen. This dimension has to do with setting standards, monitoring deviations from these standards, and taking corrective action as necessary. Examples of this include focusing attention on irregularities, mistakes, exceptions, and deviations from standards. Leaders who have a high level of management by exception direct their attention toward failures to meet standards and typically don't interfere until problems become serious. They could also be characterized as firm believers in the phrase "If it ain't broke, don't fix it."

Specific behaviors you can exhibit when leading your DDD team to make yourself appear to have a higher level of management by exception is to warn the team that they are close to dropping below a specific level of performance. For example if you feel your team's score is getting too low, make sure you warn them.

Also, be sure to read the entire leader statement before you begin the game. The first part of this statement relates to the reward structure used in this game but the second is directed towards ensuring that you appear to exhibit the highest level of management by exception to your team.

Finally, don't be afraid to bring mistakes to the attention of your teammates. For example, if someone destroys a friendly target make sure you bring it to their attention and tell them not to do that in the future. In fact, brining this to their attention is actually a good thing. Many times people get so involved in the game they might not realize that they have destroyed a friendly. If this happens, or if they do something else they should

not have, make sure you bring this to their attention. You don't have to be mean about it, just let them know what happened and ask nicely to not to it again.

Slide #8: Management by Exception clip

Let's watch our last video clip which exemplifies management by exception. In the following clip from Apollo 13 Gene Krantz is presented with a situation that was previously not thought of. In this scene his team brings a deviation to a norm to his attention and he tells them that they needed to find a way to correct the problem.

[Second Apollo 13 video clip]

Slide #9: Your role in DDD

Even though we have covered numerous ways that you can appear to be a transactional leader, there are a few more specific things that you can do to exhibit this leadership style. First, read the introductory statement to your team using a normal and even toned voice. In other words you will want to use the most normal sounding voice possible. Avoid large changes in your pace or loudness

Second, you will want to make sure that your team develops strategies on how to operate. As a leader you can decided how to do this but it is important that it gets done.

Third, you will be the only person on your team that can see the entire screen. This allows you to direct the actions of others to specific threats even when they cannot see them. For example, when targets appear outside of their detection rings you can warn them that they are coming.

Finally, you will be given an opportunity between the games to summarize everyone's progress, talk about future strategies or make any other comments to the group that you would like to. Please do your best to concentrate on only exhibiting

transactional behaviors during this period. During the first game, please make notes that you can refer to during this time of things you would like to see the team do differently, the same, or simply just better.

Slide #10: A short quiz

As promised you will now take a short quiz to ensure that you understand exactly what type of behavior you should exhibit. In a moment, your trainer will hand you a piece of paper with a list of phrases on it. Some of these phrases describe a transactional leader and others do not. Simply circle those phrases that describe a transactional leader and pass the sheet back to your trainer when you are done. Feel free to refer back to your notes page. After you have finished that we will finish your training with a short description of how DDD works.

Slide #11: Things you need to know about DDD - Starting

Even though you will not be required to operate any of the vehicles in the simulation it is important for you to understand how the game works.

The first thing you need to know is how to start it.

Slide #12: Things you need to know about DDD – Starting picture

When your team is ready to start the game make sure everyone, including yourself, uses the mouse to left-click on the start button on the right hand side of the screen in the report area. It should say refresh if you clicked correctly.

Slide #13: Things you need to know about DDD – Identifying/Transferring

The only other function you will need to know how to perform on the computer is identifying and transferring the identity of targets to your teammates. Once the target gets within the blue rings of your base you will be allowed to identify it as either a friend

or foe and transfer the identity of that target to your teammates. While you can see all the targets on the screen you will only be able to identify and transfer target identities while the targets are inside the blue identification ring of your base.

Slide #14: Things you need to know about DDD – Identifying/Transferring - Picture

Identify targets by first right clicking on the target and then choosing Identify. Now another window will pop up. This window will appear every time you want to identify a target. You always do the same thing to identify a target using this window – first click on "Fused" and then go down and click on "ok." If you did it correctly the diamond with a question mark it in will change to the type of target it is.

However, after you identify a target you still must transfer it to you teammates. This allows them to know what type of target it is without needing to re-identify once it gets within range of their base or one of their vehicles. To transfer the identity of a pre-identified target, right click on the target again and go down to "Transfer Info." Then click on "all linked DMs" in the next box that appears. Remember that even though you transferred the identity to you teammates they cannot see it unless it is in range of their base or one of their vehicles.

