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A multi-level investigation of emergent leadership and dispersion effects in virtual teams

Steven Daniel Charlier
University of Iowa

A MULTI-LEVEL INVESTIGATION OF EMERGENT LEADERSHIP AND DISPERSION EFFECTS IN VIRTUAL TEAMS

by

Steven Daniel Charlier

An Abstract

Of a thesis submitted in partial fulfillment of the requirements for the
Doctor of Philosophy degree in Business Administration in the
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Thesis Supervisor: Professor Greg L. Stewart

ABSTRACT

The overarching goal of the proposed study is to develop and test a mediated multi-level model of leadership emergence in virtual teams, which aims to better understand not only the processes that result in leadership emergence in self-managed virtual teams, but also how patterns of emergent leadership and team member dispersion can impact team performance in collaborative activities. Virtual teams, which can be defined as "a collection of individuals who are geographically and/or organizationally or otherwise dispersed and who collaborate via communication and information technologies in order to accomplish a specific goal" (Zigurs, 2003), continue to grow in importance as to how organizations function in the 21st century (Hertel, Konradt, & Orlikowski, 2004; Lipnack & Stamps, 2000), and the benefits to companies and individuals are numerous. For employees, virtual teamwork offers flexibility in work-life balance, a decrease in time spent in travel and commuting, and a greater range of work-related opportunities and experiences, particularly for individuals with physical disabilities. For organizations, virtual teams offer cost savings on office space and travel, an increased knowledge base and accelerated organizational learning, access to a wider range of expertise and qualified labor, and increased productivity (Jude-York, Davis, & Wise, 2000; Gillam & Oppenheim, 2006).

The model to be tested in the proposed study is predicated on the input → mediator → output → input (IMOI) model proposed by Ilgen, Hollenbeck, Johnson, & Jundt (2005). Also, heeding the recent call for researchers to better incorporate the potential of attribution theory (see Heider, 1958; Kelley, 1973; Weiner, 1986) in explaining organizational behavior (Martinko, Harvey, & Dasborough, 2010), the interpersonal attribution model proposed by Gilbert & Malone (1995) is applied within the IMOI framework for the purposes of this study. At the individual level, the model provides a theoretical linkage between communication behaviors and several outcomes,

including team member perceptions/attributions and, ultimately, emergent leadership. At the team level, the model also incorporates the effect of leadership pattern differences across teams, as well as differences in level of virtuality, on overall team performance.

Based on the results of an experiment involving 86 four-person teams, it was found that configuration and collocation have significant effects on team performance and peer perceptions of individual team members. A curvilinear relationship was found between the level of dispersion among team members and team performance, such that performance generally decreased as team dispersion increased, yet performance improved at the high end of the dispersion continuum. Collocation also had strong positive effects on perceptions of trust, ability, and leadership emergence. In terms of the relationships between communication-related behaviors and emergent leadership, task-based communications proved to be the strongest predictor of emergent leadership. The use of texting language was positively associated with perceptions of leadership emergence as well. These results have significant practical implications for the design of virtual teams from both a team configuration and a team member skills/individual differences perspective. Several avenues of future research are also discussed.

Abstract Approved: _____
Thesis Supervisor

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Title and Department

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Date

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A thesis submitted in partial fulfillment of the requirements for the Doctor of Philosophy degree in Business Administration in the Graduate College of The University of Iowa

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Graduate College
The University of Iowa
Iowa City, Iowa

CERTIFICATE OF APPROVAL

PH.D. THESIS

This is to certify that the Ph.D. thesis of

Steven Daniel Charlier

has been approved by the Examining Committee for the thesis requirement for the Doctor of Philosophy degree in Business Administration at the July 2012 graduation.

Thesis Committee:

Greg L. Stewart, Thesis Supervisor

Kenneth G. Brown

Amy E. Colbert

M. Travis Maynard

Sara L. Rynes

To Jacqueline, Bryson, and Parker
In memory of my father, Elmer G. Charlier

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CHAPTER I:

INTRODUCTION: PROBLEM STATEMENT AND RATIONALE FOR STUDY

Virtual teams, which can be defined as "a collection of individuals who are geographically and/or organizationally or otherwise dispersed and who collaborate via communication and information technologies in order to accomplish a specific goal" (Zigurs, 2003), continue to grow in importance as to how organizations function in the 21st century (Hertel, Konradt, & Orlikowski, 2004; Lipnack & Stamps, 2000). Surveys have found that more than half of all large corporations (i.e. greater than 5,000 employees) utilize virtual teams (de Lisser, 1999), and that more than 60% of professional employees work in virtual teams (Kanawattanachai & Yoo, 2002). As of 2006, 40% of IBM's employees no longer have a physical home base in a building provided by the company (The Economist, 2006). A 2004 study (Furst, Reeves, Rosen, & Blackburn, 2004) estimated that 8.4 million employees in the U.S. alone work in virtual teams. This is a figure that will surely continue to grow as multinational corporations continue to flourish (Walsh, Meyer, & Schoonhoven, 2006; MacDuffie, 2007).

The potential benefits to companies and individuals are numerous. For employees, virtual teamwork offers flexibility in work-life balance, a decrease in time spent in travel and commuting, and a greater range of work-related opportunities and experiences, particularly for individuals with physical disabilities. For organizations, virtual teams offer cost savings on office space and travel, an increased knowledge base and accelerated organizational learning, access to a wider range of expertise and qualified labor, and increased productivity (Jude-York, Davis, & Wise, 2000; Gillam & Oppenheim, 2006).

For many companies, the move to implement virtual teams is a necessary step to remain competitive in an ever-expanding global marketplace. Walsh et al. (2006) reported that employment in US-based transnational corporations grew by 34% between 1991 and 2001, while 42% of the workforces for these organizations utilize workers from outside of the US. The authors also highlight the idea of "disaggregation" of work (i.e., "the fragmentations of organizations, career and jobs"; MacDuffie, 2007) as a modern-day trend in the work lives of employees. Through both of these trends, MacDuffie (2007) proposes that organizations and the nature of work itself are in the midst of a global shift towards a focus on knowledge over physical assets, adaptability over specialized expertise, projects and teams over individual advancement, and global external labor markets over internal ones. As such, according to Duarte & Snyder (2006), many successful organizations today have embraced the need to find new ways to work across boundaries through the innovative use of technology, systems, processes, and people – all under the rubric of "virtual teams".

The observation made by MacDuffie (2007) and Duarte & Snyder (2006) regarding the proliferation of projects and teams in comparison to individualized work is an important one. While teamwork has always been a critical aspect of organizational life, its relative importance has certainly increased of late. Therefore, there is both practical and theoretical value to gaining a better understanding of all aspects of team-based work. In particular, one of the most heavily researched and practically-relevant aspects of management inquiry relates to leadership. Results from a number of meta-analyses have shown that differences in leadership style and effectiveness have been linked to various outcomes in the organizational context, including employee-level measures of performance, satisfaction (Judge & Piccolo, 2004), and intent to quit (Gerstner & Day, 1997). Thus, for decades, researchers have tried to investigate a variety of facets of leadership by asking the question, "What makes a successful leader?"

Several prominent schools of thought have arisen from this inquiry during the industrialized era. Stemming from the "great man" theories of the 19th century, trait-based theories were prominent up through the late 1940s (Stogdill, 1948), and have enjoyed a resurgence in recent years (Bono & Judge, 2004). Behavioral approaches to leadership, including Theory X (McGregor, 1960) and the Ohio State studies on initiating structure and consideration (see Stogdill, 1950), stemmed from the somewhat disappointing results of previous trait-leadership studies. In turn, situational approaches to leadership were developed to better account for differences in leadership effectiveness across various contexts – such theories included contingency theory (Fiedler, 1964) and path-goal theory (House, 1971). Modern leadership theories, including transformational leadership (Burns, 1978) and leader-member exchange (Dansereau, Graen, & Haga, 1975), look to incorporate facets of many of these previous streams through the lens of the relationship leaders have with their followers. Yet none of these theories (or approaches) has emerged as a clear and singular explanatory mechanism for understanding how leadership works – hence, the need for continued exploration in this area across all work-related contexts is still present.

While leadership researchers have devoted considerable energy towards understanding the outcomes and effects of leadership, scholars have also looked extensively at the antecedents of leadership. By gaining a better understanding of specific attitudes, traits, behaviors, or skills that correlate with or result in leadership emergence, the implications of these findings could impact not only future theory development within scholarly pursuits, but also staffing processes and selection decisions within the practitioner realm. Therefore, a continued focus on deriving a comprehensive view of leadership emergence – including what causes leaders to emerge, as well as what effects emergent leaders can have on team outcomes – holds both academic and practical value.

Practically speaking, leaders in teams may emerge in two ways. First, individuals may quite simply be appointed to a leadership position on a given team by a recognized superior. Second, as is often the case for self-managed teams, leaders are not prearranged - rather, they emerge from within the group over time. Self-managed work teams are one of the most common team types utilized in organizations (Lawler, Mohrman, & Ledford, 1995; Lawler, 1998), and can be defined as teams that allow members to share in the management and leadership functions of the team (O'Connell, Doverspike, & Cober, 2002), as well as define how the work of the team will be accomplished. It is important to note that self-managed work teams are particularly prevalent in the virtual work environment (Carte, Chidambaram, & Becker, 2006; Yoo & Alavi, 2004), and are the focus of this study.

Regarding this second process of leader emergence, there is a rich history of research that attempts to understand the effects of individual differences on leadership emergence (see meta-analyses by Lord, De Vader, & Alliger, 1986; Eagly & Karau, 1991; Judge, Ilies, Bono, & Gerhardt, 2002). Within the virtual teams literature, previous research has also looked at a number of established individual-level variables related to leader emergence, including transformational leadership (Hambley, O'Neill, & Kline, 2007; Balthazard, Waldman, & Warren, 2009; Purvanova & Bono, 2009), transactional leadership (Hambley et al., 2007), and Big 5 personality traits (Balthazard et al., 2009). A few studies have also looked at process-related constructs that are perhaps more unique to the demands of leading virtually, including interaction style (Potter & Balthazard, 2002), activity level, and grammatical complexity of virtual communications (Balthazard et al., 2009). Nevertheless, while these studies attempt to illustrate the direct relationship between certain behaviors and emergent leadership, I believe that there is still an important intermediary gap between behaviors and outcomes that can be bridged through the application of attribution theory (see Heider, 1958; Kelley, 1967, 1973; Bem, 1972; Weiner, 1986; Gilbert & Malone, 1995) and the role of perceptions.

At the core of attribution theory is the notion that observers make judgments about others based on their behavior and the environmental factors that may influence others' behavior. Logic would presume that when "strong" situations are present (i.e., when environmental factors reinforce a certain type of behavioral expectation; Mischel, 1977), behaviors should be attributed to the situation, rather than any dispositional aspect of the individual exhibiting the behavior. This is sometimes referred to as a correctional process, in that individuals will "correct" their initial dispositional inference of a certain behavior to an environmental attribution, given the availability of situational data. However, individuals often demonstrate a "correspondence bias" (Gilbert & Malone, 1995), whereby people infer dispositional qualities of others from their behavior, even when environmental factors could easily be the impetus for the behavior itself – in effect, a correction is not made. Thus, individual perceptions and attributions play a key role in how people view one another, regardless of the strength of the situation or the level of information that is available to the observer. But along these lines, considering the lack of situational information that is present within virtual teams, it is evident that the power of perception is perhaps even greater in this type of environment – if individuals are predisposed to making dispositional inferences about others when face-to-face, the inclination is likely to be even stronger when little to no environmental information is present. Hence, the proposed study presents a model that bridges the gap between behavior and leadership emergence, using perceptions as the mediating force that connects the two areas.

Another area that has received little attention relates to the methodology employed in most virtual team research. While laboratory studies are commonplace, the *modus operandi* of most research in this arena has generally been to compare effects between "virtual" teams (defined in any number of different ways; Schweitzer & Duxbury, 2010) and traditional, face-to-face teams. Although early research tended to dichotomize teams into these two classifications, more recent definitions have viewed the

concept of *virtuality* as a continuum for all types of teams (Kirkman et al., 2004; Zigurs, 2003; Bell & Kozlowski, 2002; Griffith & Neale, 2001). Deviations from the norm of juxtaposing traditional and virtual teams have generally centered upon manipulating the type of communication media used in virtual teams (i.e., chat vs. videoconferencing; see Hambley et al., 2007). The proposed study will also manipulate two of the primary dimensions of virtual teams (Schweitzer & Duxbury, 2010) – the collocation and configuration of virtual team members. While the terms are somewhat synonymous, "collocation" generally refers to the concentration of team members at a given location or locations, while "configuration" more specifically denotes the number of locations that contain team members, as well as the number of team members at each location. One important distinction between the two constructs is the level of analysis inherent with each term. At its core, collocation is a dyadic construct – its focus is on the physical location of two people relative to one another. On the other hand, configuration is a team-level construct, and requires consideration of all team members and their physical locations as a whole. Previous studies have found significant effects for collocation and configuration differences amongst teams in regards to individual satisfaction levels, team performance, teamwork, and cohesion (O'Leary & Mortensen, 2010; Webster & Wong, 2008).

While the literature has generally used the two terms interchangeably, I believe that there are distinct differences in regards to how the constructs should be viewed and measured, as well as how each may have differential impacts on individuals and teams. In this regard, the theoretical model for this study proposes that differences in collocation are expected to impact emergent leadership at the individual level. As will be discussed in greater detail later in the paper, individuals who are collocated with their fellow team members are expected to be rated as more trustworthy and, in turn, more likely to be viewed as an emergent leader. Meanwhile, it is also posited that the effects of collocation on individual emergent leadership will aggregate to the team level, such that the

configuration of the team will combine with the aggregated leadership "profile" of the team to impact team performance. In this regard, teams that are "more virtual" in configuration (i.e., encompass a greater proportion of "virtual" dyadic relationships amongst team members) are expected to have lower task performance. Hence, the effect of configuration is focused solely at the team level of analysis, even though configuration itself is derived from the patterns of collocated and non-collocated individuals on a given team.

To summarize, the overarching goal of the proposed study is to develop and test a model of leadership emergence in virtual teams, while also taking into account the potential for the effects of collocation and configuration differences on emergent leadership and team performance. The proposed model, found in Figure 1.1 and discussed in detail in Chapter 2, is predicated on the IMOI (i.e., input → mediator → output → input) model developed by Ilgen, Hollenbeck, Johnson, & Jundt (2005). The IMOI model was based on the input → process → output (I-P-O) model first set forth by Steiner (1972), and expanded upon by McGrath (1984) and Cohen & Bailey (1997). Because the focus of this study is to better understand the emergent leadership *processes* that unfold in virtual teams, traditional *inputs* are not considered within the theoretical model. Thus, the model begins with a group of initial processes which fall under two main headings, both of which are focused on intrateam communications – namely, structure (i.e., how communications are composed/organized) and content (i.e., the focus of the information or messaging itself).

The focus on communications for the current study was made for two reasons. First, communications are at the heart of any team that features interdependent tasks. Simply put, teams cannot be successful without some level of effective communication among team members. Second aspects of communications become even more important in the virtual team context, given that other "physical" factors (e.g., shared environments and context, body language) are noticeably lacking in virtual team operations. Thus,

virtual team members are highly reliant on a limited set of information – namely, how and what people communicate – on which to base their perceptions of others.

Heeding the recent call for researchers to better incorporate the potential of attribution theory in explaining organizational behavior (Martinko, Harvey, & Dasborough, 2010), the interpersonal attribution model proposed by Gilbert & Malone (1995) is applied within the IMOI framework for the purposes of this study. This model provides a theoretical linkage between communication processes/behaviors and the focal output of the model at the individual level: emergent leadership. I propose that an individual's communication structure and content (i.e., the "how" and "what" of communications) have a substantial impact on how that individual is perceived in virtual teams. This is particularly salient in newly-developed self-managing virtual teams, where team members may have little to no other information available from which to base their perceptions of others. Specifically, the model posits that team members derive perceptions of others regarding their general ability and level of trust from this communication-related information, which results in an overall assessment of others' leadership status within the team. While these assessments are made at the individual (or dyadic) level within virtual teams, this information can also be aggregated to the team level by analyzing the individual leadership assessments in total for a given team. By deriving leadership profiles for the team based on this information (e.g., strong individual leadership, shared leadership, laissez-faire leadership), this information can be analyzed in regards to the relationship between these different potential leadership profiles and objective team performance. As will be discussed in greater detail in Chapter 2, it is hypothesized that a team leadership profile of shared leadership – high perceptions of leadership among multiple virtual team members – will result in higher objective team performance. The level of team virtuality (via differences between teams in terms of configuration) is also expected to have a direct effect on team performance as well.

Thus, to reiterate the theoretical model proposed in Figure 1.1, there are three levels that will be examined in the current study. Level 3 consists of the team-level constructs and relationships, which are focused on the prediction of objective team performance through team configuration and leadership profiles. Level 2 is the central portion of the model, which is concentrated on individual-level constructs. At this level, individual communication-related behaviors are hypothesized to impact peer perceptions of the individual's general mental ability and level of trust. In turn, these perceptions are expected to be related to perceptions of emergent leadership at the individual level as well. Finally, Level 1 is at the dyadic level, and relates to the dyadic relationships each team member has with others on the team. Thus, this level looks specifically at a dichotomous measure of whether or not two individuals are collocated, and projects that individuals who are collocated will have higher perceptions of interpersonal trust than team members who are not collocated.

There are several contributions to the virtual teams and emergent leadership literatures that should be able to be derived from this study. First, the creation of several experimental conditions that differ in regards to configuration (a proxy variable for virtuality in general, in this experiment) will allow for analysis of various relationships across a relatively full spectrum of virtuality. As a result, while comparisons of virtual vs. face-to-face or low vs. high virtuality can allow for tests of significant differences between groups or linear relationships between variables, this structure should allow for more fine-grained analysis across the virtuality continuum. Second, the collection of communication-related independent variables in the model of emergent leadership to be tested in this study is unique. While the Marks et al. (2001) typology of team processes has been utilized extensively in the overall teams literature, their application within the virtual teams context has been quite limited. Likewise, the empirical research on texting language numbers only a few studies, while the average response time variable has not been studied at all. Thus, this communication-centric model of leader emergence is

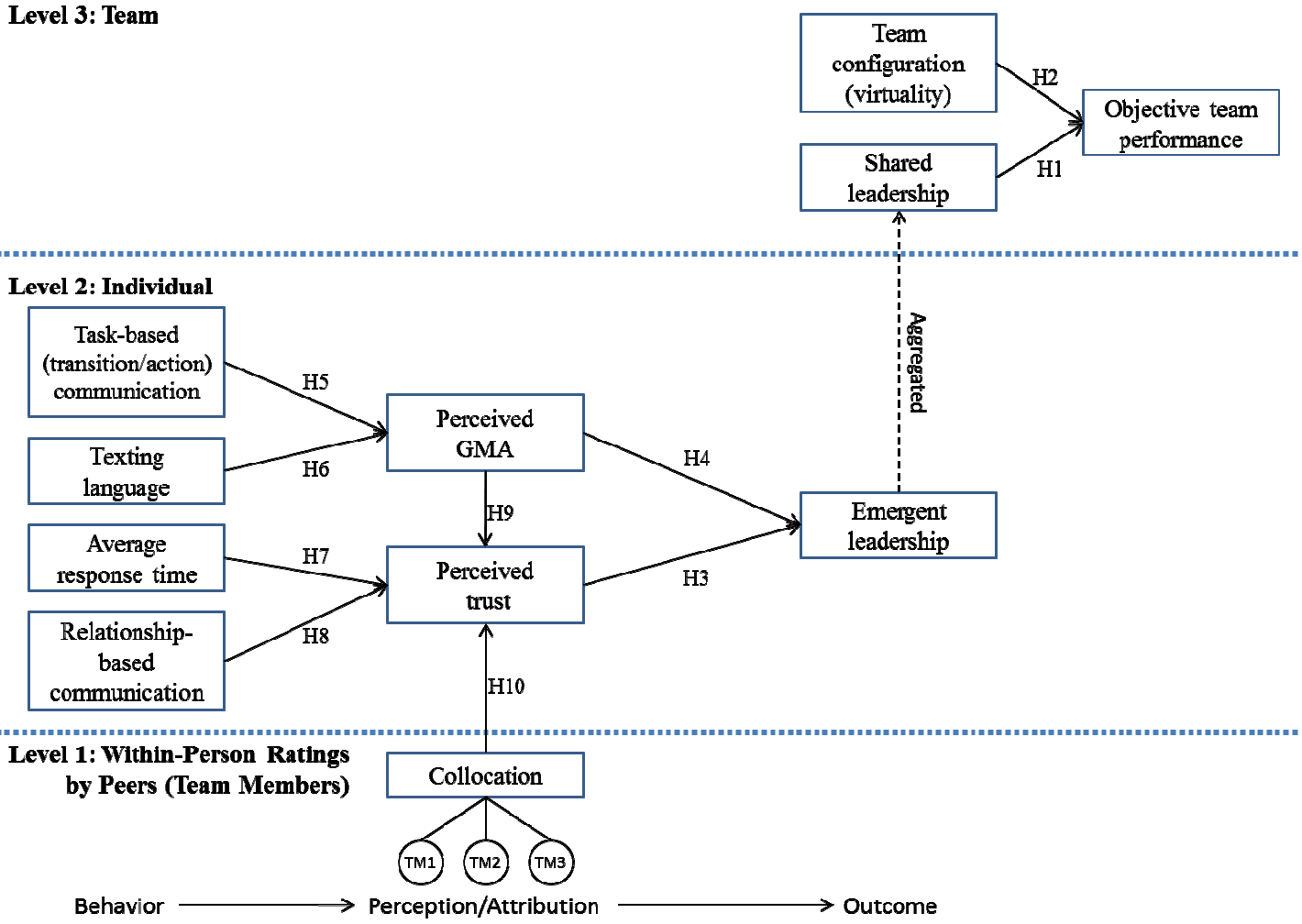
unique to the virtual teams literature, as well as the teams literature as a whole. Third, all interactions between team members will be captured for the entire duration of the activity, either via chat transcripts (for computer-mediated communication) or video recording (for all collocated, face-to-face communication). Thus, while the focus of the current study will be on the computer-mediated communications, the overall dataset will provide a unique opportunity to analyze all of the collocated and virtual communications for the experimental teams. Finally, the focal leadership pattern to be explored within the theoretical model is that of shared leadership. From a measurement perspective, the existing literature has exhibited a misalignment until some very recent developments. This study will utilize the emerging area of social network analysis to present a new method of measuring shared leadership, which hopefully will bring observed measures of shared leadership closer to the latent underlying construct.

While a call has been made for an increased focus of virtual team research to utilize field samples (Martins, Gilson, & Maynard, 2004), the decision to test the proposed theoretical model in a laboratory setting was made for a number of reasons. First, the experimental setting allows for a higher level of control for many important aspects of the study, including the tenure of the team members' relationship with one another, the level of expertise among participants related to the team's activities, and the configuration of team members during the experimental activities. It is, quite simply, impossible to achieve this level of control in a field setting. While statistical controls could be used to remedy some of these issues, the fact that one of the focal dependent variables for the study is leadership emergence necessitates that the teams be brought together for the first time at the onset of the study, to ensure that previous interactions between team members do not contaminate the results of the study. Hence, the logistical issues related to ensuring a reasonable level of control over these methodological concerns seem too difficult to overcome for a field sample. Finally, it is not an immaterial matter that organizations and employees themselves are often unwilling to

allow having all of their communications tracked and analyzed, which is a vital part of testing the theoretical model for this study. Hence, the very real issue of a lack of organizational support (and hence, data availability) was also considered.

The remainder of the paper is structured in the following manner. Chapter 2 begins with a discussion of the definition of, and criteria for, virtual teams. Next, I discuss the extant research on dispersion, collocation, and configuration of virtual team members, as well as relevant research in the area of trust and general mental ability, with a particular emphasis on virtual teams. Chapter 2 also describes the overall theoretical model and provides rationales for the individual hypotheses to be tested in the proposed study. Chapter 3 provides the methodology to be executed for the study, as well as a discussion of the analysis techniques that were employed to conduct statistical tests of the hypotheses. Chapter 4 provides a review of the experimental results, detailing the level of quantitative support provided by the data set that was collected for this study for all aspects of the theoretical model. Chapter 5 discusses these results in more detail, placing particular focus on the hypotheses that did not receive empirical support, and providing potential explanations for their occurrence. This concluding chapter also delves into several *post hoc* analyses that I performed using a mixed methods approach. Implications for research and practice are presented, along with limitations of the current study.

Figure 1.1. Theoretical Model



CHAPTER II:
LITERATURE REVIEW, THEORETICAL MODEL, AND HYPOTHESES

In this chapter, I will provide a brief review of several streams of research within the virtual teams realm, which will serve as background for the discussion of the theoretical model to be tested. This review will include the definition and criteria for virtual teams – what they are, and the similarities and differences they share with traditional work-related teams. Next, I will focus on the Level 3 relationships within the proposed theoretical model (see Figure 1.1), and will begin this section by introducing the concept of emergent leadership and discussing the relevant literature on shared leadership in virtual teams. This will serve as the basis for Hypothesis 1 in the proposed theoretical model. The chapter will continue with a discussion of previous research related to collocation levels and configuration differences amongst virtual teams. As this is the main condition which is to be manipulated in the proposed study, the review will look at the impact of collocation/configuration from several perspectives, including team performance (Hypothesis 2).

The next section of the chapter will focus on Level 2 of the theoretical model, and will begin with an overview of the IMOI model of teams (Ilgen et al., 2005), the interpersonal attribution model (Gilbert & Malone, 1995), and various theories on technology-mediated communication (Daft & Lengel, 1984; Dennis & Valacich, 1999). A brief review of prominent theories in the trust literature (McAllister, 1995; Mayer, Davis, & Schoorman, 1995) and background on research on general mental ability (GMA) will also be conducted – the relationship between perceptual aspects of both of these areas with emergent leadership are proposed in Hypotheses 3 and 4. The next set of hypotheses (5 through 8) is focused on communication-related behaviors and their relationships with the mediating variables of perceived trust and GMA. Hypothesis 9

discusses the literature surrounding the somewhat symbiotic relationship between interpersonal perceptions of trust and GMA. Finally, Level 1 of the theoretical model is discussed, which is focused on the impact of collocation between team members on dyadic perceptions of trust (Hypothesis 10). However, before delving into the model and hypotheses for the proposed study, I will begin with an evaluation of the ongoing scholarly debate over the conceptualization and definition of a "virtual" team.

Introduction: What is a "Virtual Team"?

Researchers have struggled with reaching a consensus on what specifically defines a virtual team. To begin, however, a definition of a "team" – virtual or otherwise – is in order. Perhaps the most current pervasive definition of a team in the literature is provided by Hackman, Wageman, Ruddy, & Ray (2000) and paraphrased in MacDuffie (2007: 563) – "a collection of individuals who are interdependent in their tasks, share responsibility for outcomes, see themselves (and viewed by others) as an intact social unit embedded in one or more social systems, and collectively manage their relationships across boundaries." In regard to virtual teams, however, the picture is not so clear. Martins et al. (2004) note that the majority of definitions include some mention of interdependent teams that rely on technology to communicate, and that cross multiple time and geographic boundaries (Bell & Kozlowski, 2002; Lipnack & Stamps, 1999, 2000), although even these high-level attributes are subject to debate (Schweitzer & Duxbury, 2010; Chudoba et al, 2005; Kirkman & Mathieu, 2005). While early research tended to dichotomize teams between "traditional" (face-to-face) and virtual teams, more recent definitions have instead viewed *level of virtuality* as a continuum for teams in general (Kirkman et al., 2004; Zigurs, 2003; Bell & Kozlowski, 2002; Griffith & Neale, 2001).

Nevertheless, in the most recent addition to the literature, Schweitzer & Duxbury (2010) provide a review of recent papers that attempt to ascertain both the criteria for

differentiating a virtual team from a traditional team, as well as the appropriate dimensionality of virtual teams. In terms of criteria for establishing virtuality, the authors found six areas that were commonly cited in virtual teams research as prerequisites for a virtual team: geographic dispersion, boundary-spanning team membership, asynchronous work, temporality (i.e., short time frames for working together), cultural diversity, and enablement by/reliance on communication technology. The authors conclude that only geographic dispersion and asynchronicity can be considered as criteria for differentiating virtual teams from traditional, face-to-face teams, and that presence of either criterion will suffice in being able to label a team "virtual". In their opinion, temporality, boundary spanning among team members, and cultural diversity are not unique to virtual teams, and thus are not sufficient criteria for establishing that a team is "virtual". In terms of the final criterion, technology-dependent communication, the authors state that "the use of communication technology is assumed to be a characteristic of all teams, whereas dependence on technology is likely a consequence of virtual teamwork. We contend that neither of these circumstances is, however, sufficient to define a VT…" (Schweitzer & Duxbury, 2010: 274).

In terms of the optimal dimensionality of virtual team criteria, the authors found five common dimensions across virtual team research: geographic dispersion, degree of collocation/configuration, asynchronous work, extent (lack) of face-to-face contact, and technology dependence. From their review, the authors conclude that all of the first four dimensions are useful in measuring the level of virtuality of a team – again, technology dependence is viewed by the authors as a result of being a virtual team, and not a dimension of how virtual a team might be. Thus, to summarize, Schweitzer & Duxbury (2010) conclude that the only requirement for being a virtual team is geographic dispersion and/or asynchronous work. However, the level of virtuality of a given team can best be measured through the level of geographic dispersion, degree of

collocation/configuration, degree of asynchronicity in the team's work, and the level of face-to-face contact among team members.

While the Schweitzer & Duxbury (2010) paper does an excellent job of reviewing the extant literature on the subject, there are issues with some of their arguments and conclusions. First, consider their final definition of a virtual team:

> "A VT is first and foremost a team, which means that it is made up of individuals working together interdependently with mutual accountability for a common goal. In addition, in order to be considered virtual, a team must have members who do not work in either the same place and/or at the same time, and therefore cannot collaborate face-to-face all of the time. As such, VT members must rely on communication technology to get their work done." (274)

The authors purport that geographic dispersion and/or asynchronous work flows are the only requirements for a virtual team; yet, their definition also establishes requirements of lack of face-to-face interaction and reliance on communication technology for a team to be "virtual". Thus, there is an obvious discrepancy between their analysis and eventual definition of a virtual team.

Second, both of the requirements for a virtual team proposed by Schweitzer & Duxbury (2010) cannot be easily viewed as dichotomous variables – geographic dispersion and level of asynchronicity are likely best characterized as a continuum of potential levels. Thus, to state that either is a requirement for a virtual team leaves much room for interpretation. How much geographic dispersion/asynchronicity is needed to make the switch from the classification of a team as traditional to virtual? Simply put, defining what constitutes a "virtual team" is still a matter of great debate.

Beyond the attempts of Schweitzer & Duxbury (2010) and others before them, several researchers (as mentioned previously) have instead viewed virtuality as a potential facet of all teams, and have suggested that attempting to make a distinction between traditional and virtual teams is "unrealistic and artificial" (Kirkman & Mathieu, 2005; 701). Zigurs (2003), for example, defines virtual teams as "a collection of

individuals who are geographically and/or organizationally or otherwise dispersed and who collaborate via communication and information technologies in order to accomplish a specific goal." (340) She proposes that the level of virtuality for a team can be measured across four types of dispersion: geographic, cultural, temporal, and organizational. Note that the author does not state that any of these dimensions alone are a requirement for a virtual team; rather, that they are means through which to attempt to ascertain the level of virtuality in a given team.

In a similar vein, Kirkman & Mathieu (2005) propose three dimensions for measuring team virtuality: 1) level of use of technology to coordinate and execute team processes, 2) level of media richness of said technological tools, and 3) level of synchronicity in team member interaction through technology. Along these lines, the authors propose that teams can be considered "more virtual" as the level of technology reliance increases, the level of media richness in communication tools decreases, and the level of synchronicity in team member interaction decreases. In other words, teams with the highest level of virtuality will rely exclusively on technology to communicate, will only use technology that is low in richness for intrateam communication (i.e., email, fax), and will perform all of their work in an asynchronous manner. The authors note that dispersion of team members alone does not necessarily equate to a team being "virtual"; rather, it is the way in which team members execute their collective work, through the use of technology, that best determines the level of virtuality for a given team.

In summary, based on a review of the literature, my definition and operationalization of a virtual team aligns with that of Zigurs (2003) and Kirkman & Mathieu (2005). I define a ***virtual team*** to be *a team which features some degree of dispersion among team members, such that constant face-to-face interaction and execution of the team's work is not possible; as such, the use of technology to communicate and collaborate between team members is paramount to the team's ability to successfully complete their work.* This definition is also quite similar to that of Martins

et al. (2004), who define virtual teams as "teams whose members use technology to varying degrees in working across locational, temporal, and relational boundaries to accomplish an interdependent task." Both definitions imply that only two requirements exist for a team to be considered "virtual", at least to some degree: 1) some form of dispersion is necessary to have a virtual team, although the level of this dispersion may vary; 2) technology must be used in some capacity to allow team members to bridge the form of dispersion inherent in their team's structure that prevents face-to-face interaction. As such, I believe that the levels of dispersion (whether they be geographic, temporal, cultural, relational, or others), as well as the richness of communication media (e.g., phone, fax, email, videoconference) and associated synchronicity of communication, are proper dimensions through which to measure the level of virtuality in a given team. As will be shown later in this chapter, the focus of the experimental manipulation in the proposed study is derived from this definition – virtual team members across conditions will experience varying degrees of virtuality (and hence, varying levels of reliance on technology between team conditions) to facilitate communication and collaboration with fellow team members.

Returning to the theoretical model in Figure 1.1, the effects of dispersion, collocation, and configuration differences between teams are projected to impact the functioning of virtual teams at several levels, including team performance (Hypothesis 2) and perceptions of trust between team members (Hypothesis 10). While these differences are the focal manipulation for the study, one of the major purposes of the study is to better understand how leaders emerge in self-managing virtual teams, as represented by the Level 2 portion of the theoretical model. In turn, the study also looks at aggregation of individual-level measures of emergent leadership into leadership emergence profiles (and specifically, the level of shared leadership within a team) and their impact on team performance. Thus, the notion of shared leadership between multiple members of a team is also reviewed. I will begin the next section of this paper with a brief introduction of

the concept of emergent leadership at the individual level, which will lead into a larger discussion of the shared leadership concept at the team level.

Level 3: Team-Level Relationships and Hypotheses

Emergent and shared leadership defined. Leadership is a multifaceted construct, which has been codified and defined in several different ways within the literature (Bass, 1990). At a high level, leadership can be defined as "influence exerted…over other people to guide, structure, and facilitate relationships in a group" (Yukl, 1998: 3). In turn, Morgeson, DeRue, & Karam (2010) have categorized the sources (i.e., structural dimensions) of leadership into two areas: formal vs. informal, and internal vs. external. For this study, the quadrant of informal/internal leadership is most relevant, given that this leadership structure is common within self-managing virtual teams (Carson, Tesluk, & Marrone, 2007). Thus, the concept of emergent leadership can be defined as perceptions of leadership that are accorded by other team members and emerge over time through group processes (Yoo & Alavi, 2004). It is important to note that this definition also specifically excludes leadership status that is designated or based on formal position – likewise, the definition also excludes individuals who are outside of the team structure. Rather, leaders "earn" their leadership status through influence and contributions to the team (Hollander, 1960, 1961).

Although the focus of the preceding paragraph has been on *emergent* leadership (particularly in virtual teams), the notion of *shared* leadership is also a key facet of the theoretical model to be tested, and the focal leadership construct in the theoretical model at the team level. Shared leadership is defined as "an emergent team property that results from the distribution of leadership influence across multiple team members" (Carson et al., 2007: 1218). It is derived from the interactions and influences that team members have with one another within the team context in regard to motivation, direction, negotiation, and support (Yukl, 1998; Carson et al., 2007).

Researchers have disagreed about how to best measure shared leadership. One method has been the use of the Team Multifactor Leadership Questionnaire (TMLQ, Form 5X) developed by Avolio and colleagues (2003). While this battery of items is clearly focused at the team level, its applicability to the concept of shared leadership is questionable, as the referent of the items is the team as a whole, rather than the specific intricacies of a network of relationships between team members. With this in mind, an approach based on social network theory (Brass, 1995; Mehra, Smith, Dixon, & Robertson, 2006) has been advocated to better capture the "web" of interrelationships within a given team that can result in shared leadership among members.

While emergent and shared leadership are related constructs, it is important to note the similarities and differences between the two. Of course, both are predicated on the idea of leadership. Also, both emergent and shared leadership are derived from perceptions of others within the context of a given team – neither can be effectively measured or understood without first capturing the opinions of team members regarding their colleagues. Nevertheless, the biggest difference between the two relates to the level of analysis. Emergent leadership is focused at the individual level, and is derived from the perceptions of others as they relate to a single person. On the other hand, shared leadership is a team-level construct, aggregated from the measures of individual (emergent or appointed) leadership across the entire team. Similarly, shared leadership implies that two or more individuals on a team must elicit perceptions of leadership at some point in time during the team's tenure for an actual "sharing" of leadership to occur – no such stipulation exists for leadership emergence at an individual level. While it can be argued that there is some level of interdependence between individual levels of emergent leadership in teams (i.e., not everyone can be a leader all of the time in a group setting), there is quite clearly a requirement of interdependence for shared leadership to occur. Thus, to summarize, emergent and shared leadership are related yet distinct

constructs, whereby individual levels of leadership are aggregated to form a leadership pattern (which includes the notion of shared leadership) within a given team.

Leadership patterns and team performance. Starting with the team level in the proposed model, research on the relationship between overall team leadership patterns and team performance has been somewhat mixed. One stream of research has looked at differences in performance for individuals/teams that exhibit collaborative vs. directive leadership behaviors. Somech (2005) utilized a sample of 136 high functionally heterogeneous primary care medical teams, and found that participative leadership style was positively associated with team reflection, which in turn fostered team innovation; however, this leadership style decreased team in-role performance. Carte, Chidambaram, & Becker (2006) attempted to integrate both traditional and emerging theories on leadership in their study of student teams across three US universities. First, the authors propose that *e-leadership* – defined in Avolio, Kahai, & Dodge (2001: 617) as a "social influence process mediated by [technology] to produce a change in attitudes, feelings, thinking, behavior, and/or performance" – while striving to achieve similar results as traditional conceptualizations of leadership, may take a different form due to aspects of the virtual context, including information asymmetry, team dispersion, and the "permanent record" of communications (Avolio & Kahai, 2003). Second, the authors use the concept of *substitutes for leadership* (Kerr & Jermier, 1978) to propose how contextual factors and the use of advanced technology in virtual teams can provide substitutes for leadership skills or actions. The authors focused on explaining differences in performance across a median split of their sample, and found that high performance groups had more overall incidents of leader behavior (with a noted emphasis on directive behavior), were higher in shared monitoring behaviors (e.g., collect and distribute information, check progress, provide a sense of continuity) and higher in "concentrated production" (e.g., closure seeking, motivating behavior resulting in task completion).

A second, yet related, avenue for research on the relationship between team leadership and performance has focused on the level of centralization of leadership within a team. Misiolek & Heckman (2005) used a sample of student teams to look at two levels of emergent leadership – "strong leadership", defined as teams where at least one person was viewed as the leader by more than half of the team, and "weak leadership", where teams did not have a general consensus on who the leader was. The authors found that strong leadership teams had emergent leaders who had significantly higher communication levels (from relationship, process, and task perspectives) than their fellow team members, where weak leadership teams had no difference amongst team members. However, while the differences in communication patterns were evident, the authors found no relationship between the leadership structure of the teams and their task performance ratings. These findings were off-set by a recent dissertation (Jefferson, 2009), who found that leader behaviors (categorized into two types – centralized and decentralized) did not influence team member attitudes related to perceptions of teamwork or metacognition, but did impact performance. The author reported that teams using centralized leadership had significantly better problem-solving performance than decentralized leadership teams, across various conditions of media richness. Thus, these two initial attempts to better understand how team leadership patterns and team performance are related did not result in conclusive evidence that generalizes across studies.

However, a third research stream has resulted in a handful of empirical studies that focus on the concept of shared leadership as an explicit source of leadership, and the results are promising. Avolio, Jung, Murry, & Sivasubramaniam (1996) found that the level of shared leadership among teams of undergraduate students was positively correlated with self-reported effectiveness. Taggar, Hackett, and Saha (1999) looked at the impact of various individual-level attributes on the performance of autonomous teams, and found that the highest levels of performance were for teams that had high

leadership behaviors for all members of the team. Sivasubramaniam, Murry, Avolio, & Jung (2002) found that team-level transformational leadership (participants rated the level of transformational leadership exhibited by the team as a whole) was a significant predictor of team performance, using a sample of undergraduate business students over the course of a scholastic semester. Pearce and Sims (2002) looked at differences in performance for teams that featured shared leadership versus "vertical leadership" (i.e., teams that have a manager with formal authority that is hierarchically positioned above the team), and found higher performance levels for the shared leadership teams. In subsequent follow-on studies, Pearce, Yoo, and Alavi (2004) studied virtual teams engaged in social work projects, while Ensley, Hmielski, and Pearce (2006) looked at top management team performance in new ventures; again, both studies found that shared leadership was a stronger predictor of team performance than vertical leadership. Finally, Carson et al. (2007) found a strong positive relationship between shared leadership and client-rated team performance for a group of student consulting teams.

In summary, these studies suggest that higher levels of shared leadership will be associated with stronger performance levels in virtual teams. Therefore, I predict the following:

Hypothesis 1: The level of shared leadership within a team will be positively related to objective team performance.

Team Virtuality: Dispersion, Collocation, and Configuration

The second construct that is hypothesized in the theoretical model to have a direct effect on team performance is team virtuality. As stated in the first section of this chapter, dispersion is a key factor in what makes a team "virtual". The work of O'Leary & Cummings (2007) is appropriate to serve as an introduction to this next section of the paper, as their "review of reviews" related to geographic dispersion in teams demonstrates that the vast majority of previous research studies have focused solely on

the spatial dimension of geographic dispersion (i.e., the actual physical distance between team members). However, O'Leary & Cummings (2007) propose that spatial dispersion is only one of many dimensions that are important to consider in regard to geographic dispersion in virtual teams. As such, the authors suggest three main dimensions of geographic dispersion: spatial, temporal (overlap of work hours/time zone differences between team members), and configurational. Configurational can be further subdivided into three separate views: the number of physical sites encompassed by a virtual team, the level of isolation of team members from others on the team, and the balance between subgroups of team members across the various physical team sites. Based on these dimensions, O'Leary & Cummings (2007) hypothesize that each has a unique effect on virtual team functioning, and should be considered independently. Table 2.1 provides an overview of the key outcomes and theoretical mechanisms associated with each dispersion dimension. Overall, the dimensions are theorized to impact several facets of team effectiveness, including conflict, coordination, communication, and problem solving.

As mentioned previously, spatial dispersion is the most common form of geographic dispersion considered in the literature, although the exact measurement of spatial dispersion is rarely performed. In fact, O'Leary & Cummings (2007) found only five studies that conducted any explicit measurement of geographic dispersion. Three studies (Cummings, 2004; Finholt & Sproull, 1990; Trevino et al., 2000) used a Likert scale to determine the level of geographic distance between team members (e.g., building, city, state, country, and continent). Rice & Aydin (1991) used floor schematics to derive degrees of spatial and configurational dispersion between team members located in the same building. And McDonough, Kahn, & Barczak (2001) used categories to differentiate between teams that were collocated, "virtual", and "global", although these categories had considerable overlap with one another. In short, while geographic dispersion is often cited as an important characteristic in virtual team research, explicit

consideration and/or measurement of the various dimensions of geographic dispersion is extremely limited.

One recent study (Hoegl, Ernst, & Proserpio, 2007) that was published at the time of the O'Leary & Cummings (2007) review is an example of the type of dispersion measure that is commonly found in the literature. Hoegl et al. (2007) looked at the moderating effects of physical team member dispersion on the relationship between teamwork and team performance in global software development teams. Team member dispersion was measured using a four-item scale (Hoegl & Proserpio, 2004) that focused on 1) the effort required to visit with other team members, 2) the perception of distance impacting performance, and 3) difficulties in meeting face-to-face spontaneously with team members. The authors found that dispersion did moderate the teamwork → team performance relationship, such that higher levels of dispersion increased the impact of teamwork on team performance. But what is perhaps most interesting in their results is that the highest levels of performance for teams in their sample, based on regression analysis, were for very low proximity teams with high levels of teamwork. Thus, in this case, higher degrees of dispersion did not necessarily have a negative impact on performance – when high dispersion teams were able to develop and utilize strong teamwork skills (which, admittedly, can be more difficult than in low dispersion teams), their performance was optimal.

The second major dimension of dispersion as proposed by O'Leary and Cummings (2007) is "temporal", defined as "the extent to which team members' normal work hours overlap" (438). It is somewhat difficult to parse the effects of temporal dispersion from other dimensions of dispersion, as temporal dispersion will generally go hand-in-hand with at least one other dimension of dispersion – the exception to this would be shift work at a common location. Nevertheless, the studies listed in Table 2.2 do demonstrate the logical result of having minimal overlap of workdays among team

members: difficulty in engaging in real-time collaboration and problem solving (i.e., asynchronous work flows).

The effects of differences in collocation and configuration – the third major dimension of dispersion in the O'Leary & Cummings (2007) model – have been investigated in a number of previous studies, although consistency of measurement across studies and across the configural sub-dimensions has been lacking. Nevertheless, researchers have found that collocation and configuration differences across teams can impact several important team-related constructs, including communication processes, performance, satisfaction, and identification (Webster & Wong, 2008; O'Leary & Mortensen, 2010; Cramton, Orvis, & Wilson, 2007; Heuser, 2009).

It is worth noting at this point that the focus of the experiment in terms of dispersion dimensions is squarely on configuration and collocation. This decision was made for both theoretical and practical reasons. From a theoretical perspective, spatial dispersion has been the primary area of focus for virtual team research; given this, I wanted to explore some of the less common dimensions in the O'Leary and Cummings (2007) model. From a practical perspective, the use of a student sample and a controlled experiment required the development of a protocol that would be realistically executable, given the time demands and lack of geographic dispersion of on-campus students. Thus, at the individual level, participants were randomly assigned to teams of four and are either isolated from the rest of the team or collocated with one or two other team members. The level of dispersion between dyads on a given team thus formed the collocation measure. At the team level, teams were organized into one of four experimental conditions that differ in their configuration of team members across multiple locations. Configurations included a very high virtual condition (no collocated team members), a configuration of four team members across three locations (two collocated team members with two isolates, which will be referred to as the "high virtuality" condition), a low virtuality condition (two collocated members at each of two

locations), and a very low virtuality condition (three collocated team members with one isolate. Thus, the first two dimensions within the O'Leary and Cummings (2007) model – spatial and temporal – were controlled across all of the experimental conditions. Participants were physically located in the same building during the experiment, which therefore prevented any differences between conditions from a temporal perspective (because participants had synchronous communication capabilities during the activity, no time delays in communication due to differences in physical proximity to each another were present).

While it can be argued that this manipulation of team configurations limits the overall breadth of "virtuality" of the experimental teams across all of the experimental conditions, there are two positive aspects of this design that are important to note. First, one of the major goals of the study is to better understand the impact of collocation and configuration differences on virtual teams. By controlling the other types of dispersion, I am able to pinpoint the effects of the focal collocation/configuration variables. Second, this experimental design underlies the definition of a "virtual team" presented earlier, in that all experimental teams will share the two common traits of a virtual team: dispersion amongst team members that prevents complete face-to-face interaction, and the use of technology to bridge the dispersion and facilitate communications among team members.

In this regard, Hypothesis 2 focuses on the relationship between the level of virtuality (manipulated in this study through differences in collocation and configuration) in a given team and its performance. Many studies in the virtual team literature have looked at the issue of how technology-mediated communication (versus face-to-face interaction) impacts both team processes and performance. Results have been equivocal, at best (Heuser, 2009). In terms of sheer quantity of information exchanged in virtual teams as compared to traditional ones, researchers have found support for a negative effect of technology mediation (Hiltz, Johnson, & Turoff, 1986; Siegel, Dubrovsky, Kiesler, & McGuire, 1986; Straus, 1996; Bhappu, Griffith, & Northcraft, 1997), no

significant difference in amount of communication between traditional and virtual teams (Weisband, 1992; Jarverpaa et al., 1998), as well as a positive effect of technology mediation on information sharing (Jessup & Tansik, 1991). The literature is also divided in terms of how virtual teams differ from traditional teams in regards to the relative importance of task- versus relationship-based processes. Previous studies have found that virtual teams tend to be more task-focused than face-to-face teams (Hiltz et al., 1986; Lebie, Rhoades, & McGrath, 1996). Other studies have found no significant differences between virtual and traditional teams on the emphasis placed on either type of process communications (Walther, 1995; Bordia, DiFonzo, & Chang, 1999). In this vein, Hentonnen & Blomqvist (2005) used a mixed methods technique to investigate how communications technology supported virtual team performance for a global telecommunications company. The authors found that technology usage positively influenced several team processes, including information sharing and storage (task-focused), as well as relational communication (relationship-focused).

Two streams of thought can be used to help interpret these conflicting results. First, researchers have posited that technology-mediated communication can help facilitate team member participation in a number of ways. One method is through providing opportunities for multiple individuals to participate concurrently, thus removing the blocking (i.e., “everyone can’t talk at once”) barrier inherent in face-to-face group interactions. Another is through the removal of social barriers – individuals may be more apt to freely participate virtually, given the lack of immediate physical and non-verbal feedback and potential for social pressure or ridicule from other group members. Thus, for circumstances where teams are large in number or include individuals that are reluctant to participate in a traditional, face-to-face discussion, the use of technology-mediated communication media may provide benefits over traditional means both in terms of overall levels of communication as well as team performance.

Nevertheless, as might be expected given the lack of consistency in results regarding team processes, the results of studies which attempted to compare face-to-face and virtual teams in terms of quality of performance have also showed a lack of convergence. Several studies found an advantage for face-to-face teams over virtual teams (Andres, 2002; Straus & McGrath, 1994), while others found the opposite to be true (Yang & Jin, 2008; Nan, Johnston, & Olsen, 2008; Jarvenpaa, Knoll, & Leidner, 1998; Schmidt, Montoya-Weiss, & Massey, 2001). In some cases, the results were inconclusive (Whitman, Malzahn, Chaparro, Russell et al., 2005; Potter & Balthazard, 2002). Further complicating matters is the consistent, yet limited, finding that combining face-to-face communication with technology-mediated communication yields positive results for virtual teams (Hill, Bartol, Tesluk, & Langa, 2009; Kirkman et al., 2002; Duarte & Snyder, 2001; Lipnack & Stamps, 2000). Meanwhile, Siebdrat, Hoegl, & Ernst (2009) looked at 80 global software development teams and measured the level of task and "socio-emotional" (i.e., interpersonal) processes embedded within each team. Based on manager reports of team performance and team-reported process data, the authors found that task-related processes were the most crucial for virtual team success. The authors also found that the interaction of task process level and dispersion was such that the strongest results were for highly dispersed teams with high levels of task processes. The manuscript is quick to note that the lowest performance (by a wide margin) were also teams with high levels of dispersion, but low task process levels. Hoegl et al. (2007) also found that as level of dispersion in teams increased, the variance in performance also increased – as with the Siebdrat et al. (2004) study, the highest performance levels were attained by low proximity (i.e., high virtuality) teams. Hence, high levels of dispersion seem to imply a risk/reward scenario, where teams that feature high level of virtuality have the potential to do extraordinary work, as well as the potential to fail miserably. Still, another view is needed to help make sense of these findings.

One such view in the literature is more generalist in nature, and relates to the given context for virtual work to be performed – namely, that media richness should align with the type of work to be undertaken (Maruping & Agarwal, 2004). The results of the Rico & Cohen (2005) study support this position, as they found that matching communication synchronicity with task interdependence resulted in higher team performance. Similarly, Pauleen (2003) provides an extensive case study of a global virtual team that supports these notions from the perspective of communication media choice. He found that individuals more often used face-to-face communication for a number of relationship-focused activities, including conflict management and dialoguing on key issues. Use of less rich media (telephone, email) was more often focused on task-related activities – crisis management, status updates, and documentation. Thus, the study provides some evidence that practitioners will tend to gravitate towards communication media that are most appropriate for the type of messaging (relationship versus task) that needs to occur. Nevertheless, while these trends may exist, they are also not "perfect"; in other words, individuals do not always choose the optimal communication media for a given task. This may occur for a variety of reasons, including availability of media, personal comfort level with a particular medium (Carlson & Zmud, 1999), time constraints, and so on. Thus, while the Pauleen (2003) study does demonstrate that practitioners may on occasion shift between communication media depending on the type of activity, the study also provides evidence that media selection is not perfect in practice.

In summary, it appears that there is an interactive effect between communication media richness and task type that may be important to recognize when considering the potential combined impact of these two variables on team performance. For the current study, technology-mediated communication will be held constant across all experimental conditions, in the form of electronic text-based chat. Therefore, participants will not have the opportunity to move between lower and higher media richness sources when

communicating with non-collocated team members. Likewise, the task type will also be the same for all experimental teams, which will focus on the need for collaborative decision making for teams to be successful.

Taken in combination – a moderately rich medium for distributed communications, and a task which will require intensive collaboration among team members – two issues seem to arise for teams as their level of virtuality increases. First, team members will be limited in their communication media options – per Pauleen (2003), as a moderately rich medium, chat may not be ideal for either task- or relationship-related communications, which could summarily impact performance for high virtuality teams. Second, because a greater proportion of communications will be routed through the chat forum as team virtuality increases, it is plausible that this will cause high virtuality team participants to take longer to make decisions and complete the task (Graetz et al., 1998; Straus & McGrath, 1996). Relatedly, Mesmer-Magnus and DeChurch (2009) found that the effectiveness of information sharing was strongly related to team performance. Thus, teams that are forced to rely more heavily on communication media that are less suited for the type of information sharing required by the task will be at a disadvantage relative to teams that are more able to utilize face-to-face communication. Hence, Hypothesis 2 postulates that team virtuality will have a negative relationship with team performance, given these two important conditions:

> *Hypothesis 2: Level of team virtuality (via differences in configuration) will have a negative relationship with objective team performance. Teams with a greater proportion of non-collocated dyadic relationships will have lower objective team performance when compared to teams with a lesser proportion of non-collocated dyadic relationships.*

Having reviewed the team-level (Level 3) relationships that are proposed in the theoretical model for this study, I will now move to the individual level of analysis (Level

2), with the focus on understanding the processes associated with leadership emergence in self-managed virtual teams. However, before providing the rationale behind the individual relationships that are predicted in the model, a brief discussion of three theories is necessary to provide an overarching framework for the remainder of the model. First, the IMOI model of team processes (Ilgen et al., 2005) will be described, which forms the basis for the overall structure of the model. Second, attribution theory and the interpersonal attribution model (Gilbert & Malone, 1995) will follow, which helps to explain the processes that take place in the formation of perceptions. Finally, two theories in the area of communication – media richness theory (Daft & Lengel, 1984) and media synchronicity theory (Dennis & Valacich, 1999; Dennis, Fuller, & Valacich, 2008) – will be introduced. These theories underscore the importance of communication in the virtual team context, and help set the stage for the proposed relationships between communication-related behaviors/attributes and external perceptions that are central to the overall model.

Level 2: Individual-Level Relationships and Hypotheses

IMOI Model. Stemming from the work of Steiner (1972), McGrath (1984), Cohen & Bailey (1997), and Marks et al. (2001), Ilgen and colleagues (2005) presented a new framework for understanding the mechanisms of team functioning, which they labeled the IMOI model (representing a circular process of inputs, mediators, and outputs, back to inputs). The most striking change in the model as compared to previous team-related frameworks is the switch from "processes" (P) to "mediators" (M) in the center of the model. Ilgen et al. (2005) propose that the mediating variables between team inputs (e.g., task design, group composition/attributes, and organizational context) and outcomes (e.g., performance, satisfaction, viability, and turnover) go beyond the simple category of "processes" (e.g. conflict, communication). Cohen & Bailey (1997) introduced the idea of group-level psychosocial traits as a secondary mediator between

inputs and outcomes. Later, Marks et al. (2001: 357) coined the term "emergent states" to represent "properties of the team that are dynamic in nature and vary as a function of team context, inputs, processes, and outcomes". Simply put, Ilgen et al. (2005) have recapitulated what previous scholars tried to do in broadening the definition of "processes" to "mediators" to include several other activities that take place after teams are formed that impact their eventual success or failure.

It is important to note that the current study does not attempt to encompass the entire IMOI model – rather, the major focus of the study is to better understand the "black box" of mediating variables as it relates to emergent leadership, and subsequent impact on team performance. While the IMOI model is typically used at the team level of analysis, I have applied this at the individual level of analysis, as my focus here relates to understanding how individuals behave/are perceived within a team-based environment. Beyond this, two differences between the IMOI model and the theoretical model of this study are evident. First, inputs are not included as part of the theoretical model of this study, in the hopes of maintaining sufficient parsimony and power in testing the focal mediating variables of the model. In line with this limitation, the circular pattern that is implied by the IMOI model (i.e., outcomes impacting inputs as time progresses) is also not captured in the current study's model. The lack of a longitudinal design makes it impossible to test this idea within the confines of this study. Thus, the proposed theoretical model focuses on mediators and outcomes in virtual teams.

Attribution Theory. One theory which provides insight into the "black box" of mediators in team processes is attribution theory. The concept of attribution is defined as "the process by which people make inferences about the causes of events" (Cramton, Orvis, & Wilson, 2007: 526). Gilbert & Malone (1995) developed a theoretical model that helps to explain the interpersonal attribution process – their model is replicated in Figure 2.1. In short, individuals (with their inherent prior beliefs, values, and experiences) perceive a situation and form behavioral expectations of others for that

situation. When others' behavior is subsequently observed, individuals make a dispositional attribution about others, based on the observed behavior. If others' behavior "fits" with expectations, attributions are corrected from a dispositional attribution to a situational one (Lupfer, Clark, & Hutcherson, 1990; Winter & Uleman, 1984, 1986). On the other hand, if others' behavior does not fit with expectations, the dispositional attribution remains in place.

The implications of this model are important within the context of virtual teams. Individuals in virtual teams may lack information on the "situations" of others – be it physical/environmental, social, or work-related (i.e., other work demands). Previous research has shown that members of distributed work groups lack awareness, or "mutual knowledge", of their teammates' work environments and activities (Bellotti & Bly, 1996; Cramton, 2001). Likewise, due to "situation invisibility", individuals may succumb to a false consensus effect, whereby they make inaccurate assumptions about others based on selective memories and insufficient current data (Ross, 1977). Computer-mediated communication – a foundation of virtual team operations – is another area which can cause error in the attribution process, as the filtering effect of mediated communication methods can lead to reduced social cues and increased transmission errors. Thus, virtual teams create an environment whereby inaccurate perceptions of both situations and behavior are likely, leading to individuals having a higher propensity to make negative dispositional inferences about fellow teammates as compared to traditional (face-to-face) teams. Outside of the virtual realm, this notion that people generally favor dispositional explanations over situational ones has been established in the psychological literature (Gilbert, Pelham, & Krull, 1988; Tetlock, 1985), although the nomenclature is somewhat varied. Researchers have described this phenomenon as "fundamental attribution error", "correspondence bias", and the "overattribution effect". While there are fine-grained differences between the underlying models, the basis for each of these terms is generally

the same: given a lack of contextual information, individuals are more likely to attribute the behaviors of others to dispositional factors rather than situational factors.

Based on this notion, Cramton et al. (2007) utilized a 2x2 experimental design of dyadic teams (with each team consisting of a participant and a confederate) competing in a "Jeopardy"-style activity. The two conditions were collocation (teammates were either in the same room or physically separated), and situational visibility (participants were provided with an answer booklet for the activity, and were either informed or not informed about the fact that their partner/confederate did not have an answer booklet). The activity was designed in such a way that it was impossible for teams to "succeed" in the activity – post hoc surveys were employed to gauge the type (dispositional vs. situational) and level of attributions made by participants. Results showed that participants in the distributed/not-informed condition had much higher dispositional attributions about their partner than the other three conditions, as well as significantly lower satisfaction and cohesion scores.

While one may be apt to conclude that collocated teams have significant advantages over distributed teams because of the lower potential for errors in attribution, several other experimental studies have found non-significant differences in performance between collocated and virtual teams in a variety of activities and contexts (e.g., Finn, Sellen, & Wilbur, 1997; Burke, Aytes, Chidambaram, & Johnson, 1999; Burke & Chidambaram, 1999; Burgoon, Bonito, Ramirez, et al., 2002; Panteli & Davison, 2005). One explanation for this conundrum has been offered by Nan, Johnston, & Olsen (2008), who utilized a laboratory study and computer simulation to test propositions related to in-group favoritism and scarce resources. The authors propose that delays caused by computer-mediated communication help virtual teams to counteract potential in-group favoritism, which allows virtual teams to better access and integrate scarce resources – this, in turn, counterbalances the advantage of rich, face-to-face communication enjoyed

in collocated teams, resulting in similar performance levels across collocated and distributed team conditions.

Finally, a recent dissertation (Heuser, 2009) looked at the effects of configuration and communication media in four-person student teams. In her experiment, the author used two configurations ("fully distributed" – team members each at a unique location, and "partially distributed" – two members at one location, with the other two members each at unique locations). This manipulation was combined with a second manipulation on communication media made available to participants (voice-only, versus both audio and video communication). The results of the experiment showed that the collocation manipulation did not have any significant effects on the study's focal process variables of team communication, information sharing, or conflict. However, communication medium did have a significant effect on information sharing, as teams utilizing the richer communication medium had higher levels of information sharing than the voice-only condition teams.

Media Richness/Synchronicity Theory. While the relationship between collocation/configuration and performance in virtual teams seems uncertain, a second research stream may help to shed light on these inconsistent findings: communication media. Multiple theories on communication media are relevant to the study of virtual teams. One of the most prominent theories in the area of communication media is media richness theory (Daft & Lengel, 1984). The central premise of the theory is quite simple – namely, that different types of communication media will have varying levels of "richness", defined as the capacity of a communication medium to facilitate shared meaning and understanding (Daft & Lengel, 1984; Daft, Lengel, & Trevino, 1987). For task performance to be maximized within a team, the communication media used should match the complexity of the task itself. For example, if a given task is unique, requires significant exchange of information, and has emotional connotations for the actors

involved, media richness theory would propose that a communication higher in richness is necessary for successful performance.