A summary of how to identify and transfer the identity of target is printed on the notes sheets you have been given.

Slide #15: Things you need to know about DDD - Zooming

You should also be aware of the "zoom in" command. If there are a lot of targets in one portion of the screen, you will find it difficult to specify which one you want to identify and which you want others to attack. So you can zoom in on that portion of the screen.

Slide #22: Things you need to know about DDD – Zooming picture

To do this click the "zoom in" button and move your cursor back onto the game playing area. Keeping the button down, drag your mouse around the area you want to zoom in on and let go. To zoom out you just have to click on the "zoom out" button in the report area. Remember the zoom in function during the game. Most people forget about it and it makes the game much more difficult.

Slide #16: Things you need to know about DDD – Vehicle Information

Now lets talk about the vehicles for a second. After a vehicle is launched it always takes a few seconds to appear. Also you should know that its direction can be changed at any time. Additionally, each vehicle has only one shot. As it was said in the video training, you must remember that you only get one shot with each vehicle, then you are out of ammunition and you must return that vehicle to the base to reload. Even if you attack an enemy with a power of 1 with a tank, which has a power of 5, you still get one shot. After attacking, you MUST return your vehicle to your base in order to reload.

Slide #17: DDD training slide 2

You also need to keep a few things about the targets in mind. Targets need to be identified after they have been detected. The black ring is the detection ring and the blue ring is identification ring. Once identified, this information can then be transferred to other teammates including you. In other words, once someone identifies a target only they get information about it. It is not until this information is transferred to the rest of the team that they can see what kind of target it is. Remember, only you can see what's outside of your own detection rings. No one else can see anything outside of their base's rings without the help of a vehicle.

Another thing to remember is that you want to attack enemies only after they are inside of the green forbidden zone but before they get to the red forbidden zone

Slide #18: Summary

In summary, make sure that you don't make your direction or strategies too complicated. This game can get confusing so it's best to keep everything simple. Also, remember your notes pages. If you ever get to a point that you don't know what to say, refer back to them for some hints. Last but not least, remember to have fun and good luck.

Now please take a few moments to read over the Transactional Leadership Statement you will be making to you teams before the beginning of the game. The italicized words in the brackets are suggestions you can use to help you better present the statement. If you and your team have already discussed a certain comment or topic contained in the statement, you don't need to repeat it if you don't think it's necessary. Please don't hesitate to ask a staff member if you have any questions. Also, to make your job easier, you have been given a list of phrases similar to the quiz you took. Take a moment to pick out and circle those phrases which you might think might be consistent with a transactional leadership style. Once you have circled them, feel free to refer to them and use them during the simulation.

Transformational leadership training script

Slide #1: Introduction

Congratulations on your selection as team leader. As leader, it will be your job to help your team achieve its maximum potential by facilitating their tasks using a transformational leadership style. Since you play such an important role as the team leader you will need to exhibit as many transformational leadership behaviors as possible. There will be a short quiz following the training to ensure that you understand what behaviors you need to demonstrate.

You will be leading a team that is responsible for identifying and attacking enemy targets in two 30 minute simulations. There are only a few functions on the computer that you will need to perform in this simulation so you don't need the in-depth, hands on training that your team is currently receiving but you will be responsible for leading them using a transformational leadership style which is what this presentation teaches how to do. All the game functions which you need to know for the simulation will be taught to you in this presentation.

Overview

You and your team will play two 30 minute simulation and answer several questions after they are over. Throughout the game you should exhibit the same leadership style. It cannot be overstressed that it is critical to the success of this experiment that you only exhibit those leadership behaviors which you have been asked to demonstrate. If you exhibit other types of leadership behavior it could negatively impact the efficacy of this experiment.

To help remind you of what you learned in this presentation and increase your chances of exhibiting the required leadership behaviors, you have been given notes of this presentation that you can reference during the simulation. These behaviors are associated with transformational leadership. Please feel free to refer to these sheets during the training or write any notes on them. They are yours to keep and use during the simulation.

Also, some of the comments or behaviors that will be suggested to you might seem somewhat foreign or unusual to say in front of a group of people you don't know. Just do your best to find a time to exhibit as many of the suggested behaviors as possible. You don't have to say all the comments or exhibit all the behaviors but try your best to include as many as possible. Also, feel free to repeat as many comments or behaviors as you would like. In fact, the more times you repeat something the better so long as you don't just dwell on one or two items.