One specific aspect of the structure of team tasks that is important to communication media selection is the level of interdependence. Rico & Cohen (2005) found in their experimental study that teams that matched the level of communication synchronicity to the level of task interdependence (i.e., low task interdependence → asynchronous communication medium) had the strongest performance. As such, four criteria are used to measure the richness of a communication medium: 1) feedback – ability and timeliness; 2) multiple cues – the availability of verbal, non-verbal, and physical cues in the transmission and receipt of a message; 3) language variety – "range of meaning that can be conveyed with language symbols" (Daft et al., 1987: 358); and 4) personal focus – the ability to use emotions and feelings in communication (Daft et al., 1987; Panteli & Dawson, 2001). Face-to-face communication is generally accepted as the medium with the highest level of richness, whereas impersonal written communications are generally considered the least rich of potential media choices. A hierarchy of modern-day communication media alternatives is provided in Table 2.2.

A second theory, media synchronicity theory (Dennis & Valacich, 1999; Dennis, Fuller, & Valacich, 2008), emerged from critical reviews and tepid empirical support for media richness theory. Dennis and colleagues argue that the fit of media capabilities to the communication needs of the task influences the choice of media, which in turn influences communication performance. The difference between the two theories is subtle, yet important. Media richness theory was developed to help predict which media should be most effective for a given task; media synchronicity theory focuses on the fit between media and the *communication needs* of a task, not the task itself. As such, media synchronicity theory incorporates the inherent flexibility of both the attributes of modern communication tools and the communication needs for a given task over time. For example, modern collaboration software can allow for several levels of richness

simultaneously, ranging from moderately low text-based chat functions, to integrated videoconferencing with document sharing in real-time, which some have argued is perhaps higher in richness than face-to-face communication (van der Kleij, 2007). Nevertheless, the key principle in media synchronicity theory is that of fit – selecting the best medium or set of media to match the individual, social, and task-related contexts at a given point in time.

Thus, if the continuum of media richness is secondary to understanding the fit characteristics of communication media and tasks, a linkage of communication characteristics to several common communication media is in order. Table 2.3 provides a listing of communication options and characteristics for virtual teams, derived from a number of sources (Clark & Brennan, 1991; Driskell, Radtke, & Salas, 2003; Priest, Stagl, Klein, & Salas, 2006; van der Kleij, 2007). In this hierarchy, eight characteristics of communication are analyzed from the perspective of several commonplace communication media. Definitions of the eight criteria are as follows:

- Co-presence – team members are situated at the same physical location
- Visibility – team members are visible to one another
- Audibility – team members can hear one another
- Contemporality – there is little to no lag time between message transmission and receipt
- Simultaneity – messages can be sent and received by group members at the same time
- Sequentiality – team members' speaking/messaging turns stay in sequence
- Reviewability – messages can be reviewed by team members
- Revisability – messages can be revised by team members

It is worth noting that the continued advancement of collaboration software may have a profound effect on the functioning of virtual teams in the very near future.

Obviously, one major difference between collaboration software and face-to-face communication is the area of co-presence. While technology is advancing towards lessening the perceived physical gap between meeting face-to-face and meeting "virtually" (i.e., the development of holographic images and virtual worlds that provide common "physical" environments to users), it is still the stuff of science fiction for everyday workers. But some advantages that collaborative software does provide now relative to face-to-face communication are reviewability and revisability. Collaboration software provides the opportunity to not only have synchronous voice and image communications with others, but also to share, revise, and produce data, while maintaining a "log" of all activity. This last facet of collaborative software may actually make virtual teams *more* effective than traditional ones, all other things being equal. Continued research in this area, as technology continues to advance, will be needed.

Related to the previous discussion is the fundamental tenet of many communication theories that technology-mediated communication will encompass less social information (or "social context cues"; Sproull & Kiesler, 1986) as compared to face-to-face communication. This, in turn, is hypothesized to impact the speed and quality of the development of interpersonal relationships, as team members feel more anonymous and become more introspective (Kiesler, Siegel, & McGuire, 1984). In turn, interactions between team members become increasingly depersonalized, and relationships that develop in these contexts feature lower cohesion and adherence to social conventions (Kiesler, Zubrow, Moses, & Geller, 1985). Likewise, harkening back to the previous discussion on fundamental attribution error, Gilbert et al. (1988) detailed the three-step process through which individuals form explanations of others' behavior: categorization (i.e., identifying actions), characterization (i.e. making inferences about the actor based on the actions viewed), and correction (i.e., adjusting inferences based on situational or contextual information). It is this last step in the process – correction – that causes technology-mediated communication (particularly in low richness media) to have

the potential for substantially higher rates of fundamental attribution error as compared to face-to-face communication.

In summary, prior research has established the importance of communication media choice in virtual teams, both from theoretical and empirical perspectives. For virtual teams that rely on technology-mediated communication methods to interact with dispersed team members, two things are clear. First, there are stark differences between types of media (e.g., fax versus video teleconference) across a number of dimensions (again, see Table 2.2), and second, media choice can have a significant impact on multiple team-related outcomes. For the purposes of this study, the selection of a communication medium for use in the experiment was based on two factors. First, it is important that the communication medium provide enough general capabilities for communicating that the timely completion of the task is enabled. For this study, given the relatively short time frame for completion and the need for real-time interaction between participants, a synchronous communication medium is necessary. Thus, any media choice in Table 2.1 above "instant messaging/chat" should allow for virtual team members to collaborate and complete the task without undue strain stemming from limitations of the communication medium. Second, while advances in technology and decreases in the associated costs are changing the status quo of virtual team communication by providing greater accessibility to media with higher richness, media lower in richness are still commonplace in virtual team operations. The communication media most frequently used by virtual teams are email and instant messaging/text-based chat (Hollis, 2005; Penttila, 2005). And while recent reports (Kelly, 2010) have found that use of text-based chat through instant messaging platforms is declining, this general type of communication is still happening (and perhaps expanding) through social network sites and mobile devices. Likewise, in 2010, there were an estimated 2.9 billion email accounts and 2.4 billion instant messaging accounts worldwide (Radicati, 2010). Therefore, the use of low-to-moderate richness media in the workplace is still quite

prominent, and thus seems appropriate for a laboratory setting that is attempting to mirror a real-world scenario. Given these two factors, it seemed most appropriate to select a text-based chat function as the communication medium for this study.

Integration with the proposed model. Returning to the proposed theoretical model in Figure 1.1, there are several ways in which the three sets of theories previously discussed have informed the development of this model, particularly at the individual (Level 2) level. At a rudimentary level, the IMOI model provides an overall framework for how teams form, function, and produce work. Thus, given this outline of team processes, the understanding of how teams function can summarily be applied to the individual (team member) level, in terms of how these processes shape behaviors and processes at this lower level. The previously-described theories on communications underscore the overall importance of communication in a team setting. This is particularly salient for the current study, given the strong interactive effects of media selection, task type, and virtuality. Finally, attribution theory helps to tie together facets of the IMOI model and communication theories as they relate to leadership emergence in self-managing virtual teams. As demonstrated in the proposed model, individual team members provide input to the team via their communications with other team members, which in turn spark a series of processes throughout the team as a whole, both from an operational perspective (leading to team performance) and a cognitive/emotional perspective (leading to the development of various perceptions amongst team members). It is this intrapersonal perspective – how individual make attributions about others in a virtual team environment – that is central to the model and our understanding of leadership emergence as a whole.

Continuing with the central premises of attribution theory, there is often scant information at the disposal of members of newly-formed virtual teams in regards to their colleagues. However, it is likely that individuals would have preconceived expectations of certain behaviors in a virtual team environment, particularly in and around how team

members should communicate with one another, regardless of the level of other information that is available about their peers. In other words, individuals have certain standards and expectations regarding communication that can be applied and used to make inferences about others in a very short amount of time – in the case of newly-formed virtual teams, this is perhaps the strongest source of outside information that is readily available to individuals about their teammates. In short, this is the central reason behind the inclusion of communication-related antecedents in the proposed model.

However, one may argue that the link between communication-related behaviors and perceptions of leadership is direct – an individual may view the behaviors of others and summarily make a dispositional assessment of the external's leadership ability based on this perceptual interpretation. However, the concept of leadership is complex (Connaughton, Lawrence, & Ruben, 2003); as such, it stands to reason that dispositional inferences regarding leadership take time to unfold. In turn, there is the potential for intermediary steps in the process from behavioral recognition to reaching perceptual conclusions on the leadership abilities of others. Along these lines, two other perceptual constructs that have been found to correlate strongly with leadership are trust and general mental ability. The proposed theoretical model asserts that perceptions of others on these facets will serve as a mediating link between the communication-related behavior exhibited by team members and the subsequent appraisal of their leadership ability by their teammates.

Thus, the next section provides an overview of research in these areas and the rationale behind why these two perceptual constructs should relate to perceptions of emergent leadership. While the concept of emergent leadership was defined earlier in this chapter, I will begin the next section with a discussion of the literature surrounding leader emergence, with a particular focus on the virtual team arena.

Emergent Leadership

As mentioned previously, Morgeson et al. (2010) propose a taxonomy of leadership sources, based on a 2x2 matrix of team leadership criteria (formal vs. informal leadership positions, and internal vs. external locus of leadership). Under this structure, emergent leadership and shared leadership are categorized as informal/internal sources of leadership – both of these are common leadership structures of self-managing and virtual work teams in practice. According to Carson et al. (2007), this is due to several factors, including the high level of complexity and ambiguity that is often found in virtual teams, the emphasis on knowledge-based work, and the flatter organizational structures that tend to house these types of teams. Based on their review of the literature, Morgeson et al. (2010) also propose that different leadership functions have varying degrees of importance or effectiveness, depending on the source of leadership (see Table 2.4). While their analysis was limited to task-related functions, some insights can be garnered that are relevant to this study. In the transition/planning phase, the authors found that functions that are most relevant to teams that feature emergent leadership include planning/structuring of work, feedback, mission definition, and establishment of goals and expectations. During the action/execution phase, high relevance functions for emergent leaders include actual task performance, problem solving, social support, and monitoring of team performance. In an earlier effort, Pavitt (1999) finds similar patterns in the emphasis on task- and process-related communication content in leadership emergence, including such categories as “problem-proposing” and “information-seeking” (Crockett, 1955), “guiding the discussion” (Bales & Slater, 1955), procedural specialization (Ketrow, 1991), and “problem analysis” and “evaluation” (Hawkins, 1995).

While the Morgeson et al. (2010) and the Pavitt (1999) articles focus on the types of functional behaviors and communications that are most strongly related to leadership emergence in a variety of contexts, other researchers have looked at “structural aspects”

of communication – e.g., grammar, vocabulary, sentence structure, verb usage. Along these lines, one basic question that has been examined extensively by researchers is "Do emergent leaders simply communicate more?" In short, yes. Two meta-analyses from the 1980's (Mullen, Salas, & Driskell, 1989; Stein & Heller, 1983) show that the relationship between verbal participation rates and leadership is quite strong in traditional environments (ρs ranged from .5 to .7). Thus, one may conclude that the role of communication in leadership emergence in general encompasses both quantitative and qualitative aspects. Within the context of virtual teams, a number of scholars have looked at the relationship between emergent leadership and both structural and content-related aspects of communication.

One of the most prominent studies in this area (Yoo & Alavi, 2004) performed a multi-method analysis of email messages sent between seven teams of senior executives at a federal government agency. The researchers found that emergent leaders in general sent more and longer email messages than their counterparts, and that significant differences between the two groups existed in terms of the total number of task-related messages, as well as the number of messages related to logistical coordination. From a qualitative perspective, the authors noted that three roles seemed to be highly relevant to how leaders emerged within their sample: *initiator* ("first mover" to communicate a task-structuring message), *scheduler* (coordinating the work/meeting schedule of the project team), and *integrator* (taking responsibility to combine and integrate the work of others on the team for delivery of final work products). Hence, these studies corroborate the findings of Morgeson et al. (2010) and Pavitt (1999) related to the importance of both communication quantity and quality for leadership emergence.

The relationship between communication-related constructs and other forms of perception beyond emergent leadership has been studied to some extent in the virtual teams literature as well. Tyran, Tyran, & Shepherd (2003) found that emergent leaders in virtual teams not only communicate more, but also are perceived as highly trustworthy in

terms of their individual role performance, and are perceived as transformational leaders. Wolff, Pescosolido, & Druskat (2002) found that a component of emotional intelligence – empathy – was positively related to leader emergence, while its effects were partially mediated through a communication-related measure of task coordination. Sarker, Grewal, & Sarker (2002) found that communication ability and perceptions of trust and performance quality were predictors of emergent leadership in the early stages of a longitudinal experiment with virtual student teams. Adams (2009) found that, across various types of communication media, both objective and perceptual measures of discussion contribution (i.e., communication quantity) were positively related to leadership emergence, with a particular emphasis on task-related communication. Also, the author found evidence of partial mediation between objective measures of communication quantity and leadership emergence through perceptions of discussion contribution levels. Finally, Wickham & Walther (2007) developed an experiment using both assigned and emergent leaders in student teams, and found that in both cases, leaders were perceived as having higher amounts of communication and intelligence.

From this overview of communication-related emergent leadership studies in the virtual team environment, several themes can be derived. First, both the overall quality and quantity of communication provided by an individual in a virtual team environment appears to have a positive impact on their emergence as a leader. Second, the level of individual task-focused communication clearly has an influence on emergent leadership on virtual team members – several studies point to the importance of communication related to the "what" and "how" of team tasks in determining who emerges as a leader. Finally, team member perceptions appear to play an important role in leadership emergence, and many of these perceptions have been found to mediate the relationship between communication-related constructs and emergent leadership.

To this last point, one final emergent leadership study is important in regards to the current study as well. Balthazard and colleagues (2009) investigated the effects of

structural aspects of communication on leader emergence in virtual teams, and beyond the well-established relationship between communication frequency and leadership emergence, the authors also found a significant effect for a measure of grammatical complexity. While it is duly noted that the focus of the authors' study was to compare the effects of personality on leader emergence between traditional and virtual team contexts, the significant effects of communication frequency and grammatical complexity on leader emergence were not fully explored from a theoretical perspective. Based on the evidence already presented, it is clear that both the structural and content-related aspects of communication are important factors in virtual team leadership emergence. However, the mediating role of perceptions is potentially a major missing link between these two areas, which the current study hopes to address.

Mediating Perceptions: Trust and General Mental Ability

Trust. Trust can be considered as a "tension" between risk (the potential for negative outcomes) and reliance (the need for assistance from others), and has been defined as "confident positive expectations about the conduct of another" (Wilson, Straus, & McEvily, 2006: 18). Along similar lines, Mayer et al. (1995:712) defined trust as "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party." It has also been argued that trust is the most important component of team development and effectiveness (Jarvenpaa et al., 1998). But finding commonality on how to best characterize and measure trust has been somewhat more difficult. In their theoretical piece on organizational trust based on the earlier work of Blau (1964), Mayer et al. (1995) proposed that three factors are antecedents to the development of trust: perceptions of a referent others' ability, integrity, and benevolence. In their model, initial trust attributions develop as a function of perceptions in these three areas, moderated by an

individual's propensity to trust others in general. As time passes and further information is provided through experiential outcomes, individual perceptions of trust may change significantly, through alterations in the perceived trust factors listed previously. While the model does not specify a particular level of analysis, empirical evidence has largely been supportive of the model at the individual, team, and organizational levels of analysis (Schoorman, Mayer, & Davis, 2007).

Beyond the one-dimensional model of trust that was set forth by Mayer et al. (1995), interpersonal trust has also been proposed as a multi-dimensional construct in terms of having both cognitive- and affective-based forms of trust (McAllister, 1995). Cognitive-based trust is predicated on the notion that individuals choose whom they will trust under certain circumstances and criteria, based on what are taken to be "good reasons" for evidence of the existence of a trusting relationship (Lewis & Weingart, 1985). Affective-based trust, on the other hand, stems from emotional bonds, investment, and reciprocation between two individuals (Lewis & Weingart, 1985; McAllister, 1995). While researchers have largely utilized the three factor/single dimension view of trust in their empirical studies (Dirks & Ferrin, 2002), attempts to capture a multidimensional view of trust have been somewhat unsuccessful (Dirks, 1999; Ferrin & Dirks, 2003). However, Webber (2008) criticized the commonplace use of student teams for short periods of time in the experiments conducted by Dirks and colleagues, and proposed that the multidimensional aspect of trust requires time to unfold. She found support for this notion in a longitudinal experimental design – in her sample, early trust levels were found to be one-dimensional, but the cognitive-based and affective-based dimensions of trust emerged over time. In later time periods, affective trust had a differentially stronger impact on team performance than cognitive trust (although both were moderately positive).

While researchers have struggled to agree on the best means to measure and view the concept of "trust" in teams, one definitive conclusion can be reached: trust is

important. Given that most teams have some level of interdependence and reliance on one another to accomplish team goals, it is crucial that teams be able to either trust each other or be able to monitor one another's work (Ouchi, 1981; Wilson et al., 2006). In face-to-face work settings, teams lacking in trust have been found to expend additional time and effort in inefficient work processes (Ashforth & Lee, 1990), resulting in lost productivity (McAllister, 1995), a lack of information sharing and ability to effectively solve problems (Zucker, Darby, Brewer, & Peng, 1996), and lower satisfaction levels (Golembiewski & McConkie, 1975). Similarly, researchers have found considerable support for the critical role of trust in the development of effective work team processes and the successful performance of the team in virtual settings as well (Kirkman, Rosen, Tesluk, & Gibson, 2006; Polzner, Crisp, Jarvenpaa, & Kim, 2006; Webber, 2008).

While traditional work settings may provide an avenue for team members to monitor and counteract the negative influence of a lack of trust, the virtual work environment makes this nearly impossible, thus reinforcing the criticality of trust for the success of virtual teams. Interestingly, the need for trust – both from an individual leadership emergence and a team performance perspective – is found even in newly-formed virtual teams, where individuals may have little to no information on which to base trust decisions (Meyerson, Weick, & Kramer, 1996). Prior research has shown that trust can emerge quickly in virtual teams, although it can just as quickly dissipate as well (Jarvenpaa et al., 1998; Jarvenpaa & Leidner, 1999). Combined with the prior finding that the effects of transformational leadership on performance are at least partially, if not fully, mediated through trust (Jung & Avolio, 2000; Podsakoff, Mackenzie, Moorman, & Fetter, 1990), and it becomes clear that trust likely plays an important role in leadership emergence in virtual teams as well.

In fact, trust has maintained a position of prominence in several virtual team studies in regards to understanding how leaders emerge. Sarker et al. (2002) used a longitudinal design to analyze global virtual student teams over the course of a semester,

and found that interpersonal trust was a significant predictor of emergent leadership, particularly during the initial phases of team development. Jarvenpaa & Leidner (1999) found that successful teams used various general and communication-related behaviors throughout the life cycle of the project to help facilitate and maintain trust, including what they termed "positive leadership". Tyran et al. (2003) found that leadership rankings in their field sample of thirteen teams were positively related to various dimensions of trust (derived from both McAllister, 1995 and Mayer et al., 1995), including role performance, altruism, and affective trust. Finally, Hoyt & Blascovich (2003) found that the four factors of transformational leadership (Bass, 1985) were found to have moderate-to-strong positive correlations with perceptions of trust in a team's leader in a controlled experiment. Thus, given that these results generalize across both laboratory and field settings, as well as short-term and longer-term tenures for the teams that were analyzed, I expect that perceptions of trust should maintain a significant positive relationship with emergent leadership, as captured in Hypothesis 3:

> *Hypothesis 3: Peer perceptions of an individual's trust will be positively related to the peer's perception of the individual's level of emergent leadership.*

As a footnote to the previous discussion, it is important to distinguish between two terms which are obviously related: trust and trustworthiness. Trustworthiness is a perceptual variable that, according to Mayer and colleagues (1995), is comprised of three factors – ability, benevolence, and integrity. The focus of the perception is squarely on the "other", and constitutes a global characterization of an individual by another. Trust, which is the focus of Hypothesis 3 and ensuing hypotheses, is centered on the *relationship* between two individuals. An individual's perception of whether or not trust exists between themselves and another individual could potentially derive from several sources, including perceptions of others' trustworthiness, self-perceptions, the prior history of interactions, contextual factors, and perhaps still others. Thus, while

trustworthiness can be considered as an input into the development of trust, the terms are not synonymous with one another.

General Mental Ability (GMA). Intelligence (also known as cognitive ability or general mental ability) has been defined as the "ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, to overcome obstacles by taking thought" (Neisser et al., 1996: 77; Borghans, Duckworth, Heckman, & ter Weel, 1998). While GMA is sometimes used synonymously with these terms, GMA specifically relates to the single first-order factor that has been found in numerous studies focused on discerning the structure of intelligence in human beings, beginning with Spearman (1904) and continuing throughout the 20th century (see Jensen, 1998; Brody, 1992 for reviews of this literature). Nevertheless, GMA generally refers to an individual's ability to process information, reason, learn, and problem solve.

The relationship between GMA and leadership has also been studied for the better part of a century. The Judge, Colbert, & Ilies (2004) meta-analysis provided a comprehensive look at the relationship between the two areas, and showed that the relationship between the constructs of intelligence and leadership is moderately low (ρ = .21, when corrected for unreliability in the predictor and criterion; ρ = .27, when a correction for range restriction is included). Comparable results were found for the relationships between objective measures of intelligence and perceptions of emergent leadership, perceptions of leadership effectiveness, and objective measures of leader effectiveness (corrected correlations ranged from .15 - .33, with all but one below .26). But the finding in the Judge et al (2004) meta-analysis that is most relevant to this study is that the relationship between *perceptions* of intelligence and leadership is quite strong (ρ = .60, uncorrected for range restriction; ρ = .65, corrected for range restriction). Thus, it seems that for leaders, appearing smart to others is more important than actually being smart in regards to leadership emergence.

Nevertheless, research in this area is quite scarce – only nine studies were available for inclusion in the Judge et al. (2004) meta-analysis, the most recent of which was by Rubin and colleagues (2002). In their study, the authors proposed that the effects of GMA and self-monitoring on emergent leadership would be mediated through perceptions of intellectual competence. Through the use of undergraduate business students in an assessment center-type activity, their model was largely confirmed. The effects of self-monitoring on leadership emergence were fully mediated through perceived intellectual competence, while the effects of GMA on leadership emergence were partially mediated through perceived intellectual competence, thus leading credence to the idea of perceptions of GMA mediating the effects of antecedent variables in determining emergent leadership.

While research on the relationship between perceptions of GMA and leadership has been somewhat limited in the general management literature, very little research in this regard has been compiled in the virtual teams arena. One study that did look at this relationship was Wickham & Walther (2007), who developed an experiment using both assigned and emergent leaders in student teams, and found that in both cases, leaders were perceived as having higher intelligence. However, the results of the Judge et al. (2004) meta-analysis provide considerable support for the notion of a perceptual intelligence → leadership linkage in teams, regardless of context. I expect that, given the cognitive requirements of the team exercises, individuals who emerge as leaders will also be perceived by their teammates as having the necessary intellectual skills to fulfill that role for these tasks. Hence, Hypothesis 4 summarizes this position as written below.

Hypothesis 4: Perceptions of an individual's general mental ability will be positively related to perceptions of leadership emergence.

As demonstrated in Hypotheses 3 and 4, several previous studies have found significant relationships between perceptions of trust and GMA with emergent

leadership, which in turn have been hypothesized to serve as proximal predictors of emergent leadership in this study. Trust and GMA perceptions are also predicted to act as mediators between leadership emergence and the initial set of variables in the theoretical model in Figure 1.1: communication-related behaviors. In the next section, I will provide the rationale for the relationships between various communicative behaviors in virtual teams and how they are translated into perceptions of trust and GMA.

The Impact of Communication on Interpersonal Perceptions

Communication can be viewed in many forms. One perspective focuses on *content*, which relates to the subject matter and information contained within the communication itself. This perspective ignores all aspects of communication that are not related specifically to the message being relayed. A second perspective considers the characteristics of the *sender* – namely, voice inflection and non-verbal communication. In a now famous study, Mehrabian (1971) showed that in circumstances where feelings and emotions are being communicated and the message, tone of voice, and body language are not consistent, receivers are much more likely to trust the non-content related aspects of communication. While these findings have been perhaps misinterpreted over time, it is clear that the actual results of the Mehrabian (1971) study demonstrate that message content and delivery are two distinct concepts within the overall realm of communications. However, there is a third area of communications that is pertinent to the current study – *structure*. Communications structure is considered to be independent from message content, personal attributes of the sender, and the communication medium used by the sender. Instead, aspects of communication structure focus on how messages are constructed – in other words, the "mechanics" of language and communication. Examples of communications structure include grammar and sentence structure, the use of idioms, slang, and colloquial speech, as well as the concept

of time in regards to how it can influence the flow and effectiveness of communication between individuals.

The first and third perspectives on communication – content and structure – are the focus of this study for several reasons. From an overall perspective, communications are a critical part of the functioning and performance of any team, regardless of the level of virtuality or the communication media used within the team's daily operations. But as discussed previously in this paper, communications are even more vital for virtual teams, as the added complexity that comes with dispersion and technology-mediated communications can create additional barriers to success that are not as prominent in face-to-face team contexts. From the aforementioned dimensional perspective, content and structure are crucial components of effective communication in virtual teams, regardless of the media used. However, the impact of sender characteristics (e.g., voice inflection and body language) can be severely minimized, depending on the communication media used. Given the high rate of use of text-based communications in virtual teams, it is therefore commonplace that technology-mediated communications using these forms of media do not allow for sender characteristics to play a role in these inter-team communications. As the current study utilizes a form of text-based communication (synchronous "chat") in an attempt to mirror a common workplace setting, the importance of sender characteristics in the study and theoretical model are therefore minimized. Hence, the focus in the next section of the paper is on the content and structure of communications, and their proposed relationships with the mediators in the theoretical model: perceptions of trust and intelligence.

Hypothesis 5 proposes that a relationship exists between communication content (task-based communication) and perceived intelligence. In both traditional and virtual contexts, several studies have demonstrated the link between task-related communication and the dependent variable at the individual level of the theoretical model – emergent leadership (Morgeson et al., 2010; Pavitt, 1999; Yoo & Alavi, 2005; Wolff et al., 2002;

Tyran et al., 2003; Adams, 2009). The positive relationship between communication-related aptitudes and intelligence has also been well established (Arvey, 1986; Gottfredson, 1997; Stevens & Campion, 1999; Rode, Mooney, Arthaud-Day, et al., 2007); in fact, verbal ability is a major component of most intelligence tests, including the highly validated Wonderlic family of tests (Wonderlic, 1992). However, the only study within the virtual teams realm that has looked at both communication in any form and intelligence *perceptions* is the aforementioned Wickham & Walther (2007) study. Unfortunately, the direct relationship between the two constructs was not divulged in their report. However, the authors did find that emergent leaders were perceived as being higher in both the quantity of communications and intelligence, implying that a positive relationship between the two constructs existed for their study.

While the communication content → perceived GMA relationship has not been empirically tested previously, it can be logically deduced as to why individuals with higher levels of task-related communication will also be perceived as higher in GMA. Given that task-based communication includes formulating strategy, specifying goals, and monitoring/coordinating progress (Marks et al., 2001), these areas all involve significant cognitive processing, while also demonstrating a potential capability to perform the task at hand. For example, "transition" processes (Marks et al., 2001), such as effective strategy formulation and goal specification at the onset of a team's tenure together requires a high level of understanding of the overall situation facing the team, the individuals involved (potentially both internal and external to the team), and the challenges facing the team. Thus, for individuals to be successful in these initial strategic activities, demonstrating knowledge of all of these facets of the team's current situation is necessary. In turn, individuals that more frequently communicate information related to these areas are also demonstrating intelligence, in that they possess the knowledge and capabilities necessary to effectively formulate the correct strategy and target the proper goals for the team. As teams progress from the initialization stage through planning and

execution of the task, this presents another opportunity for individuals to demonstrate higher degrees of intelligence. Once the foundation for the team has been set through overall strategy and goal formation, teams will then determine how the work will be accomplished and begin completing the tasks at hand (e.g., action processes; Marks et al., 2001). Thus, individuals who exhibit task-based communication (i.e., transition and action) during these stages are demonstrating the ability to process information and problem solve in a "real-time" environment, which is also indicative of higher intelligence (Newell, 1972; Hunt, 1980).

In summary, individuals who utilize higher levels of task-related communication are more likely to be perceived as higher in intelligence than those who do not as frequently communicate ideas about strategy, goals, process, or the work itself. Thus, Hypothesis 5 states the following:

> *Hypothesis 5: An individual's level of task-based communication (consisting of communication related to "transition" and "action" processes; Marks et al., 2001) will be positively related to peer perceptions of that individual's general mental ability.*

Hypothesis 6 also proposes a communication-related antecedent (texting language) to perceptions of GMA. The interpersonal attribution model described in Gilbert & Malone (1995) plays an important role in helping to explain the linkage between structural aspects of communication and virtual team member attributions and perceptions (see Figure 2.1 for the schematic of the model). To reiterate the model, prior to an interaction, individuals take note of their current surroundings and subconsciously apply a set of expectations for others' behavior in the given environment. Observers then perceive and categorize others' behavior, and make a determination if the behavior met expectations, or ran counter to them. Nevertheless, according to Gilbert & Malone (1995), individuals will tend to make dispositional inferences about others based on their

behavior *regardless of whether or not they met expectations*. In other words, people initially make characterizations about others based on their behavior without taking into consideration the impact of context. The "correction" phase, which is initiated when other's behavior matches situational expectations and thus can be attributed to the observed context, occurs after the initial dispositional inference has been made and requires greater cognitive energy to perform. Thus, two aspects of this model are important to note. First, individuals are predisposed to making dispositional attributions based on observed behaviors. Second, the act of correcting dispositional attributions to situational ones carries a higher cognitive load, such that individuals who are engaged in mentally strenuous activities will be less inclined to making situational corrections (Gilbert et al., 1988).

Also, as previously discussed, the level of media richness in virtual team communications plays an important role in this stage of this study's theoretical model as well. While highly rich communication media are able to convey most of the non-verbal and physical information that is used to categorize others' behavior during face-to-face conversations, low/medium rich media lack some (or all) of this information. Likewise, virtual team members have considerably less awareness of their compatriots' work environment as compared to collocated teams (Bellotti & Bly, 1996; Cramton, 2001), and this lack of awareness can prevent individuals from making a correction from dispositional to situational attributions (Cramton et al., 2007). Thus, in combination, virtual team members are likely to make very strong dispositional attributions about their fellow team members based on a relative paucity of information made available to them. Given that teams will lack a history of prior interaction from which to draw inferences about others on the team, and that several aspects of interpersonal differences will be "hidden" from some or all of the team, I expect that the limited information that is available to participants will have profound effects on their perceptions of others.

One of the few things that will be readily available to virtual team members for the purposes of characterizing their fellow team members is the structural aspect of their communication. How team members compose their ideas and communicate them to others (whether via chat or verbally) provides relevant information for team members to gauge perceptions of the general mental ability of their colleagues. One unique structural aspect of text-based communication in virtual teams which could potentially have an impact on general mental ability perceptions is the use of texting language. Texting language is defined as "a non-standard form of the language that disregards grammar, punctuation and spelling rules" (Choudhury et al., 2007). Attributes of texting language generally fall into three categories (af Segerstad, 2002): *spelling and punctuation* (e.g., deletion of space between words, punctuation marks, and vowels; phonetic substitutions for words), *grammar* (deletion of pronouns, prepositions, and auxiliaries in verb phrases; substitution of shorter words), and *abbreviations/other stylistic changes* (e.g., conventional and unconventional abbreviations; slang; emoticons).

It perhaps seems intuitive to predict that increased usage of texting language would result in negative perceptions of the sender's intelligence; for example, the Balthazard et al. (2009) study found that grammatical complexity in electronic communications was positively associated with emergent leadership, even while controlling for personality and communication activity level. Likewise, the consistent use of simple sentences and/or the demonstration of "technical errors" (Vignovic & Thompson, 2010) could be perceived to represent a lack of complex thought or critical thinking skills; conversely, communication that features complex/compound sentences and is devoid of grammatical errors is likely to be associated with higher mental ability.

While texting language is predicated on grammatical flexibility, abbreviations, and alternate spellings of words (much of which could be perceived as "technical errors" as described before), Kelly, Davis, Nelson, & Mendoza (2008) found that the *appropriate* use of texting language in the context of technology-mediated communication was

perceived by study participants as an indicator of *higher* intelligence, ostensibly through the level of "tech-savviness" portrayed by these communication techniques. Thus, the effects of texting language usage on perceptions of the sender's mental ability appear to be highly context-dependent.

Given the forum for text-based communication in this study, there are two reasons to expect that texting language will be perceived positively and will result in higher general mental ability perceptions relative to those who do not use texting language. First, the setting is wholly appropriate for the use of texting language – effective chat-based communications (whether through mobile devices or computers) are reliant on individuals' ability to quickly and efficiently carry on a conversation. Thus, the use of texting language allows individuals to more rapidly express information and emotion, which is clearly a positive attribute in a technology-mediated conversation. Second, the participants in the study are young adults, who have likely been exposed to, and utilized, texting language for a substantial portion of their lifetimes. As such, their familiarity and acceptance of texting language is likely to be far higher than that of other groups (for example, the "Baby Boomer" generation). In combination, it is plausible that, as in the Kelly et al. (2008) study, the absence of texting language – given the participants and context – could be perceived in a generally negative fashion. Said another way, under the auspices of the Gilbert & Malone (1995) attribution model, this behavior would result in a negative dispositional attribution toward the "non-texting sender" of their ability to communicate effectively, or of their ability in general. Thus, Hypothesis 6 proposes the following:

> *Hypothesis 6: An individual's frequency of use of texting language will be positively related to peer perceptions of that individual's general mental ability.*

Hypotheses 7 and 8 are focused on communication-related predictors of perceptions of interpersonal trust in the virtual team environment. Beyond the

dimensionality debate of trust discussed earlier in this chapter, some researchers have taken a closer look at the Mayer et al. (1995) model within the realm of virtual teams, and have proposed some slight alterations relative to this unique context. The concept of "swift trust" (Meyerson et al., 1996), defined as the "willingness of an individual to be vulnerable to the actions of another party without the ability to control or monitor, and based on the expectation that the other person will perform" (Jarvenpaa et al., 1998), is a unique aspect of the trust development process as theorized in the virtual team literature. It is particularly relevant to this study, as the experimental teams will have no prior history or interaction with one another, and will quickly need to establish trust in completing their assigned task. Jarvenpaa and colleagues (1998) utilized the Mayer et al. (1995) model as the basis for their quantitative analysis of six global virtual teams, and found that trust was most strongly predicted by perceptions of integrity. Ability perceptions were moderately important in early stages of team development, and less so at later stages. Conversely, benevolence perceptions were not significant for teams at the onset, but grew in importance over the two-month span of the study. The authors then performed a qualitative analysis of the teams within their sample, and from this analysis, developed a new model of trust development for virtual teams that encompassed the idea of swift trust (see Figure 2.2 below). While their results showed that some team members exhibited significant levels of trust almost immediately within their virtual teams, their research (and model) still could not answer the question of how or why swift trust occurs.

To this end, Greenberg, Greenberg, & Antonucci (2007) proposed a theoretical model of trust development in virtual teams. Incorporating the work of Hung, Dennis, & Robert (2004), the authors propose that trust develops through five stages of team development: team establishment, inception, organization, transition, and execution. As teams pass through these stages of development, different factors are relevant towards the establishment of trust between team members (see Figure 2.3). According to the model,

swift trust occurs at inception, and is triggered by three external sources of information: personal endorsement from third-parties, role-based information (i.e., qualifications, functional skills), and rule-based factors – procedural guidelines or "rules of engagement" that are used to provide a common starting point for all team members as they begin to engage in the team's focal activities. Beyond inception, the authors corroborate the Jarvenpaa et al. (1998) findings that perceptions of integrity are important throughout the team's tenure, ability perceptions are important as the team organizes and develops communication patterns but wane over time, and perceptions of benevolence increase in importance to trust development as the team transitions their focus towards task accomplishment.

Three recent studies have also shed additional light on virtual team trust development. In a study of teams that featured virtual and face-to-face contexts for dyadic relationships amongst team members, Yakovleva, Reilly, & Werko (2010) found that ability perceptions had a stronger impact on trust relative to the other two factors when the dyadic relationship was virtual. As the authors discuss, "It may be that judgment of ability is a more salient factor in building trust when interactions are mostly virtual, as the other kinds of cues needed for assessing benevolence and integrity are more difficult to obtain." (Yakovleva et al., 2010: 86) In another study, Robert, Dennis, & Hung (2009) found that the three factor model of trust-related perceptions only emerged as correlates to trust as team members had greater interaction and access to information about their new teammates. Finally, Staples & Webster (2008) looked at the effect of team structure on trust development, and using a diverse sample of participants from both a large global technology company and an online panel, looked at three categories of team structure: *local* (traditional face-to-face), *global* (essentially virtual), and *hybrid* (mix of local and virtual team members). The authors found that the trust → knowledge sharing relationship strengthened as the level of interdependence decreased.

In other words, as teams became more dispersed and independent, the importance of trust in facilitating knowledge transfer (and subsequent team performance) increased.

From the studies reviewed above, it is clear that the development of swift trust – and trust in general – is an important step towards success as a newly-created self-managing virtual team. In turn, I expect that development of swift trust will likely be important to the successful completion of assigned tasks for the teams in this experiment as well. Participants will need to rapidly develop a working level of trust in order to complete their assigned tasks in a timely manner. Given these time constraints, from a structural communications perspective, I predict that the pace with which participants are able to respond to requests for information and opinion will have an impact on their perceived interpersonal trust. Individuals who take excessive amounts of time to communicate, or are non-communicative as a whole, will break any "swift trust" that the group may have initially held with them personally, and will translate into low perceptions of trust over time (Cramton, 2001). As demonstrated in the Jarvenpaa & Leidner (1999) study of multinational graduate student teams, individuals whose communications were regular, timely, and predictable were able to maintain high levels of trust. While the communication method in the Jarvenpaa & Leidner (1999) study was primarily email, these same attributes can be captured in synchronous technology-mediated communication to a considerable extent through a measure of average response time. Of course, what is considered "timely" in an email exchange is quite different than in a synchronous chat conversation. Within the customer service realm, response time for emails are generally measured in hours or days – for text-based chat, the unit of measurement is minutes or seconds (Call Center Magazine, 2006). Thus, when response times exceed the expectations of customers in this context, the rate of disengagement (and dissatisfaction) is quite high.

Along these lines, individuals with longer response times in chat-based communications may be perceived as not being focused on the activity or interested in

supporting the team. In turn, this could be interpreted as a lack of integrity or benevolence towards the group (Mayer et al, 1995), both of which were shown to be important factors in trust development in virtual teams (Greenberg et al., 2007; Jarvenpaa & Leidner, 1999). Additionally, previous research has found that a measure of perceived responsiveness had a moderately strong relationship with multiple perceptual dimensions of trust in the context of online communities (Ridings, Gefen, & Arinze, 2002). Hence, I expect to find a similar relationship between the *objective* measure of responsiveness (average response time) and perceived trust, as stated in Hypothesis 7 below:

> *Hypothesis 7: An individual's average response time will be negatively related to peer perceptions of trust with that individual.*

While Hypothesis 5 proposed the relationship between *task*-based communication content and perceptions of GMA, Hypothesis 8 is focused on *relationship*-based communication and its impact on perceptions of trust. Relationship-based communication is focused on conflict management, motivation, cohesion, and emotional regulation (Marks et al., 1997). Again referring to the three dimensional model of trust that has evolved in the literature (Blau, 1964; Mayer et al., 1995) – ability, benevolence, and integrity – the latter two are most applicable to this discussion. Benevolence refers to the expectation that others will strive to take actions that will benefit the group, while integrity is an expectation that others will act in accordance with socially accepted standards of behavior. In fact, Ridings et al. (2002) propose that the dimensions of benevolence and integrity are one and the same in the virtual environment, given that both dimensions are thought to lead to the same behavior – namely, reciprocity through the continuance of communication. Thus, relationship-based communication that is focused on 1) resolving conflict amongst team members, 2) motivating the group to successfully perform tasks assigned to the team, and 3) developing stronger social bonds amongst the team has significant parallels with the fostering of communication

reciprocity, and thus, the perception of the existence of interpersonal trust. Beyond the findings of Ridings et al. (2002), the aforementioned Jarvenpaa & Leidner (1999) study also found a significant relationship between trust perceptions and relationship-based communication (specifically, social/non-task communication and messages that conveyed enthusiasm about the task, which were found to be particularly important in facilitating trust at early stages of team development). In summation, given the short time frame for developing levels of swift trust with the colleagues, as well as the prior research which has shown the importance of relationship-based communication in establishing trust early in a team's tenure, Hypothesis 8 predicts the following:

> *Hypothesis 8: An individual's level of relationship-based communication will be positively related to peer perceptions of trust with that individual.*

Again harkening back to some of the trust theories and empirical studies already discussed, it stands to reason that perceptions of ability and interpersonal trust will also be positively correlated. Mayer et al. (1995) specifically include ability as one of the three factors that lead to trusting relationships. The cognitive-based dimension of trust as proposed by McAlister (1995) also suggests that ability perceptions will have a significant impact on trust, given the need for individuals to provide evidence (or "good reasons"; Lewis & Weingart, 1985) for establishing a level of trust with others. One way of providing evidence for the development of trust in a team environment is by demonstrating an appropriate level of either general ability or task-related ability. While task-related communication can serve as an indicator of task-specific ability as team progress through activities (as covered in Hypothesis 3), prior research suggests that early stages of team development will require more general displays of ability for setting the foundation of trusting relationships with team members. Jarvenpaa et al. (1998) found that ability perceptions are most important early in the team life cycle as teams develop communication patterns. Also, Yakovleva et al. (2010) found that ability perceptions

were strong predictors of trust in dyadic virtual relationships. Given that many of the relationships between participants in this study will be virtual, and that participants will only have a short amount of time together as a team, early perceptions of general ability should have a significant positive relationship with trust perceptions:

Hypothesis 9: Peer perceptions of an individual's GMA will be positively related to peer perceptions of trust with that individual.

Level 1: Between-Individual Relationships and Hypotheses

The last level in the proposed theoretical model (Level 1) focuses on inter-individual relationships between team members on a given virtual team. For Hypothesis 10, I return to the notion of collocation first discussed under Hypothesis 2; however, the focus at this point moves from the team/aggregate level to the individual/dyadic level. While virtual teams can be configured in an infinite number of locations, time zones, and number of participants, one-on-one relationships between team members may be greatly impacted by the simple matter of whether or not the two individuals in question are collocated or not. For example, Webster & Wong (2008) utilized a field sample of workers from various IT teams within a single services organization, and reviewed individual-level data on perceptions of team identification, communication, trust, and task skills. The authors analyzed the data in terms of three categories of teams – collocated, semi-virtual (composed of "local" and "remote" members), and virtual (entire team was geographically situated apart from one another) – and found some intriguing results. The semi-virtual teams showed significant differences in team members' perceptions of local vs. remote teammates. Local team members were perceived as higher in skill level, team identification, communication frequency, and trust than remote members, providing evidence that teams with subgroups of team members across multiple locations may face issues with in-groups and out-groups (Ashforth & Mael, 1989). Similarly, the highest group identity scores were with the local members of semi-

virtual teams, while the lowest scores were in reference to remote team members of semi-virtual teams. Both fully collocated and fully virtual teams had mean identity scores roughly at the midpoint between the local and remote semi-virtual team scores.

O'Leary & Mortensen (2010) developed a quasi-experiment with 63 six-person student teams, with participants derived from universities in the US and Canada. The experiment involved using different configurations of students between the two locations/countries, with the teams being tasked to complete course-related assignments. Four conditions were present: collocated (all 6 members at the same university), "distributed with isolate" (a 5/1 configuration), "distributed-imbalanced" (4/2 configuration), and "distributed-balanced (3/3 configuration). The authors actively minimized the presence of faultlines (Lau & Murnighan, 1998) based on language, gender, and major across all of the groups. The results from the study showed that configurations that featured sub-groups (i.e., the 3/3 and 4/2 distributions) had lower team identity and transactive memory, as well as higher conflict and coordination issues, than configurations that did not feature sub-groups (the collocated and 5/1 configurations). Within this set of configurations that featured sub-groups, the "geographic minority" sub-group (i.e., the "2" in the 4/2 distribution) generally had the worst results across the four dependent variables (conflict, coordination issues, team identity, and transactive memory) that were captured in the study.

Based on the results from these studies, it appears that team members in general hold stronger affinities with collocated team members than non-collocated team members. In other words, for teams that are configured such that team members will have both collocated and non-collocated colleagues, collocated team members will hold one another in higher esteem. In turn, this will be to the detriment of the non-collocated team members. I propose that this will translate into differences in trust perceptions in two ways. First, at the individual level, individuals who have team members that are both collocated and non-collocated will be perceived as being more trustworthy by their

collocated teammates. Second, it stands to reason that through aggregation, teams that have a higher density of collocated team members will have higher overall levels of trust than teams that have greater degrees of dispersion amongst team members. This assertion also underlies the idea that teams higher in virtuality (i.e., less collocation, on average, between team members) are proposed to have lower performance levels. The discussion of the aggregated effects of collocation differences at the team level (i.e., configuration) was the focus of Hypothesis 2. Nevertheless, for Hypothesis 10, I have focused the prediction at the individual level, in that trust perceptions will be higher for individuals that are rated by collocated team members versus non-collocated team members:

> *Hypothesis 10: Collocation will be positively related to peer perceptions of an individual's level of interpersonal trust, such that individuals who are collocated will rate each other higher in trust than individuals who are not collocated.*

To summarize, the proposed model is primarily focused at the individual level (Level 2 in Figure 1.1), and provides a theoretical framework that ties communication-related behavior and processes to emergent leadership through the lens of attribution theory and the mediating perceptions of trust and GMA. While formal hypotheses have not been developed that speak directly to this proposed mediation, data analytic techniques were used to test whether or not communication-related behaviors have a direct relationship with emergent leadership, thus bypassing any potential mediation through the perceptual mediators proposed in the model. In this regard, tests for partial and complete mediation were conducted. Beyond the individual-level portion of the theoretical model, the study also incorporates team-level constructs (team configuration/virtuality and leadership profiles, and their relationship with objective team performance) and between-individual relationships (dyadic team member collocation and its impact on perceptions of trust).

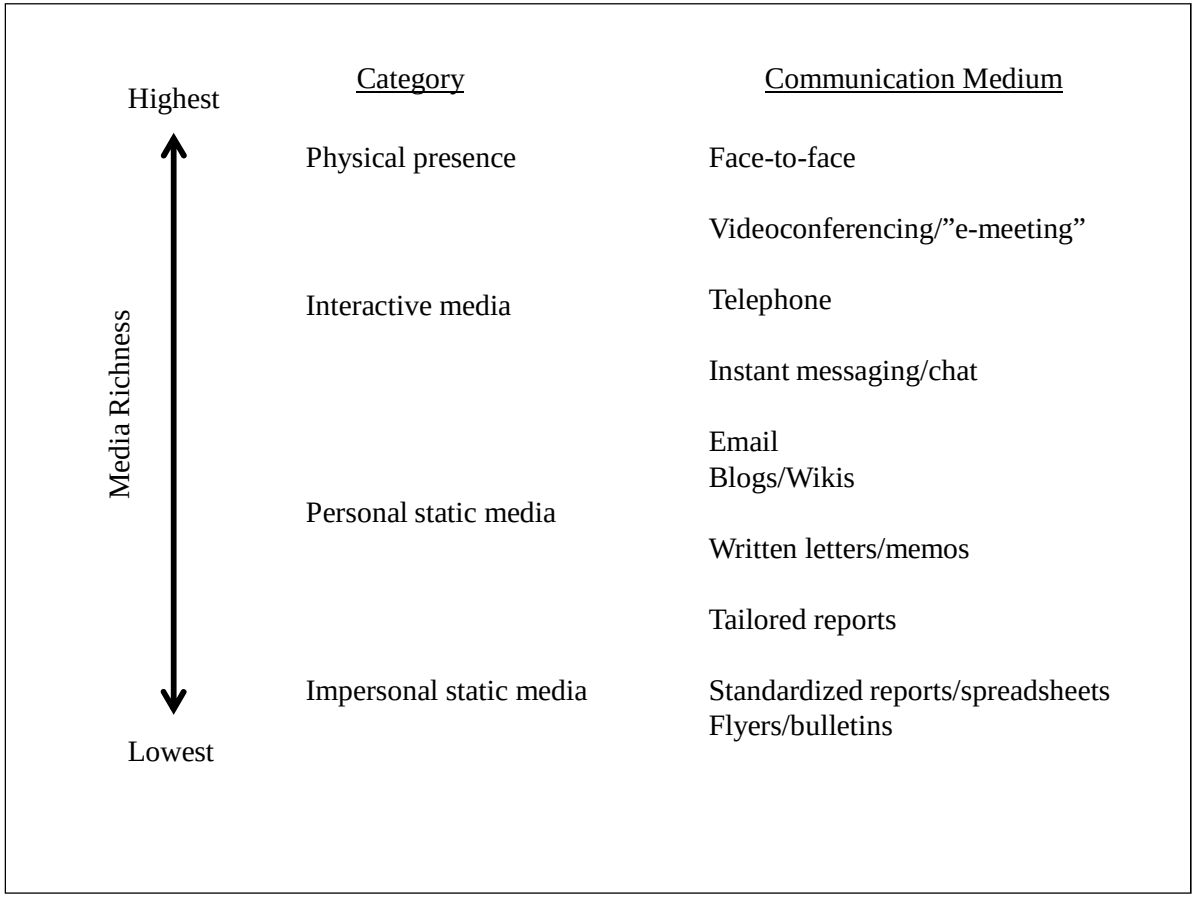
Based on this discussion of the model and rationale for the proposed hypotheses, Chapter 3 provides a detailed overview of the methodology to be used to test this model. The study is a controlled experiment, featuring four-person teams of randomly assigned participants into conditions that varied in terms of the level of collocation/virtuality. Upon arrival at the experiment location, participants were immediately convened into teams to complete a group decision-making task. At the completion of the team exercise, participants answered a series of survey items related to their experience in the team activities, including their perceptions of their fellow team members in the focal areas of the theoretical model. A discussion of potential data analysis techniques concludes the chapter.

Table 2.1. Key Outcomes and Mechanisms Associated with Dispersion Dimensions

Characteristic	Description	Example Outcome	Example Mechanism
Spatial	Geographic distance among team members	Reduced spontaneous **communication** (Burke et al., 1999; Dennis et al., 1988; Saunders et al., 2004)	Decreasing the likelihood of face-to-face interaction
Temporal	Time difference among team members	Reduced real-time **problem solving** (Grinter et al., 1999; Herbsleb et al., 2000; Malone & Crowston, 1994)	Decreasing the likelihood of synchronous interaction
Site (Configurational)	Locations where team members work	Increased **coordination complexity** (Sarbaugh-Thompson & Feldman, 1998; Yoo & Alavi, 2001; Zigurs et al., 1988)	Increasing the number of dependencies which must be managed
Isolation (Configurational)	Locations where team members work alone	Decreased **awareness** (Amstrong & Cole, 2002; Dennis, 1996; Tan et al., 1998)	Increasing the remoteness of isolated team members
Imbalance (Configurational)	Locations with uneven distribution of team members	Increased **intragroup conflict** (Allmendinger & Hackman, 1995; Kabanoff, 1991; Mannix, 1993)	Increasing majority influence and the potential for negative subgroup dynamics

Source: O'Leary, M.B., & Cummings, J.N. (2007). The spatial, temporal, and configurational characteristics of geographic dispersion in teams. ***MIS Quarterly, 31(3)***, 433-452.

Table 2.2. Hierarchy of Communication Media Richness



Source: Adapted from Lengel, R.H., & Daft, R.L. (1988). The selection of communication media as an executive skill. ***Academy of Management Executive, 11(3)***, 225-232.

Table 2.3. Characteristics of Collocated and Distributed Communication Settings

	Communication settings					
Communication characteristics	Collocated face-to-face	Collaboration software	Real-time audio/video	Audio only	Real-time text/chat	Electronic mail
Co-presence	X					
Visibility	X	X	X			
Audibility	X	X	X	X		
Contemporality	X	X	X	X	X	
Simultaneity	X	X	X	X	X	
Sequentiality	X	X	X	X	X	
Reviewability		X			X	X
Revisability		X			X	X

Source: Adapted from the following:

Clark, H.H., & Brennan, S.E. (1991). Grounding in communication. In L. Resnick, J. M. Levine, & S. D. Teasley (Eds.), ***Perspectives on socially shared cognition***. Washington, DC: American Psychological Association.

Driskell, J.E., Radtke, P.H., & Salas, E. (2003). Virtual teams: Effects of technological mediation on team performance. ***Group Dynamics: Theory, Research, and Practice, 7***, 297-323.

Priest, H.A., Stagl, K.C., Klein, C., & Salas, E. (2006). Virtual teams: Creating context for distributed teamwork. In C. Bowers, E. Salas, & F. Jentsch (Eds.), ***Creating High-Tech Teams: Practical Guidance on Work Performance and Technology***. Washington, DC: American Psychological Association.

Van der Kleij, R. (2007). ***Overcoming distance in virtual teams: Effects of communication media, experience, and time pressure on distributed teamwork***. Ph.D. thesis, Department of Work and Organizational Psychology, University of Amsterdam, The Netherlands.

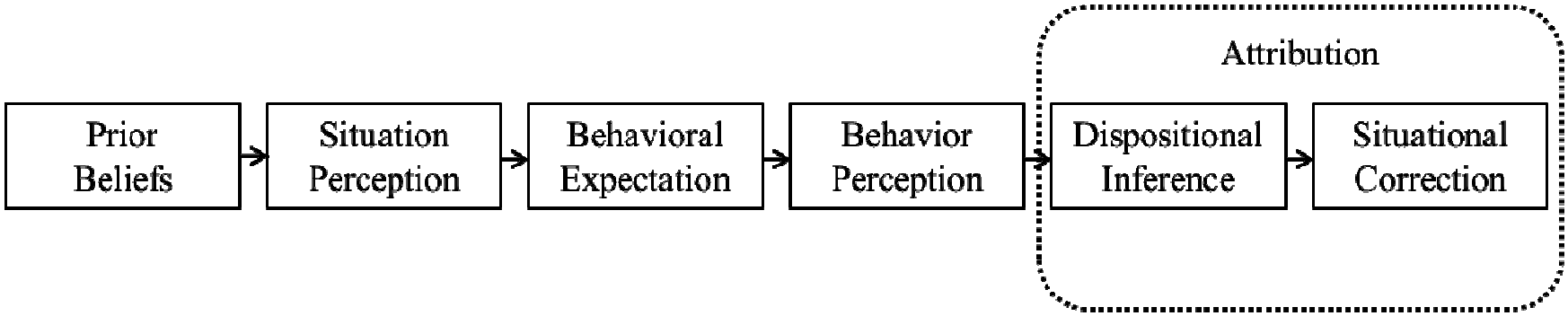
Table 2.4: Team Leadership Functions by Leadership Sources

	Formality of Leadership			
	Informal		Formal	
Leadership Function	Internal	External	Internal	External
Transition phase:				
Compose team			++	+++
Define mission	++	+++	+++	+++
Establish expectations/goals	++		++	+++
Structure and plan	+++	+	+++	+
Train and develop team	+	+++	++	++
Sensemaking	+	+++	++	+++
Provide feedback	+++	+++	+++	+++
Action phase:				
Monitor team	++		++	+++
Manage team boundaries	+	++	++	+++
Challenge team		+	++	+++
Perform team task	+++		+++	++
Solve problems	+++	+	+++	++
Provide resources		++	++	+++
Encourage team self-management			+	+++
Support social climate	+++		+++	++

Note: Cell entries reflect the source of leadership best positioned to perform a particular team leadership function, ranging from "good" (+), to "better" (+ +), to "best" (+ + +) positioned. Empty cells suggest that a particular source is not well-positioned to perform that leadership function.

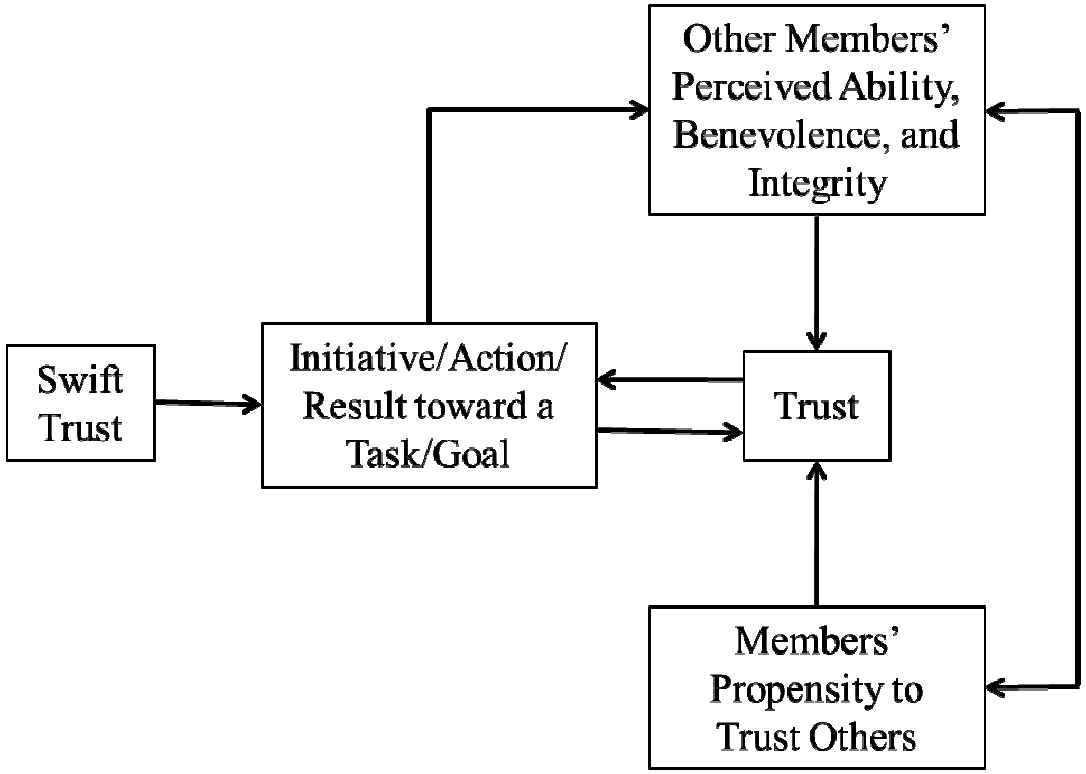
Source: Morgeson, F.P., DeRue, D.S., & Karam, E.P. (2010). Leadership in teams: A functional approach to understanding leadership structure and processes**.** ***Journal of Management, 36(1)***, 5-39.

Figure 2.1 Interpersonal Attribution Model



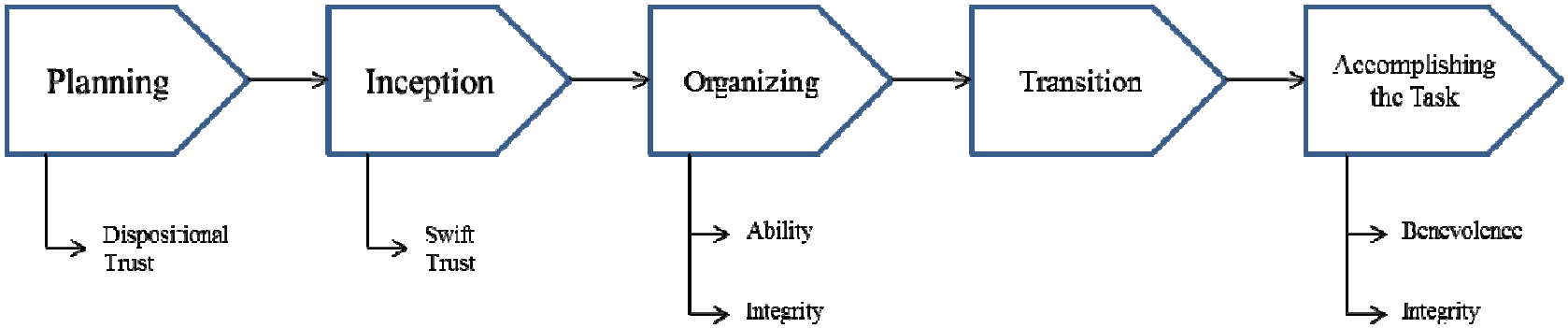
Source: Gilbert, D.T. & Malone, P.S. (1995). The correspondence bias. ***Psychological Bulletin, 117(1)***, 21-38.

Figure 2.2. Swift Trust in Virtual Teams



Source: Jarvenpaa, S.L., Knoll, K., & Leidner, D.E. (1998). Is anybody out there? Antecedents of trust in global virtual teams. ***Journal of Management Information Systems, 14(4)***, 29-64.

Figure 2.3. Trust Development in Virtual Teams



Source: Greenberg, P.S., Greenberg, R.H., & Antonucci, Y.L. (2007). Creating and sustaining trust in virtual teams. ***Business Horizons, 50***, 325-333.

CHAPTER III:

METHODS

Sample

The sample for the study consisted of 344 undergraduate business majors at a major Midwestern university. Participants were recruited via classroom announcements and email, and registered for the study via email. Participants received course credit for participating in the experiment, and were entered into a drawing for cash awards.

Procedure

Participants were directed to one of several computer terminals to begin the study. A maximum of 12 students were scheduled for each session, in the hopes that a minimum of 8 would be present. Because the experiment requires teams of 4, it was expected that each session could have a disproportionate number of participants relative to the team requirements (i.e., total participants did not always equal a multiple of 4). In those situations, "extra" students were determined by their time of arrival at the experimental setting, and were given two options: 1) to reschedule for another session, or 2) to participate in a separate study. Participants selecting option #2 were taken to another location to complete the item batteries associated with that study. Course credit was provided to all who participated in either study.

The study was conducted in three consecutive phases. Phase one began with an overview of the study purpose and procedures. Participants were randomly seated at a computer terminal on their arrival. Seats were designated to a particular experimental condition prior to the participant's arrival to the room. If individuals arrived at the session in pairs/groups, and it was obvious to the administrator that the individuals knew one another, care was taken to place these individuals with a prior relationship into different teams, or at a minimum, at different physical locations within a team. It should be noted that an item in the post-activity survey asked if participants knew any of their

teammates prior to the activity – out of 1,032 possible combinations of one participant knowing another, only 33 were noted.

Four experimental conditions were present in the current study (as graphically represented in Figure 3.1):

- **Very high virtuality** (fully virtual – four locations): Participants were taken to a cubicle, separate from other participants, and seated in front of a computer. The computer had a chat window open, which was connected to the three other participants in this condition, as well as the study administrator. Paper and writing implements were also provided at the cubicle, along with a packet of information containing instructions and documentation for the team activity. Upon arriving at the cubicle, participants were asked to review the consent documentation and instructions for Part 1 of the protocol, and wait for further instructions via the chat function from the study administrator.
- **High virtuality** (imbalanced – three locations; two collocated participants at one location, and one isolated participant at each of the other two locations): Two randomly chosen participants were taken to a room with two seats/computers adjacent to one another. Each computer had a chat window open, which was connected to the three other participants in this condition (the adjacent computer terminal in the same room, as well as the other two team members whose locations are described below), along with the study administrator. Paper and writing implements were also provided at the cubicle, along with a packet of information containing instructions and documentation for the team activity. Upon arriving at the room, the two collocated participants were asked to be seated at one of the computer terminals, review the consent documentation and instructions for Part 1 of the protocol, and wait for further instructions that would arrive via the chat

function from the study administrator. A video camera was set up in the room prior to the start of the team activities, and participants were asked for their individual consent to the session being videotaped. The other two team members were taken to separate cubicles, and followed the protocol outlined in the "Fully Virtual" condition previously described.