Alright, let's begin...

Slide #2: What is leadership?

Leadership is the process of influencing a team to achieve specific goals. There are many different styles or conceptualizations of leadership but transformational leadership is currently on of the most popular. Transformational leadership is based on forming an emotional connection with followers. It is founded on the premise that a strong personal connection exists between leaders and followers. Many times it also goes by the terms charismatic or visionary leadership. There are 4 specific dimensions of this type of leadership and we will soon go over each of these in more detail. As mentioned before, you should use a transformational style as all times during the simulation.

Slide #3: Transformational Leadership

Transformational leadership is based on forming an emotional connection with followers. This type of leadership can be broken down into 4 specific dimensions which are commonly referred to as the "4 I's": Idealized Influence, Inspirational motivation, Intellectual Stimulation, and Individual consideration. However, it is sometimes easier to think of them simply as influencing, charming, thinking, and caring

Sometimes it is difficult to tell the difference between each of these dimensions. If at any time you get confused during the simulation just remember that transformational leaders always attempt to be motivational and uplifting. Before we begin dissecting each of these dimensions lets watch a short video clip of a transformational leader at work.

Slide #4: Transformational Leadership

[Animal House clip]

While this is a humorous example from the movie Animal House, we will soon see that there were several genuine transformational leadership behaviors that were exhibited by John Belushi's character, Bluto

Slide #5: Idealized influence

The first dimension of transformational leadership is idealized influence. Idealized influence is realized when followers believe that leaders have high standards of moral and ethical conduct, when leaders are held in high personal regard, and when they engender loyalty from followers.

Let's now watch a short video clip which exemplifies this type of leadership. This clip is from the movie Braveheart with Mel Gibson. His character of William

Wallace is attempting to free the Scottish people from the tyrannical rule of the English King Longshanks.

Slide #6: Idealized influence clip

[First Braveheart clip]

From this clip we can see that William Wallace's chief concern was not for himself but his people. Further, it is obvious that he was concerned with the moral and ethical consequences that internal disagreements among the Scottish nobles had on the commoners. This exemplifies the type of selfishness that engenders loyalty from followers and demonstrates a keen sense of right and wrong.

Slide #7: Idealized influence cont.

As the leader in this simulation there are several things you can do to make your followers believe that you have a high level of idealized influence. First you can speak with a captivating voice. Make sure that your followers see you as interesting and in control. To do this you can vary the pace of your speaking. Sometimes speak fast but other times speak slow. You may also vary the loudness of your speaking. Sometimes you can speak loud and other times soft. You may also want to pause to emphasize different points. If you have something important to say, pausing at the right time can often help drive home your point. Remember in the Animal House clip how John Belushi's character of Bluto changed his voice several times and used pauses to better make his point.

Another way to increase your idealized influence is by continually emphasizing the purpose of the simulation. The purpose of this simulation is to maximize scoring by destroying as many enemy targets as possible without attacking friendly targets and to

learn the identity of the unknown targets. It will be important for you to constantly remind your followers of this fact.

A final way to increase your idealized influence is to show your followers that you have considered the moral and ethical consequences of making the wrong decisions. Let them know that it is important not to kill friendly targets because that would be wrong. Let them know that if they do inadvertently kill a friendly target it is important for them to try even harder in the future in order to keep this from happening again. You will know someone has destroyed a friendly target because after they attack it, the target will turn into a big black X and it say "error -25 points" after this your team offensive score will go down by 25 points. However, when your team properly attacks an enemy target the icon will change into what looks like a fire.

Slide #8: Inspirational Motivation

The second dimension of transformational leadership is Inspirational motivation. Often, inspirational motivation is considered to be a type of charisma. Therefore, inspirational motivational has to do with the ability of leaders to build confidence and inspire followers using symbolic elements and persuasive language. Leaders with a high level of inspirational motivation also have a strong vision for the future based on values and ideals.

Let's again look at another video clip from the movie Braveheart to better understand this dimension.

Slide #9: Inspirational Motivation clip

[First Braveheart clip]

In this clip we can see that William Wallace is using his charisma, charm and wit to be as persuasive as possible. He is so successful that in the end he convinces the people to die for their cause.