- **Low virtuality** (balanced – two locations; two collocated participants at one location, and two participants collocated at a second location): Participants were taken to a room with two seats/computers adjacent to one another. Each computer had a chat window open, which was connected to the three other participants in this condition (the adjacent computer terminal in the same room, as well as the two terminals in a second room which housed the other two team members in this condition), along with the study administrator. Paper and writing implements were also provided at the cubicle, along with a packet of information containing instructions and documentation for the team activity. Upon arriving at the room, participants were asked to be seated at one of the computer terminals, review the consent documentation and instructions for Part 1 of the protocol, and wait for further instructions that would arrive via the chat function from the study administrator. Also, a video camera was set up in each room prior to the start of the team activities, and participants were asked for their individual consent to the session being videotaped.
- **Very low virtuality** (imbalanced – two locations; three collocated participants at one location, and an isolated participant at a second location): Three randomly chosen participants were taken to a room with three seats/computers adjacent to one another. Each computer had a chat window open, which was connected to the three other participants in this condition (the other two terminals in the room, as well as the fourth team member whose location is

described below), along with the study administrator. Paper and writing implements were also provided at the cubicle, along with a packet of information containing instructions and documentation for the team activity. Upon arriving at the room, participants were asked to be seated at one of the computer terminals, review the consent documentation and instructions for Part 1 of the protocol, and wait for further instructions that would arrive via the chat function from the study administrator. A video camera was set up in the room prior to the start of the team activities, and participants were asked for their individual consent to the session being videotaped. A fourth team member was taken to a separate location, and followed the protocol outlined in the "Fully Virtual" condition previously described.

As stated above, when students arrived at their computer terminal, they were provided with the study purpose and consent documentation (see Appendix A) to read, along with the first of two sets of instructions. Participants were then asked to read the instruction forms and consent documentation, and respond with the message "I am ready" through the chat software. This portion of the experiment was not timed; generally speaking, participants needed approximately 15 minutes to read the consent documentation and the overview of the team activity.

Once all team participants communicated that they were ready to proceed, teams participated in a decision-making activity, which comprised phase two of the experiment. The activity was an amended version of the "Tinsel Town" simulation (Devine, Habig, Martin, Bott, & Grayson, 2004). The general concept of the simulation is to have participants represent the top management team of a fictional Hollywood studio, who are tasked with "green lighting" the production of one or more screenplays (and corresponding marketing levels) for the upcoming year. In the original version of the simulation, participants are all provided with some general information regarding the

fictional company and how screenplays are evaluated, while individual roles on the team (e.g., Marketing, Industry Research, Script Evaluation, and Talent Appraisal) are provided role-specific information that is not shared explicitly with the rest of the team. Given that the purpose of this study is to better understand how leaders emerge in self-managing teams with ambiguous roles, no role-specific information was used in the study – rather, all team members had access to all of the relevant information for the team's decision making. Thus, participants in the study were informed that they were the "top management team" for the organization as a whole, without any indication of specific functional alignments or areas of expertise.

For all experimental conditions, the administrator initiated phase two of the experiment by sending the following message to all participants:

> *"You may open your packets and begin the group activity. You have 15 minutes to individually review the information in the sealed folder in front of you. Please do not communicate with your teammates in any way at this time – this time is for individual review only. Also, please do not write on the materials in the folder – use the blank scratch paper if you need to take notes. I will notify you when 15 minutes are up and the next phase of the activity will begin. If at any time you need an administrator, please select "Moderators" at the bottom of the screen and send a private message."*

After 15 minutes has expired, the administrator sent the following message:

> *"You may now communicate with your teammates for the remainder of the activity, and you have 10 minutes to plan how your team will develop your recommendation. I will notify you when 10 minutes are up and the next phase of the activity will begin."*

The administrator then immediately informed the participants via a chat message that they may be eligible for a drawing for a nominal cash prize, if their team scored above a certain level in the activity, through the following message:

> *"I am also pleased to inform you that if your team achieves a profit margin of over $250M in the activity, all of the team members will be entered into a drawing for several $150 cash prizes. Eight individuals in total will be*

> *randomly selected from the pool of qualifiers to receive the award once the research program has completed. More details will be provided to you at the end of the session."*

In reality, all teams and team members qualified for the cash prize drawing – this was done to ensure that all participants had an equal and fair opportunity to receive the cash prize, such that individual participants would not penalized for having poor performing teammates. Aspects of the deception will be described later in this section. Following the 10-minute planning period, the administrator sent a final message to the participants:

> *"You now have 30 minutes to make your final recommendation. One person will need to document your decision in the Final Recommendation Sheet provided in your folder, and all team members will need to send a message stating "I concur" once a decision has been reached."*

In all four conditions, the administrator also provided notification to the teams via chat when the teams had five minutes left in the activity. Once the allotted time was over, the administrator sent the following message:

> *"Time has expired. An administrator will be by to collect your team's final recommendation from the designated team member. You may now read the "Instructions - Part 2" sheet, then click the Internet Explorer icon on the bottom of the screen and begin with the first tab/online survey. Please note that the third tab (AssesTyping.com) has additional steps on the "Instructions – Part 2" sheet that are required for access to the typing assessment."*

The administrator then collected the final work product (see Appendix E: "Final Recommendation Sheet") in person from the teams for the activity, and validated that the response was within the guidelines of the simulation. This marked the end of phase two of the experiment. Total time to complete phase two was capped at 60 minutes; however, many teams took less that the allotted amount of time to complete the team activity.

Once the team activities were completed and the responses validated, participants were then asked to complete two batteries of survey items that could be accessed via Web browser. This portion of the experiment was not timed; however, participants generally

needed approximately 15 minutes to complete these survey items. More information on the specific items to be administered in this phase is provided in the "Measures" section below. When the participant had completed the survey items, he or she sent a chat message to the administrator. The administrator then confirmed that the participant had satisfactorily completed the surveys, provided the debriefing information to the participant, thanked the participant for his or her participation, and escorted the participant from the testing area.

Measures

Team virtuality. The main distinguishing factor across the four experimental conditions relates to the configuration of team members and the number of locations used. Figure 3.1 shows how these differences can be translated into the number of "virtual relationships" that exist for a given configuration. Virtual relationships are defined as situations where two team members are not collocated and rely on electronic media to communicate. For example, the "fully virtual" condition features the maximum number of virtual relationships possible within a four-person team (six). Toward the other end of the continuum, the "imbalanced virtual – two locations" condition has the lowest number of virtual relationships among the four configurations (three). The "balanced virtual" and "imbalanced virtual – three locations" fall in between the two aforementioned conditions in terms of the number of virtual relationships (four and five, respectively). Thus, each team was assigned a value for team virtuality based on the number of virtual relationships that exist in their configuration. Teams in the "imbalanced virtual – two locations" were assigned a value of "3", "balanced virtual" had a value of "4", "imbalanced virtual – three locations" a value of "5", and "fully virtual" had a value of "6". Therefore, positive correlations with this variable represent higher values of the correlating variable with increased levels of virtuality in teams.

Structural communication. Two measures were used to capture how participants structure their communication with team members from a virtual (chat) perspective. Chat transcripts were analyzed from multiple perspectives, utilizing the time-stamped transcripts from the team activities. First, I wanted to capture how quickly team members responded to the comments and questions of others. Thus, *average response time* was measured by calculating the average time span between messages for each participant. For example, in the hypothetical scenario outlined below in Table 3.1, TeamMember1 would have an average response time of 4.5 seconds, while TeamMember2's average response time would be 6.5 seconds. There were two exceptions to this procedure. First, if the time span between two consecutive messages was over 180 seconds, the data point was automatically dropped from analysis. Second, if the time span between consecutive messages was between 60 and 180 seconds, a qualitative review of the conversation was conducted to see if the latter message was related to the former, or instead was the beginning of a new conversation/topic area. In cases where the second message was largely unrelated to the first (i.e., the initiation of a new conversation), this data point was also dropped from the average response time analysis. Both rules were enacted to better align the data with the underlying notion of the construct (*response* time) that I wished to measure.

Second, chat messages were analyzed for usage of *texting language*, using coding guidelines derived from Choudhury et al., (2007) and af Segerstad (2002). Two graduate assistants independently reviewed the chat transcripts and coded passages for all instances of texting language by participants, focused on what we referred to as "non-normal language". Coding was done within each message, such that each text message could be coded for multiple instances of texting language. For an item to be coded as evidence of texting language, the non-normal language had to fulfill one of two requirements: the use of the non-normal language either aided in clarity of thought/emotion/message, or aided in the sender's ability to respond more quickly.

Examples of the first principle include emoticons, additional/excessive punctuation, using only punctuation for an entire message (e.g., "?"), or using an asterisk for corrections after misspelled words. Examples of the second principle included abbreviations, phonetic spelling of words, or misspelling of words (purposeful or not) that resulted in less key strokes (e.g., "sik" for sick). Using these principles as guidance, the rate of agreement between the two coders was 92.8%, and disagreements were resolved via consensus. Counts of texting language instances were aggregated, resulting in an overall raw score on this variable for each participant.

Communication content. For both the verbal and computer-mediated communications, the content of the messages transmitted by participants was analyzed in two ways. First, message content was coded for *task focus* by the author and a graduate assistant. Using the Marks et al. (2001) typology of team processes, task relevant communication is defined as communication that corresponds to either "transition" (e.g., mission analysis formulation and planning, goal specification, and strategy formulation) or "action" (e.g., monitoring progress towards goals, systems monitoring, team monitoring and backup behavior, and coordination) processes. Second, again using the Marks et al. (2001) typology, *relationship-focused* communication was coded as communication that falls under the category of interpersonal processes (e.g., conflict management, motivation and confidence building, and affect management). Coding was performed at the "message" level, such that each chat message as a whole could be coded within one or more of the context categories. Again, the rate of agreement between the two coders was 92.9%, and disagreements were resolved via consensus. Similar to the aggregation done for texting language, instances of each of the three types of communications (transition, action, and relationship) were counted for each participant, resulting in a raw score by participant for each of the three content-related categories.

Perceived GMA. Participants completed three items using a 7-point Likert scale for each team member (excluding themselves), adapted from Murphy (2007).

Participants rated each of the other team members on perceptions of being competent, bright, and smart. Items were combined and averaged to form a composite perceived intelligence score. Coefficient alpha for the composite measure was .98, indicating very high within-rater consistency across the three items.

Trust. Participants completed two separate item batteries, each derived from McAllister (1995), for all other team members except for themselves. The original scales in the McAllister (1995) article feature five items for affect-based trust, and six items for cognitive-based trust. Because of the context for this experiment (i.e., newly-formed teams with no prior history), several changes were necessary to ensure that the items possess sufficient face validity for participants. To this end, two affect-based and three cognitive-based trust items were discarded, as the items were inappropriate for a newly-formed team with no opportunity for future work interactions. For the remaining six items in total, statements were revised to reflect the focus onto the activity that was just completed. Similar refinements of the McAllister (1995) item battery have been executed in prior virtual teams research (see Kanawattanachai & Yoo, 2007; Webber, 2008). The final list of items can be found in Appendix H. A factor analysis using principal axis factoring was completed *post hoc* to determine if a single, higher-order factor ("overall trust") emerged, or two distinct factors (i.e., affect-based and cognitive-based trust) were evident. The results of the factor analysis clearly showed a single factor structure to the trust data – the initial factor eigenvalue was 5.06, which accounted for over 84% of the observed variance. The next highest eigenvalue was .38. Coefficient alpha for the six-item composite measure was .96, again demonstrating a high level of within-rater consistency between items.

Emergent leadership. Following the team activities, leadership emergence perceptions among the experimental team participants were assessed via a 5-item scale derived from multiple sources, including the Generalized Leadership Impression scale (GLI; Lord, Foti, & De Vader, 1984; Lord & Alliger, 1985; Yoo & Alavi, 2004) for each

team member (including self-assessment), using a 5-point Likert scale. The 5 items are provided in Appendix I. Scores on the 5 items were averaged for each participant, resulting in four overall ratings for each participant (three peer ratings and one self-rating). As with the GMA and trust scales, a factor analysis was conducted to ensure a single factor structure to the emergent leadership items. Factor one had an eigenvalue of 3.84, which explained almost 77% of the observed variance – the next highest eigenvalue was .41. Coefficient alpha for the 5-item battery was .89.

Measures of agreement for perceptually-based constructs (GMA, trust, emergent leadership). While the intra-rater agreement, as indicated by coefficient alpha, is quite high for all three variables, inter-rater agreement among team members for a given individual was not. I calculated two measures of inter-rater agreement for each variable: $r_{wg}(j)$, which is designed to estimate the within-group agreement of a multi-item scale by comparing the observed group variance to a rectangular distribution of random variance (James, Demaree, & Wolf, 1984); and ICC(1), which indicates the level of variance in a measure that can be attributed to "group membership" (Bliese, 2000). Because the data aggregation is of multiple raters of a given individual, the "group" in this case is each individual team member. Both $r_{wg}(j)$ and ICC(1) have been used by researchers to justify the aggregation of lower level data (i.e., perceptual ratings of an given individual made by other team members) into a higher level construct (i.e., an "overall" perception of a team member by the overall team).

Hypothesis 10 predicted that collocation would have a significant effect on perceptions of trust among dyads on a team. Thus, my *a priori* expectation was that collocated and non-collocated team members would have considerably different perceptions of one another, deriving from their physical separation. Without delving into the actual statistical tests that were performed to assess this hypothesis at this point, the analysis of the agreement statistics generally confirms that team members did not agree in their perceptions of other fellow team members. The $r_{wg}(j)$ scores for GMA, trust, and

leadership emergence were .43, .33, and.74, respectively. A common rule of thumb for interpretation of $r_{wg}(j)$ scores is that figures above .70 indicate an "acceptable" measure of agreement (Bliese, 2009). Thus, while team members exhibited some level of agreement on leadership perceptions, trust and ability perceptions of individuals were clearly diverse within the experimental teams.

ICC(1) scores presented a similar, yet uncommon, pattern: -.04 for GMA, -.05 for trust, and .28 for emergent leadership. While negative ICC(1) scores are rare, they are mathematically possible, and occur when the within-group variance is smaller than the between-group variance. Dansereau, Alutto, & Yammarino (1984) refer to this as a "frog-pond" situation, and suggest that the variability of individual scores relative to the group-level mean is a key source of variability. Bliese (2000) provides an illustrative example of this phenomenon, whereby a main predictor of pay satisfaction may be an individual's pay level relative to the average pay of his/her colleagues. This appears to be the case with the trust and GMA perceptions – ratings appear not to be derived from an "absolute" standard, but rather from a comparison made between team members within the group.

But returning to the initial question of justification for aggregation, the current figures obviously pose a concern, particularly for the trust and GMA perceptual variables. However, two points can be raised in support of aggregation. First, work by Cohen, Doveh, & Eick (2001) and Dunlap, Burke, & Smith-Crowe (2003) have shown that expected $r_{wg}(j)$ values are highly influenced by the number of items and the group size. Given that both were relatively small in this study, a "statistically significant" $r_{wg}(j)$ value would have to be considerably higher than the common standard of .70 (.85 for the trust item battery, and 1.00 for GMA). Hence, from a statistical perspective, it would have been extremely difficult for the data to achieve a "significant" level of agreement, even with raters that were highly aligned with one another. Second, from a purely operational perspective, there is no reasonable alternative for measuring how an individual is

perceived by others, except for directly asking for their perceptions. For example, the perception of a particular brand is probably best measured by surveying a large group of individuals and asking for their impression. It is not expected that all respondents will agree with one another on their attitudes towards a particular brand; likewise, it cannot be expected that individuals will necessarily agree on their perceptions of one another. And, in the case of this study, it was a priori hypothesized that individuals would systematically ***disagree***, based on whether or not the individuals (rater/ratee) were collocated together. Thus, although is it clearly not ideal from a consistency perspective, there does not appear to be a viable alternative to deriving overall perceptions of individuals except via the aggregation of individual ratings.

Shared leadership. Two methods were used to calculate shared leadership within teams. The first method used a commonly used metric of shared leadership for a given team by using a social network approach (Mayo, Meindl, & Pastor, 2003) as demonstrated in Carson et al. (2007). Using the peer ratings on the 5-item emergent leadership scale (described in the previous section) for each member of a team, the density of the total level of leadership demonstrated by the team as a whole was calculated. Following the procedures set forth by Sparrowe, Liden, Wayne, & Kraimer (2001), scores on the five emergent leadership items for all team members were aggregated and divided by the total possible sum of responses (in this case, including self-report ratings, the total number of responses in 20). The notion behind this measure is that teams that rate multiple individuals as exhibiting leadership behaviors during the experiment will have higher density scores than team that had a single emergent leader (or a lack of leadership in general).

However, the use of the "density" measure as a proxy for shared leadership does not seem to get at the true nature of the construct. For example, if a four-person team has composite leadership ratings of its four members that are each equal to 3, the density figure for the team is also 3. If a different four-person team has leadership ratings of 5, 1,

5, and 1 for its members, the density score for this team would also be a 3. Clearly, there are important differences in the level of shared leadership between these two fictitious teams – differences that are not captured in the density measure. Thus, advancing on the work of Small & Rentsch (2010), a second method was employed that utilized UCINet to conduct a network analysis of each team. Composite leadership ratings for all dyads were entered into a separate matrix for each team. Each team's matrix of leadership ratings was then used to calculate the "in-degree network centrality" of the team's network. This measure compares the data provided to that of a perfect "star network" – one in which all members of the network are connected via a single person. Graphically, this individual would be placed at the center of the network, with all other team members connected only to the central figure – hence, the visual similarity to a star and the subsequent moniker. The degree of similarity to a perfect star network is captured via the in-degree network centrality calculation, whereby higher totals in this statistic indicate less shared leadership on a given team. In other words, a star network is conceptualized to be the absolute end of the shared leadership continuum; hence, as teams move further away from this configuration, they are considered to be higher in shared leadership. Because of this, correlations and other statistics have been reverse-scored when presented in this text, to correspond with the underlying construct of shared leadership.

Team performance. Team performance was measured through an objective scoring process, based on algorithms provided with the "Tinsel Town" simulation in calculating the expected profit associated with the decisions made by the teams during the experiment. Potential profit levels for the simulation range from under $30M to over $525M. Pilot testing of an alternate set of data using 22 teams of management majors within two sections of an organizational behavior course (N = 90) demonstrated sufficient variability for the purpose of this study (mean = $321M, SD = $75M). Within the current sample, the mean profit level was $442M (SD = $79M). Two teams were not able to arrive at a consensus decision during the allotted time – these teams were assigned a

score of $150M, which represents the fictional budget for their team. In general, all unused budget was considered to be profit in the performance calculation.

Controls. Age, gender, nationality, and scholastic year were collected as control variables. It was not predicted *a priori* that any of these variables would have a significant relationship with any of the focal constructs within the theoretical model.

As mentioned previously, Appendix B lists a number of other variables which were also collected over the course of the experiment – however, they are not a formal part of the dissertation or theoretical model.

Data Analysis

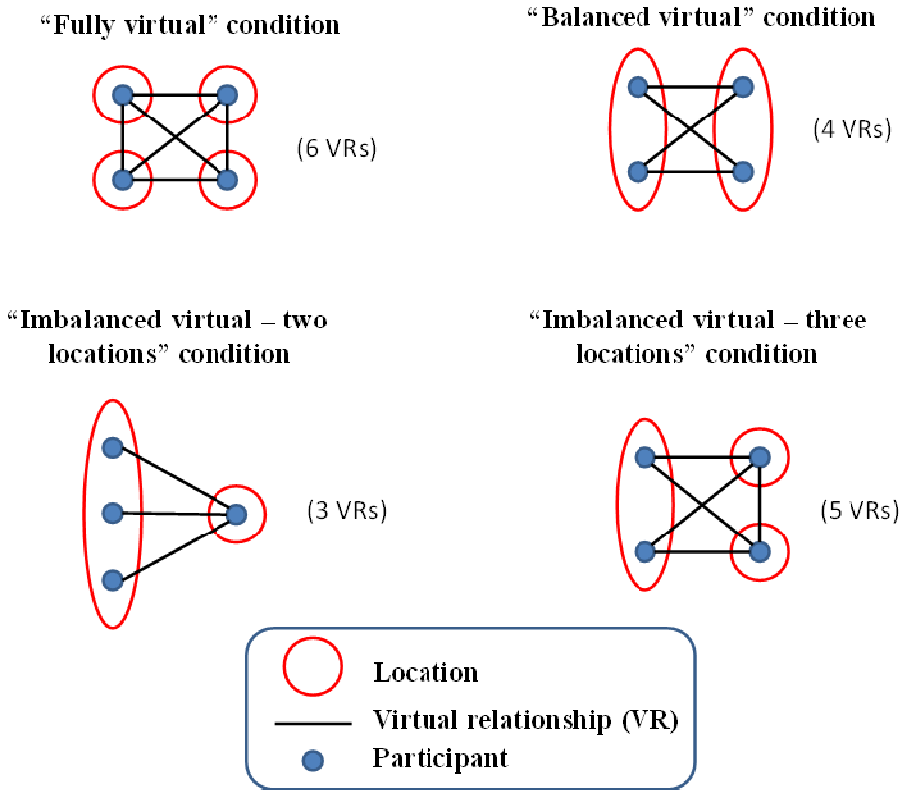
Due to the multi-level nature of the theoretical model, analysis of the data *in toto* presented some issues. First, the relationship between the emergent leadership construct (dependent variable in level 2 - individual) and the shared leadership construct (independent variable in level 3 - team) involved different procedures for data aggregation, depending on the measure of shared leadership under consideration. For the leadership density measure of shared leadership, a global team-level mean of leadership ratings was used, whereby all dyadic ratings of perceived leadership within a given team were averaged together. For the (reverse-scored) network centrality measure, the basis of the measure is again the dyadic leadership ratings within the team. However, in this case, the overall *pattern* of ratings across the team as a whole was the basis for the network centrality calculation. Because there were no direct hypothesized relationships between the individual- and group-level variables, and given the distinct conceptual differences between individual-level *perceptions* of leadership vs. team-level *patterns* of leadership, I chose to analyze the two levels separately. Thus, team-level hypotheses (numbers 1 and 2) were tested via multiple regression in SPSS. Individual-level hypotheses (number 3 through 9) were tested using bivariate correlations and hierarchical regression for each individual hypothesis, and via structural equation modeling to test for mediation across

the entire individual-level predictive model. Finally, Hypothesis 10 featured a second area of cross-level analysis, focused on the relationship between the constructs of perceived trust (level 2 - individual) and collocation (level 1 – between-person). Analysis of variance (ANOVA) was used to look at the difference in trust perceptions between collocated and non-collocated team members across the entire sample. Because Hypothesis 10 was focused at the between-person level, the central unit of analysis was a dyadic rating between team members – given the four-person team structure employed in the experiment, each team member received three composite ratings from their peers in regards to trust (the focus of the hypothesis), GMA, and leadership. Each rating was categorized as to whether or not the rater/ratee were collocated (1) or not (0), which served as the factor variable for the ANOVA analysis.

Table 3.1. Example of Average Response Time Calculation

Chat Transcript	**Response Times**
(11:13:32) TeamMember1: I think we should go with option 2	
(11:13:35) TeamMember2: Why?	TM2 – 3 sec
(11:13:37) TeamMember2: Option 1 looks best to me.	
(11:13:44) TeamMember1: But what about overhead costs – they're too high!	TM1 – 7 sec
(11:13:52) TeamMember2: Hmm…I don't know…	TM2 – 8 sec
(11:13:53) TeamMember1: Gotta think of the bottom line!	TM1 – 1 sec
(11:14:03) TeamMember2: I guess you're right – let's go with option 2	TM2 – 10 sec
(11:14:09) TeamMember1: OK – what next?	TM1 – 6 sec
(11:14:13) TeamMember1: How about marketing?	
(11:14:18) TeamMember2: Jensen looks like the best candidate to me…	TM2 – 5 sec
(11:14:22) TeamMember2: She's got the strongest KSAs of the group.	
(11:14:26) TeamMember1: Right – I agree.	TM1 – 4 sec
Total time gaps for TM1: 18 seconds; 4 responses → average of 4.5 seconds	
Total time gaps for TM2: 26 seconds; 4 responses → average of 6.5 seconds	

Figure 3.1. Team Virtuality/Configuration Designs



CHAPTER IV:

RESULTS

This chapter will report the results of the data analysis used to test the hypotheses put forth in the overall theoretical model. I will begin with a brief overview of the descriptive statistics for all study variables, followed by the presentation of results for each of the ten hypotheses.

Descriptive Statistics

Descriptive statistics are presented in Table 4.1 for all study variables, and Table 4.2 by experimental condition. Zero-order correlations for all study data are presented in Table 4.3 (team level variables) and Table 4.4 (individual level variables). There are several aspects of the data presented in these tables that should be noted. As stated previously, *shared leadership - density* was calculated by taking the mean of all composite ratings for all individual team members on a given team. *Shared leadership – centrality* is represented by UCINet's in-degree network centrality statistic, which has been operationalized as the converse of shared leadership. Hence, bivariate correlations of this variable in Table 4.3 have been reverse-scored, to reflect the shared leadership construct (versus the leadership centrality concept, as the statistic is originally designed to measure). The *virtuality* measure is derived from the experimental conditions manipulated during the experiment, using the proxy measure of the number of virtual relationships in a given configuration (i.e., 3 for the very low virtuality condition, 4 for the low virtuality condition, etc.).

One surprising finding that is evident from a review of Table 4.4 is the very high bivariate correlation between perceptions of *trust* and *GMA* ($r = .83$, $p < .01$). This finding led me to conduct an exploratory factor analysis, focused on discovering the factorial structure underlying the perceptual measures of trust, GMA, and leadership. Results of this analysis are provided in Table 4.5, which clearly show that the trust and

GMA items compose one factor, and the leadership ratings represent a second independent factor. Thus, due to the high multicollinearity exhibited by these items, a composite measure of perceived trust/GMA was derived and used in place of the individual perceived trust and perceived GMA measures for tests of the overall theoretical model at the individual level. Nevertheless, individual hypothesis testing for predicted relationships involving either perceived trust or GMA (e.g., Hypotheses 3-9) was performed using only the item responses for each individual construct. Interpretation of what type of latent variable could be represented by these observed data will be covered later in this chapter during the review of the Hypothesis 9 results.

A second surprising finding relates to the control variables. While age (r = .00) and gender (r = -.03) had non-significant relationships with emergent leadership, both *race* and *class year* had moderate-to-strong correlations with perceptions of emergent leadership (r = .31 for a dichotomous marker of Caucasian vs. non-Caucasian; r = .17 for class year). Given the strength of the relationship between these measures and emergent leadership, statistical tests of the individual-level hypotheses will feature controls for these two variables for hypotheses that involve emergent leadership. The only control variable that correlated significantly with either perceptions of trust or perceptions of GMA was race; hence, the effects of race will be controlled for in subsequent hypothesis tests involving either of these two variables.

Hypothesis Tests

Hypothesis 1: The relationship between shared leadership and objective team performance. For both hypotheses 1 and 2, multiple regression was used to test the hypothesized relationships. In terms of bivariate correlations, both the density (r = .03, p > .10) and centrality (r = .03, p > .10) measures of shared leadership demonstrated small and non-significant relationships with team performance. Not surprisingly, regression

results mirrored the bivariate correlations (density standardized β = .029 [$p > .10$]; centrality standardized β = .025 [$p > .10$]). Hence, Hypothesis 1 was not supported.

Hypothesis 2: The relationship between virtuality and objective team performance. From Table 4.3, it is evident that a moderately strong and negative linear relationship between virtuality and objective team performance exists ($r = -.26$, $p < .01$). However, Figure 4.1 provides a scatterplot diagram of the objective performance scores for each team by virtuality condition – from this schematic, it was apparent that a curvilinear effect may exist. Likewise, Figure 4.2 shows the same scatterplot with the four performance outliers (e.g., team performance scores below $300M) removed. Curve estimation regression was used to assess this possibility – Table 4.6 presents the results of this analysis using the entire sample (Model 1), as well as a reduced sample that had four team objective performance outliers removed (Model 2). In both cases, the linear and curvilinear effects of virtuality were shown to be significant. In Model 1, the linear virtuality β equaled -1.38 ($p < .05$), while the quadratic of the virtuality measure had a β of 1.14 ($p < .10$). In Model 2, the removal of the four outlier data points had a noticeable decreasing effect on the standard estimates of error for the predictor variables, as the linear (β = -1.73 [$p < .01$]) and quadratic (β = 1.50 [$p < .05$]) coefficients demonstrated higher levels of significance. In summary, Hypothesis 2 was supported, but the additional finding of a curvilinear effect was noteworthy.

Hypothesis 3: The relationship between perceptions of trust and perceptions of emergent leadership. For hypotheses 3 through 9, hierarchical regression will be used to test individual hypotheses (entering significant control variables in step 1, followed by variables of interest in step 2), while structural equation modeling (SEM) will be used to test for direct and indirect effects within the overall individual-level (Level 2) theoretical model. Table 4.4 shows that the bivariate correlation between trust perceptions and emergent leadership was quite strong ($r = .48$, $p < .01$). Meanwhile, Table 4.7 shows the large increase that trust perceptions provided in the amount of

variance explained in emergent leadership – change in R^2 was .15 when perceived trust was added to the regression equation (Model 2a) along with the control variables. Thus, Hypothesis 3 is confirmed.

Hypothesis 4: The relationship between perceptions of general mental ability (GMA) and perceptions of emergent leadership. Again referring to Table 4.4, the bivariate correlation between perceived GMA and emergent leadership was also strong (r = .48, p < .01). Table 4.7 shows the hierarchical regression results for perceived GMA and the control variables in the prediction of emergent leadership. The addition of perceived GMA to the regression equation (Model 2b) accounted for an additional 9% of the variance in emergent leadership, providing confirmation for Hypothesis 4.

Hypothesis 5: The relationship between task-based communication frequency and perceptions of GMA. Because task-based communication can be sub-divided into two categories, according to the Marks et al. (2001) typology, I will review the relationships between these two categories of task-based communication and perceived GMA. *Transition* communications did not have a significant relationship with perceptions of GMA (r = .05, p > .10), but *action* communications exhibited a positive and moderately-strong relationship with GMA perceptions (r = .18, p < .01). Given that race was the only control variable that had a significant relationship with perceived GMA, hierarchical regression models for hypotheses 5 and 6 used only race as the initial entry variable. Table 4.8 shows the results of the hierarchical regression, which indicate that action communications accounted for significantly more variance in GMA perceptions when added to the model featuring only the control variable (Model 2a; ΔR^2 = .03). In total, the results provide partial support for Hypothesis 5.[1]

[1] Additional analysis was performed using an overall task-related communication measure, calculated by adding together the transition and action-related communication data points for each participant. Overall task-related communication had a significant relationship with GMA (r = .12, p < .05); however, hierarchical regression analysis showed that overall task-related communication was not a significant predictor (t = 1.91, p > .05) of perceived GMA when entered in a regression equation with the control variable (race)

Hypothesis 6: The relationship between texting language and perceptions of GMA. The bivariate correlation between use of texting language and GMA perceptions was moderate but significant ($r = .17$, $p < .01$). Model 2b in Table 4.8 provides the results of the hierarchical regression analysis – texting language explained an additional 2% of variance in perceptions of GMA, beyond that which could be explained by the control variable alone. Hence, Hypothesis 6 was confirmed.

Hypothesis 7: The relationship between average response time and perceptions of trust. In Table 4.4, it can be seen that the bivariate relationship between an individual's average response time and others' perception of their level of interpersonal trust is small and non-significant ($r = .04$, $p > .10$). Table 4.9 shows the hierarchical regression results, again entering race as a control variable in step 1, with the focal independent variable entered in step 2. Model 2a shows that average response time does not explain any additional variance in perceptions of trust; hence, Hypothesis 7 was not confirmed.

Hypothesis 8: The relationship between relationship-based communication and perceptions of trust. Again referring to Table 4.4, the bivariate correlation between an individual's use of relationship-focused communications and their level of perceived trust by their teammates is .11 ($p < .05$). Using hierarchical regression, Table 4.9 shows that the relationship communications measure was a significant predictor of perceptions of trust, and explained an additional 1% of variance beyond the control variable, providing a weak level of support for Hypothesis 8.

Hypothesis 9: The relationship between perceptions of GMA and perceptions of trust. The bivariate correlation between these two variables was very high ($r = .83$). Given that this extremely strong relationship does not include any correction for measurement error, it is evident that the two item batteries were measuring the same latent construct. Therefore, for the purposes of testing the overall theoretical model at the individual level, the perceptual GMA and trust composite measures were combined to

avoid misinterpretation of these variables as separate constructs. Nevertheless, Hypothesis 9 was confirmed.

A brief discussion of what potential latent variable these items are measuring is in order. Based on a review of the item content, one potential interpretation is that these items are tapping an "implicit leader" profile (e.g., Lord, Foti, & Phillips, 1982; Lord et al., 1984) that individuals possess. Regarding implicit theories, Sternberg (1985) conducted several studies on individuals' implicit theories of intelligence, creativity, and wisdom, and defined implicit theories as "constructions by people…that reside in the minds of these individuals" (Sternberg, 1985: 608). Thus, at their core, implicit theories are formulated from prototypes that exist within individuals of their beliefs regarding what others "should be" in regards to a particular trait or categorization.

Given that these two sets of items (trust and GMA) were ostensibly designed to measure different constructs (i.e., the level of perceived trust that a rater has in a ratee, as well as a rater's perception of the level of intellect possessed by a ratee), it seems that a higher-order latent variable is actually what it being captured by the data. While an implicit leader-type construct may be driving these results, the fact that both the trust and GMA composite measures correlated at roughly a .40 level with the leadership ratings leads me to believe that this is not exactly the case. Instead, I believe that what is likely being measured is an "implicit team member" prototype – in other words, a global assessment of whether or not an individual is perceived as a good teammate. Clearly, both of these dimensions (trust and ability) would be important, positive attributes that most individuals would want their fellow team members to possess. And given the statistical differentiation between these items and the leadership measures, these items seem to be tapping into a more broad generalization of individuals beyond their potential capacity as a leader. If true, it is worth noting that this does not appear to be a specific construct that has been researched in our field up to now; hence, this presents an opportunity for future research to determine if this truly is a unique construct relative to

other implicit theories, as well as what other factors (beyond trust and GMA perceptions) could potentially underlie this construct.

Finally, because the previous discussion is purely speculative, and to maintain some consistency with the original constructs used within the theoretical model (and the existing measures utilized in the experiment), I will continue to use the term "Perceived GMA/Trust" throughout the remainder of the paper when describing the data captured via the perceptual trust and GMA items. Nevertheless, I believe that a strong argument could be made that the actual latent variable being captured by these items is a global assessment of a peer's capacity to be a good team member.

Hypothesis 10: The relationship between rater perceptions of ratee trust and rater/ratee collocation. To test this hypothesis, an analysis of variance (ANOVA) was conducted to view the difference between trust perceptions of collocated individuals and the ratings of trust by individuals who were not collocated with the person that they were rating. Table 4.10 shows the results of this ANOVA, along with descriptive statistics of the two groups (collocated vs. non-collocated). Clear differences were evident in terms of not only perceptions of trust (mean composite trust ratings on a 7-point Likert scale were 5.95 for collocated dyads, compared to 4.93 for non-collocated dyads), but also for perceptions of GMA (composite means of 6.16 – collocated vs. 5.23 – non-collocated) and leadership (on a 5-point Likert scale, composite means of 3.96 – collocated vs. 3.51 – non-collocated). Thus, collocation had a significantly positive influence on trust perceptions, thereby providing support for Hypothesis 10.

Analysis of overall Level 2 (Individual Level) model in the prediction of leadership emergence perceptions. Before concluding this chapter, a brief discussion of the overall Level 2 model is necessary. Using SPSS AMOS software, structural equation modeling (SEM) was performed to test the fit of the overall theoretical model related to the prediction of emergent leadership at the individual level. As mentioned previously during the Hypothesis 9 results discussion, because of the high

multicollinearity that was exhibited between the two proposed mediating variables in the theoretical model (i.e. perceptions of trust and perceptions of GMA), these items were combined into a single composite variable (again, hereafter referred to as "perceived trust/GMA"). All path analysis models presented henceforth will feature only perceived trust/GMA as a potential mediating variable.

In constructing this analysis, I chose to use only observed variables within the model. All of the independent variables (i.e., communications-related constructs) were entered into the first model, with specified paths directly to the DV (emergent leadership) and through the mediating variable (perceived trust/GMA). I chose to have all covariances estimated between all of the independent variables, given that the bivariate correlations among this group of variables indicated significant collinearity (see Table 4.4). The mediator (perceived trust/GMA) was entered into the SEM model as a single observed data point, consisting of the average of the composite averages of trust and GMA by each of the three raters. Likewise, the DV of emergent leadership was entered into the model as a single observed data point (mean of the three raters' composite ratings of emergent leadership for a given individual).

Figure 4.3 shows the results of the SEM path analysis, using the entire hypothesized model (with the exception of the aforementioned change to the mediators). Because the model is saturated (i.e., has zero degrees of freedom), fit is perfect. However, this analysis does provide a general overview of the strength of relationships between all of the focal variables, as specified in the original theoretical model in Figure 1.1. Significant relationships are found between two of the independent variables (action communications and texting language) and the proposed mediator (perceived trust/GMA), while three measures were significant predictors of emergent leadership (perceived trust/GMA, and both types of task-based communication, transition and action communications). Table 4.11 provides an overview of the direct and indirect effects of the focal study variables in the prediction of emergent leadership. It is worth noting that

the squared multiple correlation for the prediction of the trust/GMA composite variable was only .05, while the total R^2 for predicting leader emergence within the model was .31.

Based on the information provided by the just-identified model, I analyzed several other possible models that had > 0 degrees of freedom, in the hopes of deriving a more parsimonious and better-fitting model for the data set. Due to the very low level of unique variance that could be attributed to the relationship-based communication variable in the prediction of either trust/GMA (standardized path coefficient of .03, n.s.) or leadership emergence (standardized path coefficient of .00, n.s.), the variable was dropped altogether from all subsequent models. Likewise, the links between transition (task-based) communication and trust/GMA (standardized path coefficient of -.07, n.s.), and between texting language and emergent leadership (standardized path coefficient of .02, n.s.) were also deleted due to low unique predictive capability. Three proposed models were then analyzed, all of which varied in their use of the average time to respond (ATR) construct (see Figure 4.4 for graphical representations of the three alternative models. Model 1 included the relationship between ATR and both trust/GMA and emergent leadership. Model 2 included only the relationship between ATR and leader emergence. Model 3 dropped ATR from the overall model. A comparison of the models and several fit indices are provided in Table 4.12. All indicate reasonably similar levels of fit with the data; however, for the purposes of achieving parsimony, Model 3 (eliminating ATR from the model) is probably the optimal choice.

Summary of results of hypothesis testing. Table 4.13 provides a summary of the hypotheses and results presented in this chapter. From an overall perspective, a majority of the hypothetical bivariate relationships were confirmed; however, based on the path analysis results presented above, it was evident that most of the effects of communication-related independent variables on emergent leadership were direct, rather

than mediated through perceptions of trust and GMA as originally hypothesized. Chapter 5 will discuss this, and other results, in more detail.

Table 4.1. Descriptive Statistics for All Study Variables

Variable	N	Mean	SD	Minimum	Maximum	Skewness	Kurtosis
Team-Level Statistics							
Shared Leadership - Density [a]	86	3.60	0.32	2.92	4.28	-0.06	-0.31
Shared Leadership - Centrality [b]	86	17.00	7.72	4.71	39.67	0.42	-0.50
Virtuality [c]	86	4.51	1.13	3.00	6.00	0.00	-1.37
Performance [d]	86	441.98	79.33	150.00	527.88	-1.66	3.75
Individual-Level Statistics							
Transition Communication [e]	344	1.72	1.91	0.00	11.00	1.69	3.61
Action Communication [e]	344	2.56	2.63	0.00	15.00	1.42	2.26
Texting [e]	344	6.31	7.31	0.00	38.00	1.74	3.17
Relationship Communication [e]	344	0.80	1.21	0.00	8.00	2.32	7.43
Average Response Time [f]	344	19.89	12.01	0.00	85.57	2.00	6.52
Perceived Trust [g]	344	5.19	0.89	2.50	7.00	-0.49	-0.09
Perceived GMA [g]	344	5.47	0.88	2.89	7.00	-0.50	-0.15
Perceived Leadership [a]	344	3.60	0.73	1.00	4.93	-0.90	0.72

Note: Units of measurement for variables: a. 5-point Likert scale; b. Percentage; c. Number of dyadic virtual relationships on team; d. Profit - Millions of dollars; e. Number of coded instances; f. Time - seconds; g. 7-point Likert scale

Table 4.2. Descriptive Statistics for Study Variables by Condition

Variable	VL Virtuality Condition			L Virtuality Condition			H Virtuality Condition			VH Virtuality Condition		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
Team-Level Statistics												
Shared Leadership - Density [a]	21	3.50	0.30	22	3.69	0.31	21	3.56	0.34	22	3.65	0.31
Shared Leadership - Centrality [c]	21	20.02	7.25	22	15.21	7.07	21	17.99	8.72	22	14.96	7.12
Performance [d]	21	483.28	42.91	22	443.59	81.65	21	409.00	79.52	22	432.42	90.20
Individual-Level Statistics												
Transition Communication [e]	84	1.12	1.83	88	1.80	1.89	84	1.83	2.00	88	2.09	1.83
Action Communication [e]	84	1.46	1.57	88	2.66	2.53	84	2.35	2.69	88	3.73	3.00
Texting [e]	84	4.18	7.44	88	6.36	6.12	84	5.49	6.05	88	9.06	8.54
Relationship Communication [e]	84	0.68	1.21	88	0.60	0.95	84	0.86	1.22	88	1.07	1.38
Average Response Time [f]	84	26.03	16.97	88	20.65	11.68	84	18.84	8.61	88	14.29	4.11
Perceived Trust [g]	84	5.09	0.92	88	5.32	0.92	84	5.03	0.98	88	5.32	0.70
Perceived GMA [g]	84	5.48	0.81	88	5.70	0.88	84	5.24	0.99	88	5.46	0.79
Perceived Leadership [a]	84	3.50	0.84	88	3.69	0.70	84	3.57	0.74	88	3.64	0.64

Note: Units of measurement for variables: a. 5-point Likert scale; b. Number of dyadic virtual relationships on team; c. Percentage; d. Profit - Millions of dollars; e. Number of coded instances; f. Time - seconds; g. 7-point Likert scale

Table 4.3. Zero-Order Correlation Matrix for Team-Level Variables

Variable	Mean	SD	1	2	3	4
1. Shared Leadership - Density	3.60	0.32	----			
2. Shared Leadership - Centrality[a]	17.00	7.72	0.58 **	----		
3. Virtuality	4.51	1.13	0.11	0.18 *	----	
4. Objective Performance	441.98	79.33	0.03	0.03	-0.26 **	----

Note. a = correlations for this item are reverse-scored, due to the fact that higher scores in the centrality measure reflect lower levels of shared leadership

N = 86 for all variables

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

Table 4.4. Zero-Order Correlation Matrix for Individual-Level Variables

Variable	N	Mean	SD	1	2	3	4	5	6	7	8	9	10
1. Race	342	0.78	0.42	----									
2. Class Year	340	2.92	0.68	0.09	----								
3. Transition	344	1.72	1.90	0.09	0.15**	----							
4. Action	344	2.56	2.60	0.10	0.06	0.43**	----						
5. Texting	344	6.31	7.30	0.05	0.12*	0.28**	0.40**	----					
6. Relationship	344	0.80	1.20	0.07	0.12*	0.35**	0.51**	0.41**	----				
7. Response Time	344	19.90	12.00	0.12*	0.08	0.04	0.00	-0.09	-0.03	----			
8. Perceived Trust	344	5.19	0.92	0.19**	0.08	0.02	0.17**	0.17**	0.11*	0.04	----		
9. Perceived GMA	344	5.41	1.02	0.15*	0.04	0.04	0.15**	0.12*	0.09	0.07	0.85**	----	
10. Emergent Leadership	344	3.60	0.73	0.31**	0.17**	0.26**	0.38**	0.22**	0.22**	0.10	0.46**	0.40**	----

Note. Race - Dichotomous coding of Caucasian (1) and non-Caucasian (0). Class Year - Scale from 1-4 (1 = Freshman through 4 = Senior)

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

Table 4.5. Pattern Matrix for Factor Analysis of Trust, GMA, and Leadership Items

Item	Factor	
	1	2
Trust1	**0.832**	0.071
Trust2	**0.849**	0.036
Trust3	**0.871**	0.029
Trust4	**0.898**	0.010
Trust5	**0.918**	0.004
Trust6	**0.901**	-0.015
GMA1	**0.938**	-0.055
GMA2	**0.943**	-0.028
GMA3	**0.926**	-0.016
Lead1	0.121	**0.772**
Lead2	-0.005	**0.887**
Lead3	0.083	**0.785**
Lead4	-0.092	**0.888**
Lead5	-0.050	**0.857**

Note: Extraction Method: Principal Axis Factoring.
Rotation Method: Promax with Kaiser Normalization.
(Rotation converged in 3 iterations)

Table 4.6. Curve Estimation Regression Results for Virtuality and Objective Team Performance

`		Unstandardized		Standardized			
Model	**Variable**	**B**	**SE**	**Beta**	**t**	***p***	**R^2**
1	(Constant)	567.57	45.91		12.36	0.00	
(N = 86)	Virtuality	-97.30	41.69	-1.38	-2.33	0.02	.07
	Virtuality^2	15.72	8.18	1.14	1.92	0.06	.04
2	(Constant)	558.74	32.37		17.26	0.00	
(N = 82)	Virtuality	-86.19	29.64	-1.73	-2.91	0.01	.06
	Virtuality^2	14.77	5.85	1.50	2.53	0.01	.07

Note. Model 1 represents the full data set. Model 2 represents the full data set with four outliers data points removed (four teams with objective performance scores of less than $300M).

Table 4.7. Hierarchical Regression Results for Proximal Predictors of Emergent Leadership Perceptions

Model	Variable	Unstandardized B	Unstandardized SE	Standardized Beta	t	*p*	Total R^2	ΔR^2
1	(Constant)	2.76	0.17		16.08	0.00		
	Race	0.52	0.09	0.30	5.75	0.00	0.12	
	Class Year	0.15	0.05	0.14	2.82	0.00		
2a	(Constant)	1.24	0.24		5.23	0.00		
	Race	0.39	0.08	0.22	4.69	0.00		
	Class Year	0.13	0.05	0.12	2.58	0.01	0.27	0.15
	Perceived Trust	0.33	0.04	0.40	8.51	0.00		
2b	(Constant)	1.30	0.26		5.02	0.00		
	Race	0.42	0.09	0.24	5.00	0.00		
	Class Year	0.14	0.05	0.14	2.85	0.00	0.23	0.11
	Perceived GMA	0.28	0.04	0.34	7.11	0.00		

Note: Dependent Variable: Emergent Leadership

Table 4.8. Hierarchical Regression Results for Predictors of Perceptions of General Mental Ability

Model	Variable	Unstandardized B	Unstandardized SE	Standardized Beta	t	*p*	Total R^2	ΔR^2
1	(Constant)	5.22	0.10		52.73	0.00	0.02	
	Race	0.32	0.11	0.15	2.88	0.00		
2a	(Constant)	5.15	0.11		48.10	0.00		
	Race	0.30	0.11	0.14	2.66	0.01		
	Transition	-0.02	0.03	-0.04	-0.61	0.54	0.04	0.02
	Action	0.05	0.02	0.15	2.48	0.01		
2b	(Constant)	5.15	0.10		49.03	0.00		
	Race	0.31	0.11	0.15	2.79	0.01	0.04	0.02
	Texting	0.01	0.01	0.11	2.11	0.04		

Note: Dependent Variable: Perceptions of GMA

Table 4.9. Hierarchical Regression Results for Predictors of Perceptions of Trust

Model	Variable	Unstandardized B	Unstandardized SE	Standardized Beta	t	*p*	Total R^2	ΔR^2
1	(Constant)	4.88	0.10		48.58	0.00	0.03	
	Race	0.40	0.11	0.19	3.51	0.00		
2a	(Constant)	4.88	0.12		40.05	0.00		
	Race	0.40	0.11	0.19	3.47	0.00	0.03	0.00
	Response Time	0.00	0.00	0.00	0.01	1.00		
2b	(Constant)	4.84	0.10		46.82	0.00		
	Race	0.39	0.11	0.18	3.38	0.00	0.04	0.01
	Relationship	0.07	0.04	0.09	1.77	0.08		

Note: Dependent Variable: Perceptions of Trust

Table 4.10. Descriptive Statistics and ANOVA Results for Hypothesis 10

Descriptive Statistics

Variable	Collocation[a]	N	Mean	SD	SE	95% CI for Mean Lower	95% CI for Mean Upper
Trust	0	768	**4.93**	1.60	0.06	4.81	5.04
	1	255	**5.95**	1.46	0.09	5.77	6.13
	Total	1023	5.18	1.63	0.05	5.08	5.28
GMA	0	767	**5.23**	1.57	0.06	5.12	5.34
	1	256	**6.16**	1.41	0.09	5.99	6.33
	Total	1023	5.46	1.59	0.05	5.36	5.56
Leadership	0	774	**3.51**	0.97	0.03	3.44	3.58
	1	258	**3.96**	0.85	0.05	3.85	4.06
	Total	1032	3.62	0.96	0.03	3.56	3.68

Note: [(a)] 0 = Virtual; 1 = Collocated

ANOVA

		SS	df	MS	F	Sig.
Trust	Between Groups	200.35	1	200.35	81.50	0.000
	Within Groups	2510.07	1021	2.46		
	Total	2710.42	1022			
GMA	Between Groups	167.50	1	167.50	71.18	0.000
	Within Groups	2402.70	1021	2.35		
	Total	2570.20	1022			
Leadership	Between Groups	38.84	1	38.84	43.95	0.000
	Within Groups	910.12	1030	0.88		
	Total	948.95	1031			

Table 4.11. Indirect and Direct Effects of Focal Study Variables

Variable	Indirect	Direct	Total
Transition	-.03	.13 **	.11 *
Action	.06 *	.24 **	.30 **
Texting	.05 *	.02	.07
Relationship	.01	.00	.01
ATR	.03	.07	.10
Perceived Trust/GMA		.36 **	.36 **

Note: Dependent Variable: Emergent Leadership

* $p < .05$ ** $p < .01$ (For the indirect effects column, notations of significance represent the significance of the relationship between the independent variable and the mediating variable [perceived trust/GMA])

ATR = Average time to respond; GMA = General mental ability

Table 4.12. Alternative Level 2 Models and Fit Indices

Index	Model 1	Model 2	Model 3
Description	ATR (Direct + indirect)	ATR (Direct only)	ATR Dropped from Model
Chi-sq	1.45	3.15	1.14
df	2	3	2
p-value	0.485	0.369	0.565
GFI	0.999	0.997	0.999
AGFI	0.985	0.979	0.990
NFI	0.995	0.989	0.996
CFI	1.000	0.999	1.000
RMSEA	0.000	0.012	0.000
90% CI - lower limit	0.000	0.000	0.000
90% CI - upper limit	0.097	0.093	0.091

Note. GFI = Goodness-of-Fit Index; AGFI = Adjusted Goodness-of-Fit Index; NFI = Normed Fit Index; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation

Table 4.13. Summary of Hypotheses and Results

Hypothesis	Supported	Partial/Weak Support	Not Supported
Hypothesis 1: The level of shared leadership within a team will be positively related to objective team performance.			x
Hypothesis 2: Level of team virtuality (via differences in configuration) will have a negative relationship with objective team performance. Teams with a greater proportion of non-collocated dyadic relationships will have lower objective team performance when compared to teams with a lesser proportion of non-collocated dyadic relationships.	x		
Hypothesis 3: Perceptions of an individual's trustworthiness will be positively related to leadership emergence.	x		
Hypothesis 4: Perceptions of an individual's general mental ability will be positively related to leadership emergence.	x		
Hypothesis 5: An individual's level of task-based communication will be positively related to peer perceptions of that individual's general mental ability.		x	
Hypothesis 6: An individual's frequency of use of texting language will be positively related to peer perceptions of that individual's general mental ability.	x		
Hypothesis 7: An individual's average response time will be negatively related to peer perceptions of that individual's trustworthiness.			x
Hypothesis 8: An individual's level of relationship-based communication will be positively related to peer perceptions of that individual's trustworthiness.		x	
Hypothesis 9: Peer perceptions of an individual's GMA will be positively related to peer perceptions of that individual's trustworthiness.	x		
Hypothesis 10: Collocation will be positively related to peer perceptions of an individual's trustworthiness, such that individuals who are collocated will rate each other higher in trustworthiness than individuals who are not collocated.	x		

Figure 4.1. Scatterplot of Team Performance Results by Virtuality Condition

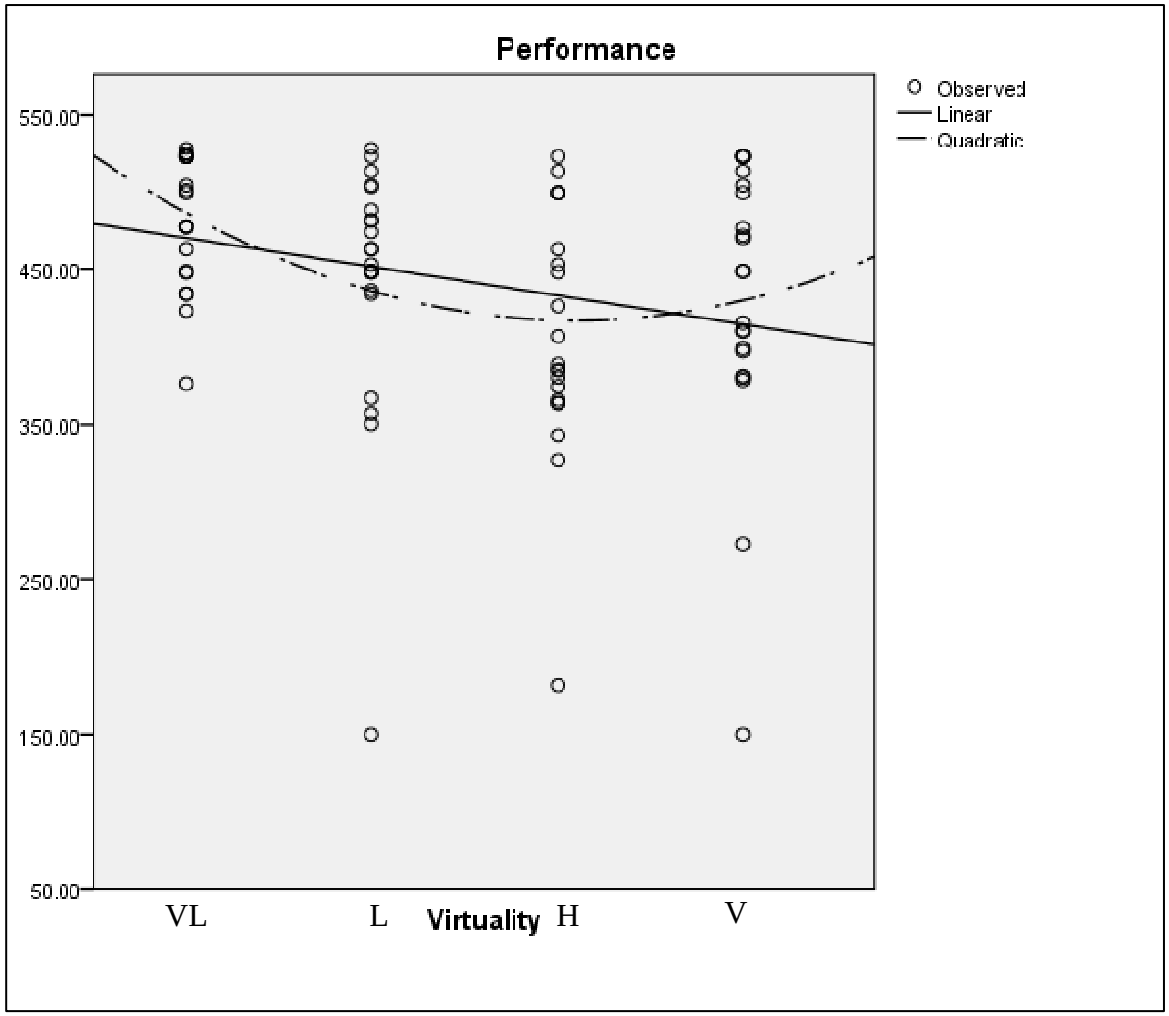


Figure 4.2. Scatterplot of Team Performance Results by Virtuality Condition (Outliers Removed)

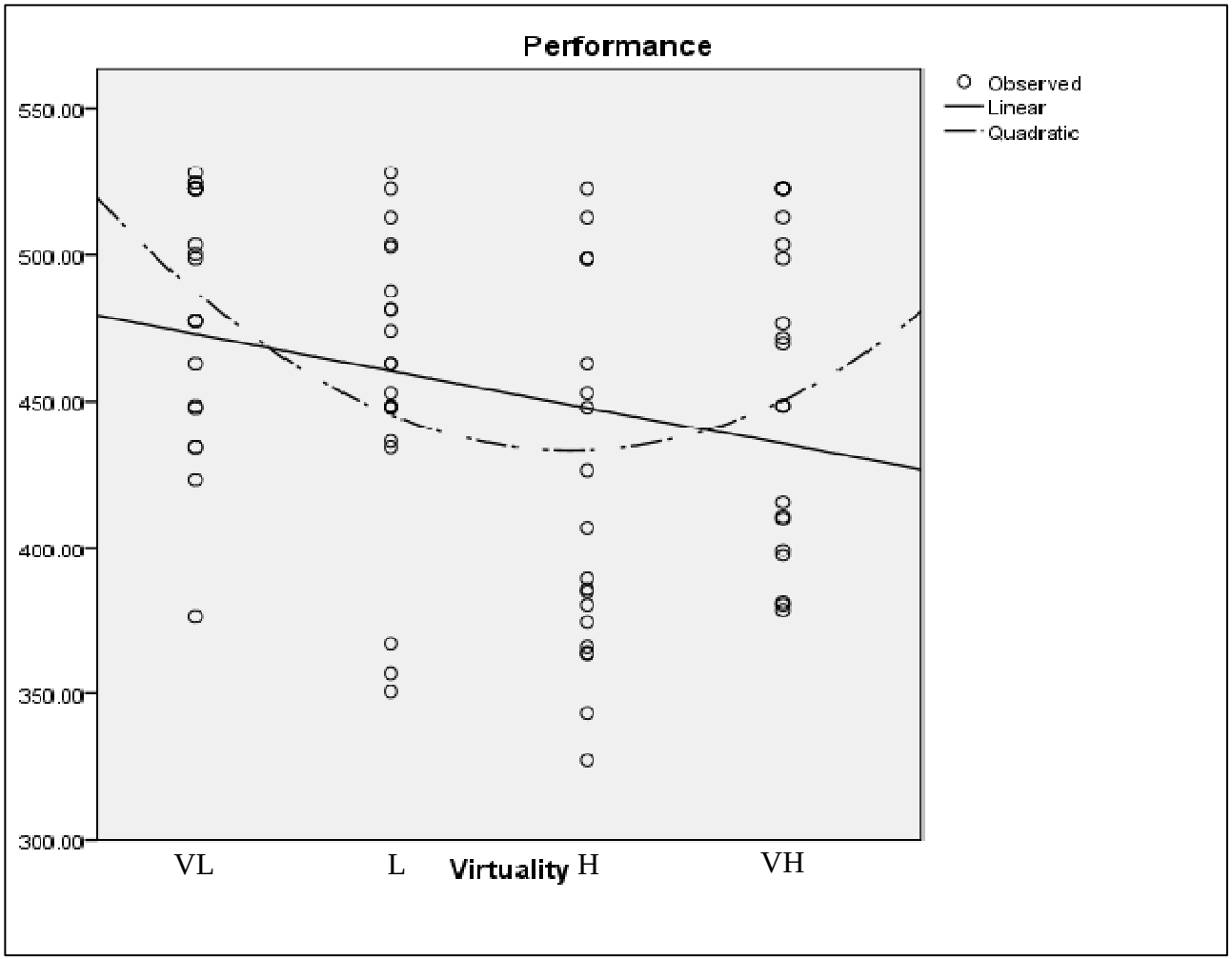
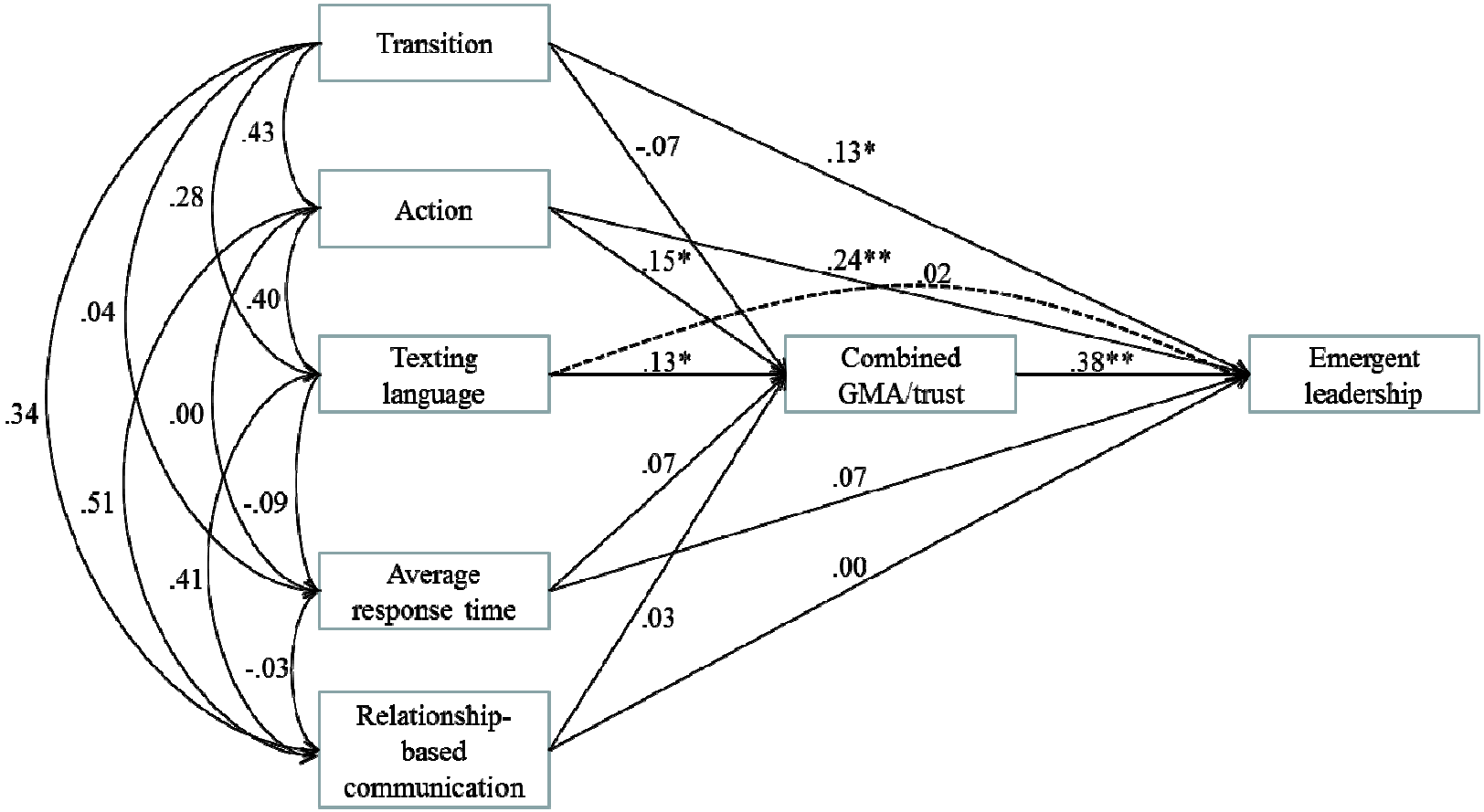