Slide #10: Inspirational Motivation cont

In this exercise there are several things you can do in order to increase your level of inspirational motivation. The first thing is to read them the transformational leadership statement that you will be given before the simulation begins. This will shown them that they you are capable of articulating a strong vision for the upcoming task. The next thing you can do is to exhibit a powerful, confident, and dynamic interaction style. Specifically, it would be wise for you to alternate between sitting and walking, making eye contact with people if they look at you, using hand gestures for emphasis while speaking, and displaying animated facial expressions. In fact, walking around during the simulation is an excellent way to exhibit a high level of inspirational motivation so try your best to walk around as much as possible. Finally, you want to try your best to express confidence that your team goals will be achieved. While people aren't speaking tell everyone that you are confident that the team goals will be met.

Slide #11: Intellectual Stimulation

The third dimension of transformational leadership is intellectual stimulation. Leaders with a high degree of intellectual stimulation challenge organizational norms, encourage divergent thinking, and push followers to develop innovative strategies. For example, they will often get others to look at problems from many different angles and suggest new ways of looking at how to complete assignments.

Let's watch one more video clip from the movie Braveheart which exemplifies this dimension

Slide #12: Intellectual Stimulation clip

In this clip William Wallace conceives a plan to defeat the heavy horse calvary of Longshanks which later turns out to be very successful.

Slide #13: Intellectual Stimulation cont

During these simulations there are several different things you can do to increase your level of intellectual stimulation. First, you can ask your team mates for suggestions. If you're ever uncertain as to what to do, ask your followers. Second, you can ask your teammates to consider different ways of performing their job. Ask them to come up with more efficient ways to complete the tasks. Finally, feel free to update or refine your strategy. If you select a specific strategy and it's not working, feel free to change it, just make certain that everyone on the team knows you are changing the strategy otherwise miscommunications might occur.

In the first clip we watched, John Belushi's character of Bluto first convinces his team mate Otter to go along with his plan who then provides additional intellectual stimulation for the rest of the group. For example, Otter convinces the group to devise a grand gesture to act as a statement. From this we can see that it is not important for the leader to directly exhibit all the elements of transformational leadership themselves so long as they can inspire others to do it for them.

Slide #14: Individual Consideration

The final transformational behavior is individual consideration. Leaders with a high level of this dimension are able to recognize the unique growth and development needs of followers as well as coaching followers and consulting with them.

As with the other dimensions, there are specific behaviors that you can exhibit with your team to appear to have a greater level of individual consideration. First, you can recognize individual accomplishments. You want to make sure that when someone does a good job that you praise them to the whole team. For example, you might simply say, "Hey Joe, nice job getting that target." Second, you can also spend some time providing individual support. If you notice that someone is having difficulty performing, you might want to spend some more time with them. Specifically, you could just ask them if there is anything that you can do to make their job easier. However, make certain that if you do spend more time with them that you appear helpful and useful. Sometimes there is a fine line between being supportive and annoying

Slide #15: Your role in DDD

Even though we have covered numerous ways that you can appear to be a transformational leader, there are a few more specific things that you can do to exhibit this style of leadership. First, read the introductory statement to your team using a commanding and dynamic voice. Remember to vary your pace and loudness.

Second, you will want to make sure that your team develops strategies on how to operate. As a transformational leader it is important that you consider everyone's input when you develop these strategies so make sure you ask everyone for their input.

Third, you will be the only person on your team that can see the entire screen. This allows you to direct the actions of others to specific threats even when they cannot

see them. For example, when targets appear outside of their detection rings you can warn them that they are coming.

Finally, you will be given an opportunity between the games to summarize everyone's progress, talk about future strategies or make any other comments to the group that you would like to. Please do your best to concentrate on only exhibiting transformational behaviors during this period. During the first game, please make notes that you can refer to during this time of things you would like to see the team do differently, the same, or simply just better.

Slide #16: A short quiz

As promised you will now take a short quiz to ensure that you understand exactly what set of leadership behaviors you should exhibit. In a moment, your trainer will hand you a piece of paper with a list of phrases on it. Some of these phrases describe a transformational leader and others do not. Simply circle those phrases that describe a transformational leader and pass the sheet back to your trainer when you are done. Feel free to refer back to your notes page. After you have finished that we will finish your training with a short description of how DDD works.

Slide #17: Things you need to know about DDD - Starting

Even though you will not be required to operate any of the vehicles in the simulation it is important for you to understand how the game works.

The first thing you need to know is how to start it.

Slide #18: Things you need to know about DDD – Starting picture

When your team is ready to start the game make sure everyone, including yourself, uses the mouse to left-click on the start button on the right hand side of the screen in the report area. It should say refresh if you clicked correctly.