Figure 4.3. Path Analysis of Full Level 2 (Individual Level) Model



Note: All coefficient estimates are standardized. * = $p < .05$ ** = $p < .01$

Figure 4.4. Alternate Level 2 Models

Model 1:

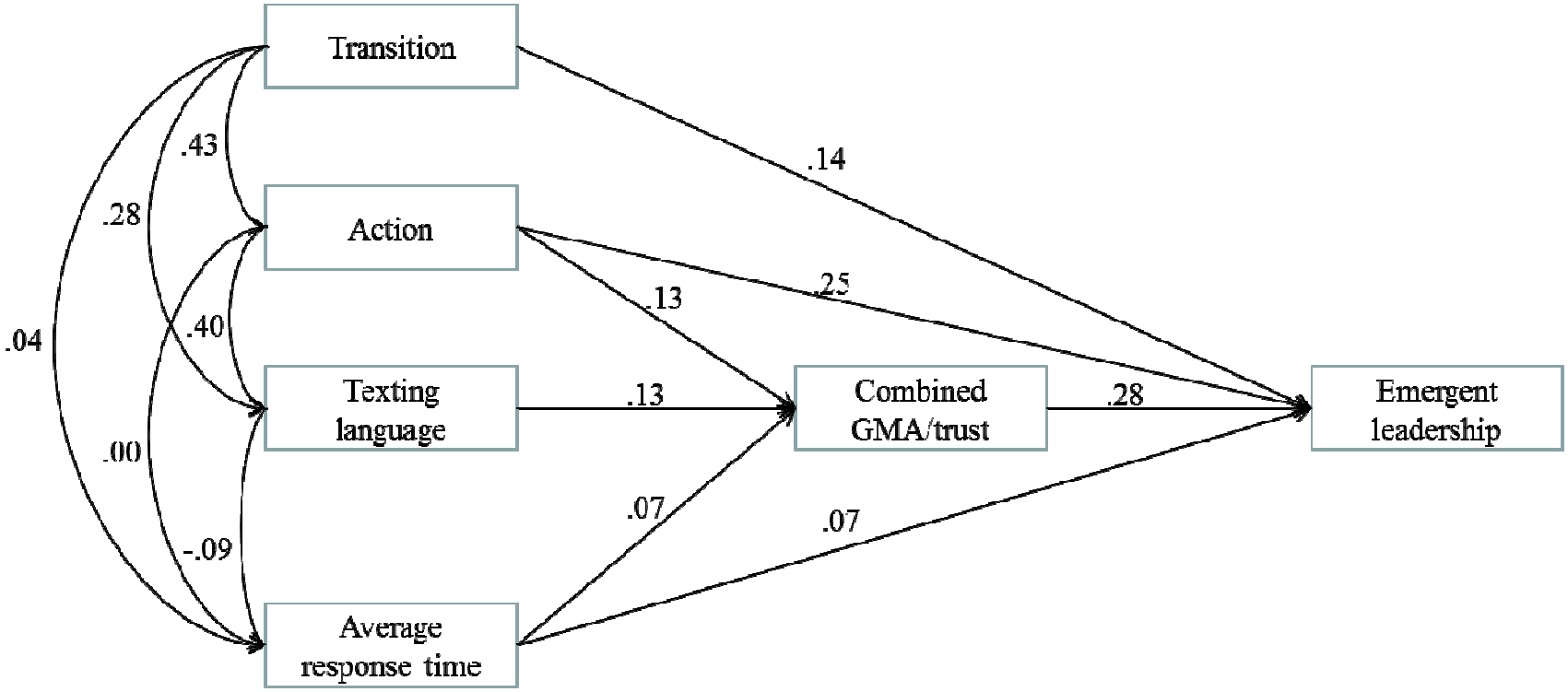


Figure 4.4 continued

Model 2:

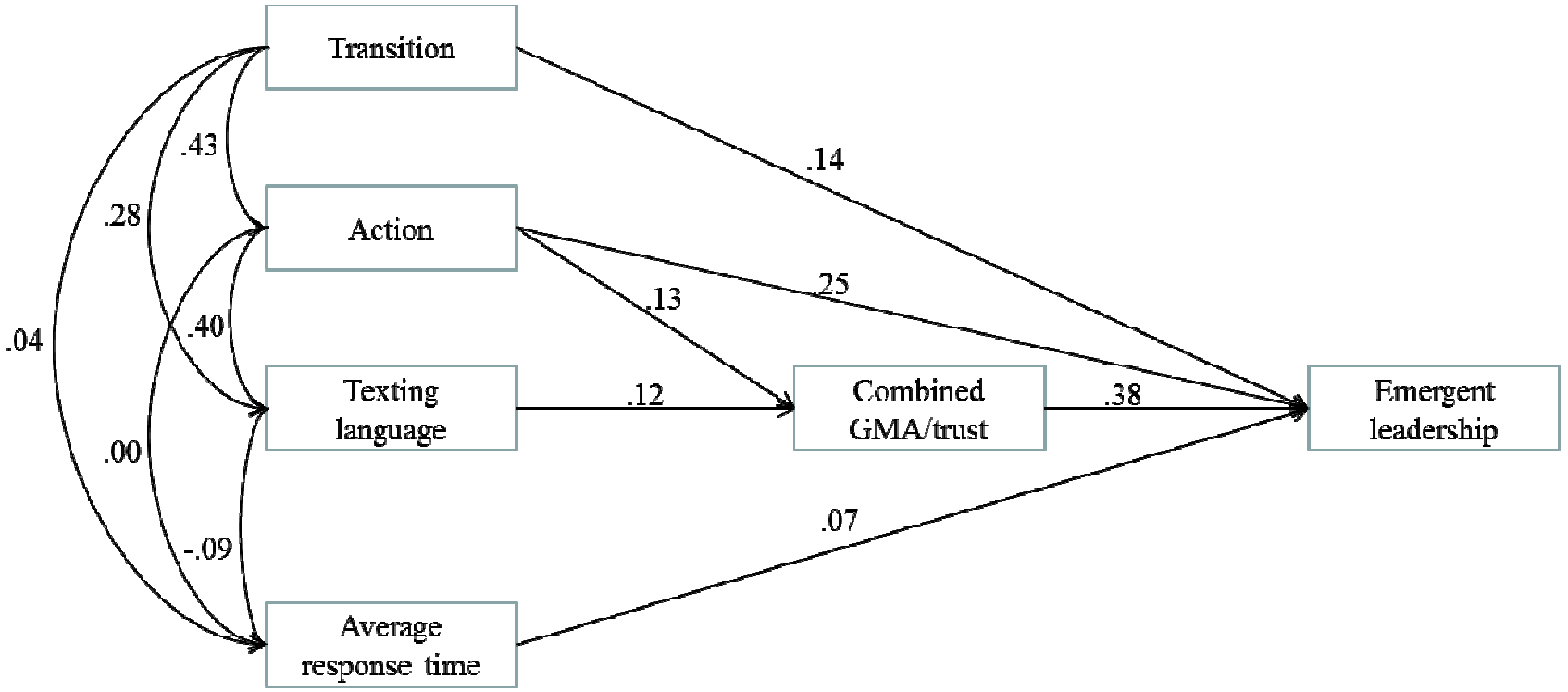
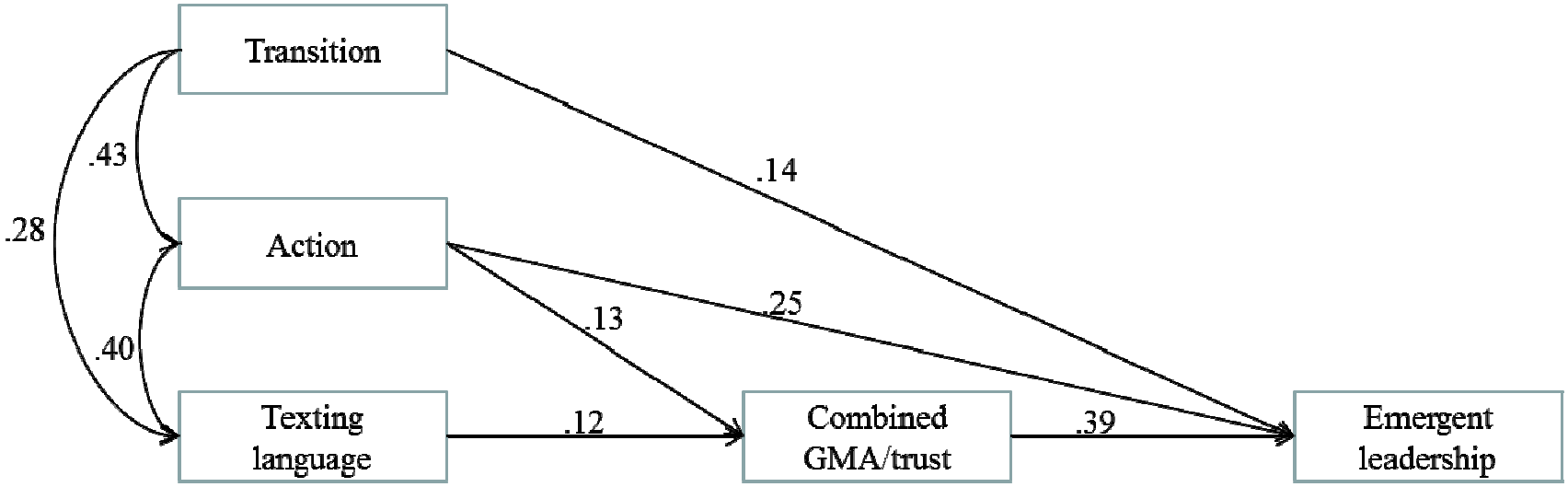


Figure 4.4 continued

Model 3:



CHAPTER V:
DISCUSSION

The final chapter of this dissertation provides an overall discussion of the research findings from the experiment that was conducted to empirically test the theoretical model provided in Figure 1.1. I will begin with an overview of the particular findings from the study, providing interpretation of the results as well as potential justifications for hypotheses that did not receive empirical support. I will then discuss the limitations of the current study, followed by a review of implications for practice that can be gleaned from these results. The chapter concludes with a discussion of potential directions for future research and some parting thoughts.

Overview of Findings

The overall purpose of this study was two-fold. First, the study was designed to focus on the impact of dispersion (i.e., collocation and configuration) on both team performance and emergent leadership within the virtual team context. Second, a theoretical model was developed and tested that focused on communication-related behaviors (some particular to computer-mediated communications) and their impact on how individuals are perceived by others, particularly in regards to two constructs that are central to many leadership theories: trust and ability. In the ensuing pages, I will review the results for each of the hypotheses in the study, beginning with potential explanations for why two of the hypotheses did not receive empirical support.

But before continuing with the discussion of the individual hypotheses, some clarifying comments regarding the overall model, particularly centered on the Level 2 (individual-level) results, is in order. While most of the individual hypotheses were confirmed by the data, I did not include any formal hypotheses regarding the mediation effects that were predicted in the model – clearly, the results presented at the end of the previous chapter in this regard were disappointing. The total R^2 for the proposed

mediators (perceived trust and GMA) as predicted by the communication-related variables was actually quite low (.05); hence, it was nearly impossible for mediated effects on leadership emergence to be found. While the predictive capacity of the model regarding emergent leadership was considerably stronger (R^2 = .31), the overall results still fell short of expectations.

Because of these findings, I felt that it was necessary to do several *post hoc* analyses that were not originally planned. My initial motivation for this line of investigation was to try to understand why certain hypotheses did not receive empirical support – hence, the first section of this discussion is focused on this endeavor. But beyond this analysis, I was also intrigued by several patterns that became apparent to me through observations made as the administrator for the experiment. Because the initial quantitative analysis did not fully explain these patterns, I employed a mixed methods approach to several aspects of the data and the transpiring events that I observed over the course of the experiment. The results of these analyses will be discussed at multiple times throughout this discussion section.

Thus, my goal for this chapter is to move beyond just a discussion of the quantitative analyses that were conducted to test the formal hypotheses. Instead, my objective is to delve deeper into some of the more interesting relationships and patterns that occurred in these experimental teams, with the hopes that a combination of qualitative and quantitative analysis can shed further light on the focal constructs and processes involved in this study. To this end, a mixed methods approach was used to better understand the somewhat disappointing results regarding the relationship between patterns of leadership within teams and their performance.

Hypothesis 1 (not supported) – Shared leadership and team performance. Perhaps the most surprising result of the study was that neither the density nor the centrality measures of team leadership were a significant predictor of team performance. Given the vast literature on the relationship between leadership and performance at the

team level (see meta-analyses by Stewart, 2006 and Burke, Stagl, Klein, Goodwin, Salas, & Halpin, 2006; also see Carson et al., 2007; Ensley et al., 2006; Pearce & Sims, 2002; Taggar et al., 1999), it is clear that leadership can have a significant impact on team performance. Thus, while shared leadership was not an important factor in team performance in this study, a post hoc analysis was conducted to investigate other possible methods in which leadership could have been impactful on team performance.

Through a team-by-team review of objective performance levels and individual leadership ratings of each team, a pattern began to emerge. Many of the lowest performing teams (seven of the ten lowest performing teams, including the worst three) had one member of the team ranked significantly below the other three members. Table 5.1 lists the objective performance levels and the composite leadership ratings for each individual team member in the ten lowest performing teams. It is worth noting that the average leader density of the ten teams listed in Table 5.1 is 3.58, which is only .02 below the overall mean for the entire dataset – hence, the possibility that a general lack of leadership at the team level could have contributed to poor team performance is not likely. While the variance among team member ratings was quite low in some teams (e.g., teams 104 and 126), many of these low performing teams had an individual team member that was providing a level of leadership that was noticeably below the rest of the team (e.g., teams 102, 118, 162, and 177).

Based on the discovery of this pattern, I used the mean leadership density score for each team as a dividing line between individuals, thus dividing the members of a team into two groups: “leaders” (those whose composite leader rating was above the team’s mean) and “non-leaders” (individuals with leader ratings below the mean of the team). This was done to at least partially account for potential individual- and team-level bias in leadership ratings – I was concerned that using the global leadership density mean as the cutoff between leaders and non-leaders would have been inconsistent with the dynamics of some teams (e.g., teams that as a whole exemplified either very strong or laissez-faire

leadership). By using the team-level mean as the dividing line, I hoped to better capture the idiosyncrasies of individual raters and/or team-level dynamics that would be reflected in the leadership ratings within each team. I then categorized the teams by the number of "leaders" on the team, which divided the overall dataset into three groups: 1-leader teams (N = 7), 2-leader teams (N=52), and 3-leader teams (N=27). Subsequently, I conducted an ANOVA between the three groups on three different team-level dependent variables: mean leader density, virtuality, and performance. Descriptive statistics of this analysis are provided in Table 5.2, while the ANOVA results and post hoc Bonferroni test results (done to correct for uneven group sizes among the three categories) are provided in Tables 5.3 and 5.4, respectively. While no significant relationships were found between the number of leaders in a group and the team's overall leader density score or the experimental condition (i.e., level of virtuality) for the team, an effect was found in regards to team performance. Teams that featured only 1 team member with a composite leader score above the mean had performance levels approximately one SD above the teams that had three team "leaders" (i.e., only one team member below the team's leadership density score).

There are several interpretations that could be made, based on these results. An obvious conclusion that could be reached is that a team's performance will decline as the number of emergent leaders on the team increases. Thus, teams should ideally have a single recognized leader – a conclusion that stands in direct opposition to the notion of shared leadership. But given the context and characteristics of the task in the current study, this is perhaps a valid conclusion. Teams were forced to assimilate a great deal of data and make a large number of consensual decisions in a relatively short amount of time. For some of the lowest performing teams, arriving at a consensus on how to approach the work (much less solve the problem) proved to be an issue. As an illustrative example, Table 5.5 provides three excerpts of the chat transcript for one of the lowest performing teams. Beginning at 17 minutes into the exercise (team members had 15

minutes of individual review time to begin the activity), team members conducted a brief debate over how to best go about completing the task. At the 30 minute mark, after additional individual analyses were done, team members continued to debate over procedural issues. Again at 45 minutes, team members still exhibited confusion over the decision-making process, and valuable time was wasted. Throughout this process, several of the team members engaged in attempts to influence the group's direction; yet, no one was able to provide *clear* direction at any point in time. As a result, time expired before they were able to arrive at a consensus decision, and the team was subsequently given the default score of $150 million.

Conversely, Table 5.6 shows a brief excerpt from a team that featured both high performance and clear direction – in this case, direction was provided by multiple team members. At 23:05, team member #3 makes a procedural suggestion, which is immediately agreed upon by the rest of the team. Later, at 27:01, team member #1 makes a second suggestion regarding process – again, the team quickly moves in that direction. Subsequently, at 28:26, team member #2 tries to push the group towards consensus regarding a particular film, again moving the team closer to their end goal. Thus, in a span of five minutes, the team was able to gain a general degree of consensus on the decision-making procedure and begin to derive the team's overall solution. Certainly, this stands in stark contrast to the low performing team's discussion.

Thus, my first overall conclusion from this analysis is that the *clarity* of leadership is what is most crucial to team performance in this context – not the number of "leaders", per se. In this context, leadership "clarity" refers to both the level of agreement within the team on which team member(s) are serving in a leadership capacity, as well as the level of understanding among team members of how the team will operate. Given the nature of the task, the volume of information that needed to be processed, and the relatively short amount of time provided to the teams to arrive at a consensus solution, teams that were able to quickly agree upon a process and/or criteria for basing

their decision had a distinct advantage. In turn, I believe that it is also fair to assume that teams that featured only one "leader" were more likely to have increased levels of clarity in regards to their team's decision-making process when compared to teams with multiple leaders. Thus, while the data suggest that more centralized leadership will lead to higher levels of performance, it is possible that the underlying cause of that relationship is attributable to the clarity of the leadership being provided. This conclusion mirrors the results of a previous study by Yun, Faraj, & Sims, Jr. (2005) which utilized a sample of trauma resuscitation teams. In their study comparing directive vs. empowering leadership styles, a directive leadership approach by the attending surgeon was clearly more effective than an empowering style in critical, life-threatening situations. While the top management team simulation employed in this study certainly did not involve potential loss of life, it did feature a clear deadline that required teams to quickly and effectively make a complex decision. Thus, for this study, teams that had clear divisions of leadership, as well as leaders that were directive in nature, seemed to demonstrate the highest levels of leadership *clarity* and team performance. While not applicable to all contexts, these findings are certainly applicable to a common scenario in virtual team work – teams with little or no prior history together, tight deadlines, and a need to collaborate and make decisions quickly.

While the previous discussion has focused on the patterns of the leader(s) that emerged from these teams, an alternate view of the data that is focused specifically on the non-leaders may be fruitful as well. In particular, the teams that featured three "leaders" had, by fiat, a fourth team member that was perceived as significantly lower in leadership influence relative to the other three. In the "3 leader" group (N = 27), the mean composite individual rating for the non-leader was 2.62 (on a 5-point Likert scale), compared to a mean of 3.98 for the team members whose composite ratings were above the mean [$F(1,106) = 149.68$, $p < .001$]. Beyond the difference in leadership rating, participation levels in the computer-mediated chat sessions also showed variance, as non-

leaders averaged a total of 18.7 chat messages, versus 24.6 for the leaders [$F(1,105) = 3.05$, $p < .10$]. Collocation had an impact as well, as the average number of collocated teammates for the leader category was 0.81, while the non-leader team members had an average of 0.44 collocated teammates [$F(1,106) = 6.03$, $p < .05$].

However, an interesting pattern arises when the two variables considered above are analyzed in tandem. Table 5.7 shows the average number of messages sent by team members in each leader grouping and by condition. It comes as no surprise that in the fully virtual condition, there is a significant difference in the mean number of messages sent between leaders (41.44) and non-leaders (29.33). But as the level of virtuality decreases, the gap between the leaders and non-leaders in terms of frequency of communication also decreases – in fact, the non-leaders actually communicated via chat on average *more than* the leaders in the low virtuality condition (three collocated individuals with one isolate). Thus, while the quantity of chat-based communication clearly had an overall impact on leadership perceptions across the sample as a whole (the Pearson correlation between the number of chat messages sent and leadership rating was .35), this effect was negated within the very low virtuality condition by collocation – or more specifically, the lack of collocation for the fourth team member. Five teams within the VL condition also had three "leaders" – in all five cases, the "non-leader" was also the isolate. An extreme, yet illustrative, example of how these teams interacted virtually is provided in Table 5.8, which contains the entire chat transcript for one particular team. No communication between the collocated team members and the isolate occurred until almost 45 minutes into the exercise – by this point, the three collocated team members had completely devised a solution on their own. Although the chat-based communication levels between the collocated and non-collocated team members were similar, the isolation of the fourth team member from the face-to-face conversations occurring among the collocated team members obviously had the strongest impact on the isolate's leadership ratings from his/her colleagues.

But what effect did the "three leader/one non-leader" structure have on team performance? Returning to Table 5.4, we can see that teams that featured three team members with leadership ratings above the team mean had lower performance levels than the other two categories of leadership structure (i.e., one- and two-leader teams). But this pattern was not consistent across all conditions of virtuality. The top half of Table 5.9 shows the matrix of mean performance levels by team configuration and number of team "leaders", while the bottom portion of the table shows the number of teams that fell into each quadrant of the matrix. There is a visible difference between the VL virtuality condition and the other three conditions with higher levels of virtuality in terms of the magnitude of the effect of higher numbers of leaders. The VL condition teams managed to perform rather effectively, even with a fourth member that provided little leadership and was isolated from the rest of the team. In the other three conditions, teams could not cope as effectively with a team member that was clearly not pulling their weight – this was particularly true for the H and VH virtuality conditions, as the average performance for teams in these quadrants were almost a full standard deviation below the mean performance level of the overall data set.

In summary, the completion of this analysis has led me to two conclusions regarding the effect of leadership in virtual teams. First, while the notion of shared leadership is quite noble, the results of this study seem to demonstrate that *clarity of leadership* is perhaps more important, at least in the context of time-sensitive, decision-focused tasks. Teams that quickly established an agreed-upon leadership structure and achieved an overall level of clarity in terms of team process in a timely manner tended to perform at a higher level in the experimental task. Second, the impact of a team leadership structure that features an individual that is a clear negative outlier seems to increase as dispersion within the team increases. Low dispersion teams were able to remain fairly successful, even with an isolated fourth team member that did not contribute much to the team's overall solution. But as dispersion increased, the negative

impact of a non-influential fourth team member increased as well. The implications of this in practice will be discussed in a forthcoming section.

Hypothesis 7 (not supported) – Average response time and perceptions of trust. A second disappointing result of the data analysis was the lack of support for the proposed relationship between individual's communication response time and peer perceptions of trust. As shown in Table 4.4, response time had weak relationships with virtually every focal variable in the theoretical model at the individual level. Nevertheless, it seems counterintuitive that an individual's ability to respond quickly in computer-mediated synchronous conversations would not have any effect on how they are perceived by others in an online environment. Thus, I wanted to take a closer look at the data driving the response time calculation, as I believed there remained the potential for substantial measurement error in how the response time statistic was derived.

To reiterate the measurement process for this construct, each chat-based message communicated during the team activity was time-stamped. The response time for a given message was the span of time between when a message was sent and the last message sent by another team member was transmitted. Certain time spans (data points) were dropped from the analysis; for example, if a sender sent two messages in a row, the span of time between those two messages would not be considered. Also, as stated previously in Chapter 3, if the time span between two messages was over 180 seconds, this was deemed to be not a "response", but instead a new conversation. Similarly, if the time span was between 60 and 180 seconds, a qualitative review was made to see if the response was related to the previous message, or was the initiation of a new thread of conversation. While these rules helped to eliminate large outlier data points that had profound effects on some individual scores, I believe that there is still "noise" in the data that is weakening the observed statistical relationships.

An example of a potential major cause of measurement error can be found in the chat transcript found in Table 5.8. Of particular note is the last set of messages, whereby

TM1 is attempting to get the formal approval of the rest of the team on their consensus solution. At 52:14, TM1 writes, “if not we are all in agreement on concering (*sic*) then?” TM3 is the first to respond to the question at 52:35 – the response time for TM3 for this message is calculated to be 21 seconds. TM1 concurs to the solution at 52:38 – based on the protocol, the response time for this message is calculated to be 3 seconds. TM4 and TM2 send their concurring messages at 52:39 and 52:40, respectively. Again, based on the procedure used to calculate response time, they each receive a response time “score” of 1 second. The issue is clear – although all four team members were responding to the same prior message (in this case, the original question posed by TM1 at 52:14), only TM3’s response was measured against the time of that initiating question. Thus, because TM3 was the first to respond, this individual was actually *penalized* with a much higher response time statistic relative to the other, slower responding team members. Other instances of this type of mismeasurement can be found in the excerpts provided in Tables 5.5 and 5.6. Indeed, this issue was pervasive across the entire data set.

A potential solution to this issue would be to have a qualitative review of all transcripts by multiple raters, whereby reviewers would look for instances where multiple responses to a particular comment or question were submitted by different individuals. In these cases, the response time statistic would be adjusted to reflect the time span between the initial comment/question that provoked the response and each of the ensuring responses, rather than the (much shorter) time span between the previous and current response. This will help to reduce the downward bias of the average response time statistic for late responders. Second, although steps were taken to prevent penalization of team members who initiate new threads of conversation through the deletion of all response times greater than 180 seconds and the review of messages with response times between 60 and 180 seconds, additional review is warranted. It is not necessarily true that 60 seconds has to transpire before a new conversational thread can be initiated; however, it seem logical to assume that some period of time needs to pass before a new

direction or topic of conversation is introduced in the course of a synchronous chat session. Thus, individuals who initiate these shifts in the conversation are likely to have higher average response times if those initiating messages are including in the calculation of the statistic. And since these initiating messages are not aligned with the central notion of the construct being measured – that is, the average time that it takes for an individual to respond to someone else – these should not be included in the overall response time calculation. In fact, the frequency of these types of initiating messages by individual team members may also be another important communication-related attribute that is positively related to how individuals are perceived in virtual environments.

Hypothesis 2 (supported) – Virtuality and team performance. The finding of a linear and curvilinear effect of virtuality on team performance was an unexpected discovery. This result can perhaps be attributed to a combination of the effects of a moderately-rich medium for virtual communications, and the existence (or lack) of faultlines (Lau & Murnighan, 1998, 2005; Cramton & Hinds, 2005) or sub-groups (O'Leary & Mortensen, 2010; Polzer et al., 2006) within a given team configuration. Faultlines are said to exist when group members fall into two or more distinct subgroups that differ in terms of one demographic area (known as a "weak" faultline) or multiple demographic characteristics (a "strong" faultline). For example, a group composed of four members, all of which are Asian but two are male and two are female, would be an example of a weak faultline. Alternatively, another four-person group with two male Hispanic members and two female Caucasian members would feature a strong faultline. To be clear, while the central thrust of Lau & Murnighan's work relates to divisions in groups that stem from demographic differences (i.e., race, gender), a similar phenomenon has been found to occur with dispersed teams based on the geographic location of team members. As discussed previously in Chapter 2, when geographically-separated groups of individuals are asked to work together on a team, various dysfunctions have been found to arise between subgroups, including increased levels of conflict, lower

information sharing, and decreased trust. Because the number and size of subgroups varied across the four experimental conditions, I conducted a qualitative review of the transcripts within each of the conditions, in the hopes of discerning patterns of behavior that related to team performance.

Very low virtuality (3x1) condition. As shown in Table 5.10, the clear top-performing condition within the four levels of virtuality was the very low dispersion condition (3x1) – the ANOVA and post hoc LSD tests confirm that the very low condition had significantly higher performance than all three other conditions at the $p <$ .10 level or better. In this condition, neither faultlines nor a strong reliance on computer-mediated communications was present. Teams had a clear majority of team members that were physically collocated, and most teams in this condition conducted much of their discussion and analysis of the problem face-to-face. From a qualitative review of the protocols, it seemed that isolates in this condition varied greatly from team-to-team in terms of the level of their integration with the group – some were largely ignored, others were used primarily as a "devil's advocate", while a few teams made a strong and concerted effort to engage all four members and include the isolate as a viable member of the team. Indeed, the teams in this condition that were better able to integrate the isolated team member seemed to fare better in terms of performance. Table 5.11 shows an analysis by condition of the relationships between team performance and both number of computer-mediated messages sent or time spent in the activity. As can be seen, both number of chat messages and time spent had positive correlations with team performance within the VL condition. A rather simplistic, yet applicable, conclusion to be drawn from these results is that "four heads are better than three". In other words, teams that took the time and were able to better utilize the outside perspective of a fourth non-collocated team member seemed to perform better on average. Of course, with the very small sample size of teams within any single condition in this study, further investigation is needed.

Low virtuality (2x2) and high virtuality (2x1x1) conditions. But what of the higher virtuality conditions that featured geographic subgroups? For the low virtuality (2x2) condition, two clear subgroups existed – team members were able to communicate face-to-face with one other team member, but were physically removed from the other two team members. For the high virtuality (2x1x1) condition, a subgroup consisting of two collocated team members was combined with two isolated team members. While one might expect that the more virtual condition would result in teams focusing more energy towards computer-mediated communications (given that two of the four team members could only communicate with fellow team members through that channel), it is surprising that the level of overall reliance on virtual communications was quite similar between the two conditions (means of 78.6 and 86.6 in the low and high virtuality conditions, respectively).

Again, based on my experience as a "silent observer" of the online communications within all of the teams, I found a similar occurrence within these conditions as I did with the very low virtuality condition – collocated team members tended to rely on each other to a greater extent than their non-collocated teammates to complete the activity. However, since the maximum number of collocated team members was only two in both of these conditions (albeit duplicated in the low/2x2 condition), these teams were at a disadvantage as compared to the less virtual condition with three collocated teammates. In other words, the lack of a third team member in the room combined with the relative inability of teams to effectively use the synchronous chat capability to communicate with non-collocated team members, seemed to cause the lower performance levels in these two conditions. Similarly, because the high virtuality/2x1x1 condition only had one set of collocated team members, this seemed to further hinder their efforts. While the 2x2 condition did not have any larger groups of collocated teammates, having two *separate* groups that could collaborate face-to-face and then combine efforts seemed to have a positive effect. Indeed, in some cases, the two

collocated groups communicated with one another only to coordinate activities in each of the separate rooms, with the purpose of dividing the analytical work and coming together only to arrive at a consensus solution.