Slide #19: Things you need to know about DDD – Identifying/Transferring

The only other function you will need to know how to perform on the computer is identifying and transferring the identity of targets to your teammates. Once the target gets within the blue rings of your base you will be allowed to identify it as either a friend or foe and transfer the identity of that target to your teammates. While you can see all the targets on the screen you will only be able to identify and transfer target identities while the targets are inside the blue identification ring of your base.

Slide #20: Things you need to know about DDD – Identifying/Transferring - Picture

Identify targets by first right clicking on the target and then choosing Identify. Now another window will pop up. This window will appear every time you want to identify a target. You always do the same thing to identify a target using this window – first click on "Fused" and then go down and click on "ok." If you did it correctly the diamond with a question mark it in will change to the type of target it is.

However, after you identify a target you still must transfer it to you teammates. This allows them to know what type of target it is without needing to re-identify once it gets within range of their base or one of their vehicles. To transfer the identity of a pre-identified target, right click on the target again and go down to "Transfer Info." Then click on "all linked DMs" in the next box that appears. Remember that even though you transferred the identity to you teammates they cannot see it unless it is in range of their base or one of their vehicles.

A summary of how to identify and transfer the identity of target is printed on the notes sheets you have been given.

Slide #21: Things you need to know about DDD - Zooming

You should also be aware of the "zoom in" command. If there are a lot of targets in one portion of the screen, you will find it difficult to specify which one you want to identify and which you want others to attack. So you can zoom in on that portion of the screen.

Slide #22: Things you need to know about DDD – Zooming picture

To do this click the "zoom in" button and move your cursor back onto the game playing area. Keeping the button down, drag your mouse around the area you want to zoom in on and let go. To zoom out you just have to click on the "zoom out" button in the report area. Remember the zoom in function during the game. Most people forget about it and it makes the game much more difficult.

Slide #23: Things you need to know about DDD – Vehicle Information

Now lets talk about the vehicles for a second. After a vehicle is launched it always takes a few seconds to appear. Also you should know that its direction can be changed at any time. Additionally, each vehicle has only one shot. As it was said in the video training, you must remember that you only get one shot with each vehicle, then you are out of ammunition and you must return that vehicle to the base to reload. Even if you attack an enemy with a power of 1 with a tank, which has a power of 5, you still get one shot. After attacking, you MUST return your vehicle to your base in order to reload.

Slide #24: DDD training slide 2

You also need to keep a few things about the targets in mind. Targets need to be identified after they have been detected. The black ring is the detection ring and the blue ring is identification ring. Once identified, this information can then be transferred to other teammates including you. In other words, once someone identifies a target only they get information about it. It is not until this information is transferred to the rest of the team that they can see what kind of target it is. Remember, only you can see what's outside of your own detection rings. No one else can see anything outside of their base's rings without the help of a vehicle.

Another thing to remember is that you want to attack enemies only after they are inside of the green forbidden zone but before they get to the red forbidden zone

Slide #25: Summary

In summary, make sure that you don't make your direction or strategies too complicated. This game can get confusing so it's best to keep everything simple. Also, remember your notes pages. If you ever get to a point that you don't know what to say, refer back to them for some hints. Last but not least, remember to have fun and good luck.

Now please take a few moments to read over the Transformational Leadership Statement you will be making to you teams before the beginning of the game. The italicized words in the brackets are suggestions you can use to help you better present the statement. If you and your team have already discussed a certain comment or topic contained in the statement, you don't need to repeat it if you don't think it's necessary. Please don't hesitate to ask a staff member if you have any questions. Also, to make your job easier, you have been given a list of phrases similar to the quiz you took. Take a

moment to pick out and circle those phrases which you might think are consistent with a transformational leadership style. Once you have circled them, feel free to refer to them and use them during the simulation.

Appendix C TRAINING ROOM PICTURES

Figure 34. Training Room A

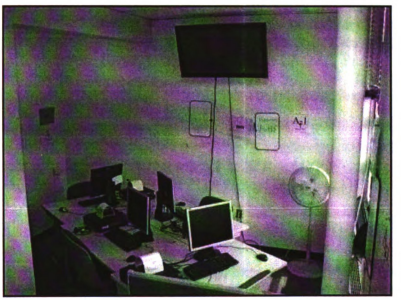


Figure 35. Training Room B

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