Relatedly, it is perhaps not a coincidence that one of the two teams that could not reach a decision came from the 2x2 condition. This team provides a nice illustration of how collocated team members relied heavily on each other, and in this case, to the detriment of the team. Table 5.12 shows the initial chat transcript for this team that failed to arrive at a decision – note that this portion of the transcript covers the first 45 minutes (out of a maximum of 60 minutes) of the activity. The collocated team members for this team consisted of TM1/TM2 (one room) and TM3/TM4 (a second room). TM1/2 clearly take the lead in strategizing a process towards developing a solution (messages sent at 27:18 and 29:11). TM4 then offers to complete a parallel process at 29:53, which is followed by TM3/4 attempting (and failing) to engage their non-collocated team members in conversation. TM1 responds to a question at 41 minutes, and the teams are silent until almost 45 minutes into the activity, when TM3 enquires about the time left in the activity. Not surprisingly, this team was well below the mean number of computer-mediated communications for the condition (58 vs. a mean of 78.6).

Very high virtuality (1x1x1x1) condition. Finally, the fully dispersed/very high virtuality condition showed an improvement in performance levels relative to teams in the high virtuality (2x1x1) condition. Clearly, geographic subgroups were not an issue in this condition, as all team members experienced the same level of physical separation from their teammates; that is, all were isolates. Thus, while teams in this condition clearly had the disadvantage of having to rely on synchronous chat to communicate, the configuration did provide one distinct advantage over the 2x1x1 condition – a "level playing field". Because there were not geographic subgroups and all communications were mediated through the computer, every team member was privy to all information being discussed. My conclusion is that this high level of information sharing helped to

negate some of the negative effects of reliance on a less-than-optimal communication medium.

But Table 5.11 raises an important caveat in regards to levels of communication and performance. As seen in the bivariate correlations portion of the table, the relationship between the number of chat-based messages and performance within the very high virtuality condition was a -.40. My interpretation of this statistic actually harkens back to a point made previously regarding clarity of leadership. From a review of the chat transcripts of teams with very high levels of communication, it was clear that low performing teams had no team member(s) that provided clear direction to the team – rather, team members debated both strategies and individual data points, and had difficulty achieving group consensus in a timely manner, which usually resulted in a hurried (and often poor) decision at the end of the allotted time. Conversely, high performing teams with high communication levels quickly agreed upon a general strategy and, while still relying on a consistently high level of discourse and consensus decision making, had team members who drove the team towards the end goal.

Conclusions from this qualitative analysis. In summary, the relationship between level of virtuality/dispersion and team performance is a complicated one, exacerbated by the effects of a virtual communication medium that was less than ideal for the activity. Teams with collocated team members relied heavily on those collocated groups to drive strategies and decisions. As team dispersion increased (and reliance on computer-mediated communication also increased), team performance suffered – likely, this was the result of both of these factors (increased dispersion and some misfit between the task type and communication medium). However, fully dispersed teams showed an increase in performance relative to the next lower virtuality condition, which I believe can be attributed to a combination of higher levels of information sharing and increased clarity of leadership.

Hypotheses 3-6, 8-9 (generally supported) – Individual-level model of emergent leadership. While most of the theoretical relationships within the individual-level portion of the model were supported, it was surprising that there was a general lack of mediation between the communication-related independent variables and perceptions of emergent leadership through perceptions of trust and general mental ability. As can be seen in Figure 4.3, only texting language could be considered as having most of its effects on leadership emergence mediating through the combined mediator of perceived trust/GMA. Partial mediation was evident for task-based/action communications, while all other variables exhibited little to no mediation. While perceptions of trust and ability are clearly related to leadership emergence, as well as most of the communication-focused variables that were analyzed in this study, further investigation is still needed to provide greater clarity to the relationships among these variables.

One area of the model that requires attention is the high multicollinearity between perceptions of trust and GMA. While the data collected in this study required that the observed indicators from these two item scales be combined into one latent variable, it is certainly possible that the two constructs are unique at the "true score" level. In fact, the construction of the actual subject survey may have greatly contributed to the near perfect correlation between these two variables. Subjects were asked at the same time, and within the same form, to respond to the trust and GMA items for each team member – perceived leadership items, on the other hand, were asked in a different format and on a separate page of the survey. Hence, to avoid cognitive dissonance (Festinger, 1957), subjects may have been compelled to answer consistently for both the trust and GMA items simply because of the design of the survey.

Another interesting finding in this portion of the overall model was the strength of task-related communications in predicting emergent leadership, especially when compared to the predictive weakness of the relationship-based communication variable. As discussed in Chapter 2, while both types of communication have been found to predict

leadership perceptions in various settings, these results corroborate the findings of others in that relationship-based communications are perhaps less important in virtual teams in general, and certainly less important in short-term, newly formed teams. It would have been interesting to see how consistent these results would have been if the teams were reconvened for several activities - while only speculation, it seems quite plausible that relationship-focused communications would take on a larger role in leadership perceptions, even at the onset, if team members knew that the tenure of the team would extend beyond a single activity.

Hypothesis 10 (supported) – Collocation and emergent leadership. Frankly, there is little gray area regarding the results presented in Table 4.10. Clearly, collocation provides a distinct advantage in regards to several types of work-related perceptions. However, it is interesting that this difference is only salient in conditions that featured both collocated and non-collocated team members. In line with the Webster & Wong (2008) study, overall mean perceptions across the four conditions (including the fully dispersed condition) were largely equivalent for trust, ability, and leadership. But conditions that featured a mix of collocated and non-collocated team members clearly showed preferences among collocated teammates. Nevertheless, a deeper dive into the data provides a more complete picture of what is transpiring between collocated and non-collocated team members.

Table 5.13 shows a comparison of means on the three perceptual variables across the three conditions that featured collocated and non-collocated team members. Ratings are categorized between collocated dyads and non-collocated dyads. The non-collocated dyads were then further subdivided into three categories: *Collocated->Isolate* (a team member that is collocated with one or more other team members that is rating an isolated team member), *Isolate->Collocated* (an isolated team member rating a collocated team member), or *Isolate->Isolate* (an isolate rating an isolate, only applicable in the high virtuality [2x1x1] condition). A fourth category exists in the low (2x2) virtuality

condition – *Collocated->Collocated* – whereby a team member that is collocated with a second team member rates one of the other team members that are collocated elsewhere. Because all of the non-collocated dyadic relationships in the low virtuality condition fall under this category (and are not found elsewhere), the results are not broken out separately in Table 5.13. It should be noted that the forthcoming analysis does violate some assumptions of independence, in that multiple ratings of a particular individual team member may fall within one category (e.g., in the VL [3x1] condition, two of the ratings for an individual in the collocated location would be included in the Collocated->Collocated category, but are treated as individual cases in the analysis). Nevertheless, several patterns emerged from this analysis.

First, differences between collocated dyads and all other categories of non-collocated dyads exist across all conditions and perceptual variables. Collocated group members consistently perceived each other as higher in trust, ability, and emergent leadership when compared to non-collocated team members. However, this effect seems to dissipate as the team's level of virtuality/dispersion increases. This dissipating effect is most prominent in the emergent leadership ratings, as the mean difference between collocated and non-collocated team members is only .17 in the high virtuality (2x1x1) condition, versus .33 and 1.18 in the low (2x2) and very low (3x1) virtuality conditions, respectively. Intuitively, this finding makes sense – the potential for isolated team members to emerge as leaders should increase as the proportion of collocation team members decreases. The differences in trust and ability perceptions, on the other hand, seem to remain fairly large between collocated and non-collocated dyads regardless of the overall team configuration. Thus, while team members are somewhat able to recognize the leader-like behaviors of non-collocated team members, biases still exist in favor of collocated team members in regards to perceptions of trust and ability.

A second method of analysis looks at differences in ratings depending on whether or not the rater or ratee is collocated or an isolate. In this regard, the dyad classification

that had the lowest overall perceptions of one another was found in the very low (3x1) configuration: isolates rating collocated team members. On average, isolates in this condition rated the trust and ability of their teammates about 2 standard deviations below the global mean of the overall data set. Leadership ratings in this dyadic category were also more than one standard deviation below the average across the entire sample. Perhaps much of this effect can be attributed to a phenomenon that occurred with collocated team members (and more frequently in the 3x1 condition) – the "spokes-typist" position. Oftentimes, a member of a collocated group would assume the role of communicator to the non-collocated team members, "speaking" on behalf of those collocated in the same room. From the isolated/non-collocated team member's perspective, the team members that did not participate in the chat discussion were a virtual unknown. Hence, many of the poor perceptions of collocated team members by isolates were simply due to the lack of information available to them with which they could base an opinion. Thus, there existed the potential for some collocated team members to have a significant impact on the direction and functioning of the team, but not actively participate in the chat-based conversation. In these cases, the disparity of ratings between the collocated and non-collocated team members would be extremely high. Yet, this is only part of the explanation of the results within the very low virtuality condition, as collocated team members also had significantly (though not as strongly) negative perceptions of isolates, even though they were privy to all outward communications made by the isolates.

Having reviewed the results of the study, including several post hoc analyses that were performed based on some of the more surprising original findings, the next section of the paper will discuss the implications of this work. Suggestions for the application of these findings to practice will be explored, followed by a review of limitations of the current study, as well as potential directions for future research.

Practical Implications

The results of this study have helped to shed light on various aspects of virtual team design and personnel selection for virtual environments that should prove beneficial to organizations that utilize virtual teams in the execution of their work. I will discuss several practical implications that are derived from the results of this study in three main categories: team configuration and performance, team member collocation and leader emergence, and communication-related attributes and leader emergence.

Team configuration and team performance. I believe that there are several implications regarding the potential impact of configuration on virtual team performance. The obvious implication for virtual teams is that higher levels of dispersion are likely to have deleterious effects on the quality of the team's decision making. But there are several important caveats to this statement that are worth noting. First, this conclusion is specific to decision-making teams – as noted previously, other types of teams/tasks have shown very different results for the effects of virtuality on team performance. Second, the impact of the reliance on a moderately-rich medium for virtual communications cannot be quantified in the current study. It stands to reason that a higher richness medium (i.e., videoconferencing) could have substantially lessened the negative effects of dispersion on team performance for this type of activity. Third, this study did not include any opportunity for non-collocated members to meet their other teammates face-to-face at any point in the activity. Prior research has shown that periodic face-to-face meetings can have numerous positive impacts on team member attitudes and team performance (Kirkman et al., 2004; Chudoba et al., 2005; Bjorn & Ngwenyama, 2010). How an initial face-to-face meeting between all team members would have impacted leader emergence and team performance within this experimental design is an area for future research. Nevertheless, based on this study and prior research, it is important for managers of virtual teams to take into account 1) the type of team/activity, 2) the communication media available for virtual communications, 3) the opportunity for face-

to-face meetings, and 4) the configuration of the team across various physical locations when designing the structure for a new virtual team. All of these factors could have a significant impact on the performance of the virtual team.

A second, and perhaps the most interesting, implication of this study concerns the advantage of having a fully dispersed team over a "mostly" dispersed team configuration. For teams that are located across several locations, the results of this study seem to imply that a team would be better served to have only one person at each location, rather than a limited number of locations with multiple team members. As stated earlier, I believe that the main reason for this finding relates to information sharing. In fully dispersed teams, no one individual or group of individuals has the advantage of face-to-face communication – in other words, the "playing field" is level between all members of the team. Given this scenario, it is more likely that communication channels will remain open and access to information will be more equivalent among all team members. This, in turn, should lead to higher quality decisions for the team as a whole, compared to a situation where small groups of team members are holding private conversations and (perhaps inadvertently) withholding information from the rest of the team. Thus, all other factors being equal, managers may be best served by implementing a fully dispersed team over one which features a combination of collocated and isolated team members.

Collocation and emergent leadership. At the individual level, the largest implications of the study's findings related to collocation and leadership deal with the role of isolates within virtual teams. For isolated leaders (whether emergent or designated), the lack of collocation with other team members can cause significant issues in terms of whether or not the individual is perceived as trustworthy, capable, or leader-like. This effect is particularly salient as the proportion of team members that are collocated increases. Based on the results of this study, a worst-case scenario for an individual team leader would be to find themselves as an isolate on a virtual team that is

largely collocated elsewhere. Hence, if a leader is selecting team members for a virtual team, it would behoove them to create a team that is at either end of the dispersion continuum (i.e., highly collocated with the team leader, or if that is not possible, fully dispersed).

In parallel, there are important implications from these findings as well in regards to what steps leaders can take to assist non-collocated team members. As discussed previously and illustrated in Table 5.8, some isolates in the very low (3x1) virtuality condition remained very isolated throughout the entire decision-making process. In fact, although not one of the focal measures in this study, participants were asked to rate their satisfaction with their team at the end of the activity. Isolates in the very low condition had a mean team satisfaction score of 4.26 (items were based on a Likert scale of 1-7), while isolates in the two higher virtuality conditions (2x1x1 – high, and 1x1x1x1 – very high) were clearly more satisfied with their teams (means of 5.64 and 5.78 respectively; $F(2,147) = 13.3$, $p < .01$). Thus, for leaders in highly imbalanced virtual teams, special care is needed to ensure that isolated members are made to feel part of the team. Combined with the previous work of Webster & Wong (2008) and O'Leary & Mortensen (2010), virtual team leaders must be cognizant of the potentially deleterious effects of isolation and sub-groups on team member processes and attitudes. In that regard, leaders should ensure that open dialogue and information sharing occurs, along with an overall climate that is team-focused, thus minimizing the potential for feelings of non-inclusiveness or conflict between team members/locations.

Communication and emergent leadership. Lastly, multiple implications in regards to the impact of communication-related attributes on leader emergence perceptions can be drawn from this study. The first implication has been clearly supported in the literature (Mullen, Salas, & Driskell, 1989; Stein & Heller, 1983) and is corroborated here – simply put, leaders communicate more than non-leaders in self-managed virtual team settings. Nevertheless, the focus of the communication is

important as well, as task-related communication had a much stronger correlation with leadership perceptions that relationship-focused communication. As mentioned earlier, while this finding could certainly be a result of the short-term, deadline-driven nature of the team activity, the relative importance of task-focused communication in predicting emergent leadership in virtual teams has been found in several other previous studies (Morgeson et al., 2010; Pavitt, 1999; Yoo & Alavi, 2005; Wolff et al., 2002; Tyran et al., 2003; Adams, 2009).

Another implication of this study relates to the use of texting language, and its impact on perceptions of leadership and trust/GMA. This was the one independent variable whose effects on emergent leadership were largely mediated through perceptions of trust and ability. Thus, the implications of this finding are relevant to leaders and team members alike – use of texting language in a computer-mediated communication setting appears to result in positive attributions from others. Given that our coding of texting language did not include any subjective appraisal of *correctness* in regards to the texting language use, this gives even higher credence to the proposed implication. One would expect, therefore, that proper use of texting language would result in an even stronger relationship with various positive perceptual constructs. While this finding still requires replication in other contexts (i.e., alternative task types, in combination with other types of communication media) and with a larger age range of subjects to warrant a firm conclusion, it does corroborate the results of the Kelly et al. study (2008). Hence, this area certainly warrants further investigation.

Study Limitations

As with any research study, there are several limitations that are worth noting regarding the interpretation of results and the application of these findings to the workplace. An obvious limitation relates to the generalizability of an experimental study, as opposed to a study featuring “real” virtual teams embedded within a workplace setting.

Nevertheless, there were several theoretically- and practically-driven reasons for conducting an experiment versus a field survey. First, my goal was to focus on gaining a better understanding of how individuals emerge as leaders in newly-formed, self-managing teams. Because of this, it was crucial that individual participants have no prior history of interaction or pre-conceived impressions of one another. Similarly, individual participants needed to enter the team setting without the precursor of titles or functional expertise – while this could have been statistically controlled for, it also would have substantially affected the overall context of the team activity. A third issue related to the individual difference measures and diagnostic tests that were completed by the participants (refer to Appendix B for more information). Simply put, few (if any) organizations would agree to having their employees spend an average of 45 minutes taking several batteries of tests – from the employee's perspective, even if I had been able to find an organization to agree to the testing, it is likely that the attrition rate on that portion of the protocol would have been quite high. Finally, the laboratory setting allowed for the control of many other important aspects of the protocol, including the use of technology, the standardization of the team-based activity, and minimization of the potential influence of external environmental factors. Taken altogether, it was clear that an experimental design need to be employed to be able to effectively test the full theoretical model.

Along similar lines, a second common limitation of experimental studies in general, and this study in particular, is the use of students as participants. Two issues are generally raised: generalizability of results to a non-student population of workers, and lack of motivation of the students during the activity. Beyond the generalizability issues discussed above, there are certainly significant differences between the student sample and work teams in practice with regards to age and experience. Nevertheless, by utilizing business majors that were, on average, in their third year of study, participants generally had acquired some prior experience working in teams. In regards to the virtuality aspect

of the protocol, it could be argued that students from this generation are actually more adept to working virtually than older generations in the workforce. Thus, while there are some obvious differences between a student sample and a typical "virtual team" in practice, the use of tech-savvy business majors – many of whom will be joining the ranks of virtual team members in practice in the near future – seemed an appropriate trade-off in return for the significant level of control that was afforded by an experimental setting. While the use of graduate students would have been a potential alternative to undergraduates (which, in turn, would have negated some of the issues previously discussed), the volume of participants needed to acquire the number of teams and data necessary for effective analysis was simply too great. Likewise, combining undergraduate and graduates in the experimental teams would have likely had a strong and confounding effect on the perceptual constructs, which would have detracted from the other results of the study. Hence, because of all of these issues, the use of undergraduate business students for the sample seemed the most prudent choice.

In regards to the potential issue of low participant motivation, I attempted to remedy this via the deception regarding the possible monetary reward for high performing teams. To reiterate, subjects were told at the beginning of the protocol that they would be eligible for a $150 cash prize drawing if their team scored above a certain profit threshold in the simulation. Although a small number of participants clearly did not participate fully in the activity, the vast majority appeared to take the simulation seriously – frankly speaking, a scenario in which a minority of "employees" are disengaged from work-related activity is probably quite close to reality. In addition, while I was also concerned that participants would find out about the deception (i.e., become aware that their entry into the $150 drawing was not performance-dependent) and subsequently perform at a lower level, this did not appear to be an issue. For example, the *final* session of teams that participated in the study featured a particularly emotional exchange between two non-collocated team members, whereby one team

member (in clear frustration) ended the debate by sending the chat message, “if you dont want 150cash at the end of this then fine”. Thus, the deception regarding the cash award seemed to have the desired effect, and remained a secret from study participants throughout the entire protocol period.

A third limitation of the study relates to the duration of the task activity. Participants were limited to no more than one hour of interaction with their fellow team members before they were asked to make several global perceptions about their colleagues. Likewise, individuals only had a short amount of time to demonstrate leadership behavior – longer durations of team interaction could have led to vastly different results in terms of who emerged as a leader over time, and/or other perceptual conclusions reached by participants about their teammates. Nevertheless, prior research has shown that “first impressions” are powerful and resistant to change. From a psychological perspective, first impression bias (Asch, 1946) and the primacy effect (Kelley, 1950) have been found to have significant impacts on impression formation in a number of different contexts (Forgas, 2011; Lim, Benbasat, & Ward, 2000; Fiske & Taylor, 1991). Within the management literature, Liden, Wayne, & Stilwell (1993) found that within leader-member dyads, expectations made by each party of the other within the first week of interaction were strongly related to subsequent measures of leader-member exchange (LMX) quality. Thus, in combination, it seems reasonable to conclude that the initial impressions made by participants within the context of the simulation activity would have been fairly consistent and long-lasting, should the teams have had further interactions beyond the initial team activity. Future research in this area would be a worthwhile endeavor.

A fourth limitation of the study is specific to the limits made on the availability of communication media to the teams during the activity. Obviously, teams in practice do not rely on a single type of medium (e.g., chat) for all communications with their team members. Indeed, prior research has found that individuals will select different media for

different situations, depending on the type of task (Daft et al., 1987) or their familiarity and comfort level with a given media (Carlson & Zmud, 1994, 1999). Nevertheless, a conscious decision to limit the media available to virtual team members to the use of text-based chat was made for several reasons. First, as stated in Chapter 2, given the time constraints for the task, any asynchronous communication media would have been completely ineffective. Second, allowing multiple types of media (i.e., teleconferencing, videoconferencing) would have opened the possibility for significant differences between sessions in terms of the media used – this would have made it quite difficult for me to gauge the impact of media on both of the focal dependent variables, team performance and individual perceptions of emergent leadership. Finally, given the strong reliance on electronic written communications in today's workplace (Radicati, 2010; Kelly, 2010; Hollis, 2005; Penttila, 2005), synchronous chat seemed to strike the best balance between control, communication effectiveness, and realism. Again, the use of other types of media and the interaction of media/task type are interesting avenues for continued exploration.

The type of task that was utilized in the experiment is another potential limitation of the study. While the "Tinsel Town" simulation had several positive attributes as related to this particular study, it is but one type of task – results may have been drastically different if a different type of task was utilized. Cohen & Bailey (1997) outline four different types of teams (work, parallel, project, and management), which in turn may deal with very different types of tasks (e.g., production, problem-solving, idea generation, and decision-making, among others). Because the focal activity in this study was a top management team decision-making simulation, results may have been quite different if the activity was, for example, a creative brainstorming session. As discussed in Martins et al. (2004), several empirical studies (Daly, 1993; Hedlund, Ilgen, & Hollenbeck, 1998; Tan, Wei, Watson, Clapper, & McLean, 1998; Holligshead, McGrath, & O'Connor, 1993; Straus & McGrath, 1994) have provided support to this notion.

Thus, the selection of any particular activity would necessarily limit the generalizability of the results, given the empirical evidence that has already been accumulated in the aforementioned studies. Therefore, while the task type may be considered a limitation, this is an inevitable factor of any study that utilizes a consistent type of activity throughout the protocol. Short of using several different types of activities (and in turn, significantly increasing the sample size requirements), this issue is unavoidable.

Finally, there is a limitation regarding the potential of common method variance (CMV) of the mediating and dependent variables in the individual (Level 2) portion of the theoretical model. Several steps were taken to help minimize this issue as much as possible. First, all of the independent variables in the emergent leadership model (i.e., average response time, task- and relationship-based communication, and use of texting language) were all derived from the chat transcripts for each group. The actual raw data used in the eventual hypothesis testing was either calculated automatically from this objective data, or coded via panels of trained experts who were blind to other aspects of the study. Thus, the potential for CMV was minimized through objective and/or non-self-rated data collection instruments. As for the mediating and dependent variables, all of these were, by definition, perceptual variables which are best captured through self-report surveys. While the emergent leadership variable could potentially have been measured via proxy using some other type of "objective" indicator of which team member(s) exhibited leadership (e.g., expert rating of group interactions), the focus of the study was to better understand how team members' perceptions of others were influenced by various factors. Likewise, using outside raters raises the question of what information should be made available to them in making a leadership appraisal – limiting access to computer-mediated communications would be insufficient for understanding what transpired for collocated team members. Conversely, allowing raters access to videotaped conversations was something which virtual team members were not privy to. Hence, taking all of this into account, I felt that it was necessary to utilize direct

measurement of peer perceptions of emergent leadership, rather than looking to non-peer-report methods.

In summary, while there are several limitations to this study, many of them are common to experimental studies and are not unique to this particular line of research. In every case, care was taken during the formulation of the study protocol to address these potential issues in the most prudent fashion. Certainly, there are avenues of future research which could potentially address several of the limitations listed above – this is the topic of the next section of the paper.

Avenues for Future Research

There are several extensions of the current study that could prove useful for future research endeavors. First, given the general confirmation of the proposed theoretical model, further testing in different contexts is needed. Because of the significant operational issues that are inherent in the testing of this model, an experimental study that features a graduate student sample may be the type of validation study that offers the least concerns from a logistical perspective. While the model may require some revising to fit with the limitations of a sample from an existing organization, this is clearly another avenue of research that is important and necessary to provide further validation of the theory. Ideally, a consulting organization that has a highly geographically-dispersed population of practitioners, along with a portfolio of projects that are, on average, relatively short in duration (i.e., less than 6 months), would be a perfect scenario to be able to capture data across the full lifecycle of the teams.

Another option of replicating the existing study with some modification would be to provide teams with multiple communication media (of differing levels of richness) within the same experimental conditions. By collecting information on participants' *a priori* competencies and preferences with different types of media, and by tracking the utilization of the different types of media during the team activity, this experimental

design would provide a logical extension of the results in the current study. Likewise, the experiment would help to shed further light on two additional communication-related theories: channel expansion theory (Carlson & Zmud, 1999) and media naturalness theory (Kock, 2004).

Channel expansion theory (Carlson & Zmud, 1999) proposes that individuals develop different perceptions of the richness of various communication media based on their prior experiences. For example, individuals with a long history of using a particular media may become very skilled at both sending and decoding messages, and thus perceive the media as richer than someone with less experience and a lower comfort level. Media naturalness theory was originally proposed by Kock (2004) as an alternative to media richness theory, which defines the naturalness of a communication medium as the degree of similarity of the medium to face-to-face communication. Media naturalness is often depicted as a continuum, with face-to-face communication in the center, lower richness media on the left (e.g., video conference, chat, email, phone), and "super-rich" media on the right (e.g., virtual reality with document sharing and collaboration tools). Thus, while media *richness* theory would suggest that the cutting-edge communication technologies of the 21st century that provide potentially higher richness levels than face-to-face communication would provide a better fit for highly complex tasks, media *naturalness* theory would instead propose that "super-rich" media require higher cognitive effort, cause higher levels of miscommunication and ambiguity, and result in information overload. Thus, there are several possibilities in terms of experimental design that could provide greater insight into how these theories relate to both leadership emergence and team performance.

While the previous discussion focused on computer-mediated communications, one aspect of virtual teams research that is often ignored or underemphasized is the "non-virtual" portion of team processes (i.e., the face-to-face interactions of collocated team members). The current study has afforded me the opportunity to capture all of the

communications that occurred during the tenures of these teams. Clearly, the face-to-face portion of these communications was not the focus of this study, but incorporating information from the video recordings of the collocated team member interactions should prove quite fruitful. One potential research question is to investigate how leadership emergence may be differentially impacted by process-related communications in virtual vs. face-to-face communications. For example, do transition-focused communications have a larger impact in collocated groups, or in virtual communications? And is this effect moderated by the level of team virtuality? While the current investigation captured and analyzed a great deal of virtual communications, the video recordings of the face-to-face interactions remain an untapped source of data to help answer this and other related research questions.

Another general area of related research would involve the incorporation of individual differences (IDs) into the individual-level portion of the model, with a dual focus on how IDs influence communication behaviors, as well as which IDs relate to the focal perceptual variables in the model (trust, ability, leadership). But taking a broader view of IDs, the literature is also still unclear on how personality is expressed via virtual communication media. A few studies (Balthazard et al., 2009; Purvanova, 2008; Tosun, & Lajunen, 2009) have attempted to better understand how individuals' personalities are manifested and perceived in computer-mediated contexts, but there is still considerable work to be done in this area.

There are several measurement issues that have arisen through the course of conducting this study, which provide additional avenues for continued research. One issue that is directly related to the results of this study is in regards to the high multicollinearity exhibited between the measures of trust and ability. As mentioned in the previous section, it is certainly plausible that the method of how the items were presented to the subjects in the online survey could have greatly contributed to the high intercorrelations between the two sets of items. While some have suggested that

multicollinearity can be best avoided by grouping items by dimension, rather than using randomization of survey items across multiple categories (Hayes & Herman, 2012), my results suggest that the grouping of multiple different constructs within the same format, structure, and timing in a particular survey may actually *induce* multicollinearity. Thus, whether measures of trust and ability perceptions are tapping distinct constructs, or are actually indicators of a single latent variable, is an area worthy of further study.

A second measurement issue relates specifically to the realm of virtual teams and has been (and continues to be) the focus of much scholarly debate – how to measure virtuality. Currently, one of the more popular measures of team virtuality comes from Chudoba and colleagues (2005), who developed a 12-item, 3-factor battery of self-report items. The three factors that emerged in their analysis were described as "team distribution" (which highly aligns with the configuration/collocation aspect of the current study), "workplace mobility" (described as "the degree to which employees work in environments other than regular offices"; Chudoba et al., 2005; 288), and "variety of practices" (defined as "the degree to which employees experience cultural and work process diversity on their teams"; Chudoba et al., 2005; 289). While many of the items align with the definition of virtual teams that I espoused in Chapter 2, I have two concerns with this item battery. First, the item responses are self-report data, which allows the potential for several types of biases to influence the responses of the subject. Related to this point, the items and potential response categories are somewhat subjective in nature. Respondents select from a 6-point Likert scale, ranging from "daily" to "never", to items such as "How often do you collaborate with people in different time zones?" Thus, I feel that the goal of any further endeavor to improve upon this situation must incorporate more objective measures and data collection processes. The use of the number of "virtual relationships" as a proxy for virtuality worked well for this experiment, but how (or if) this notion can be adjusted and applied to teams in practice is, for the moment, still unclear.

A third potential measurement issue is in regards to the decision to capture perceptions of "trust" rather than "trustworthiness" in the current study. Notwithstanding the evidence that supports the notion of "swift trust" in virtual teams (Meyerson et al., 1996, Jarvenpaa et al., 1998; Greenberg et al., 2007), a measure of trustworthiness might have been more appropriate, given the context of the experiment and the other constructs within the theoretical model. Because the team activity was a relatively short, one-time event with no possibility of continuation, participants were perhaps not highly motivated to develop trusting relationships with their fellow team members. However, participants would surely be able to make differentiated perceptual judgments about their team members in regards to their trustworthiness (again, as stated previously, putting the focus of the perception on the individual and not the relationship). Clearly, the data supports the conclusion that participants were able to differentiate between team members in terms of perceived trust. And to be fair, perceptions of trustworthiness probably played a large part in the actual responses provided by participants in regards to perceptions of trust. But because the other perceptual variables in the model were predicated on individual differences (vs. dyadic relationships), using an established and more specific measure of perceived trustworthiness would probably have been more appropriate.

A fourth and final measurement issue goes beyond the reach of virtual teams, and is focused on the shared leadership construct. While shared leadership was not a significant predictor of team performance in this study – regardless of the measurement method used – the use of Likert-scaled data within social network analysis tools was, I believe, an improvement on the status quo of the measurement of this construct. Nevertheless, further refinement of the methodology is needed.

Conclusion

Even if researchers cannot entirely agree on what exactly a "virtual team" is, practitioners and scholars alike are keenly aware of the growth and importance of virtual

teams in the workplace today. With that in mind, this study was designed to help answer two broad research questions: First, how does the configuration of a virtual team (and, in turn, whether or not team members are collocated with one another) impact a) team performance, and b) team member perceptions of trust, ability, and leadership? Second, how do individual differences in communication content and structure impact leadership emergence? The results clearly showed that team configuration had a significant and curvilinear effect on team performance in a collaborative, decision-making activity. Using data from dyadic ratings, collocation also had strong, positive effects on all three of the focal perceptual variables. And regarding the second general research question, I found that the content of communications (particularly task-focused communications) had stronger effects on emergent leadership perceptions than structural aspects of communication. Nevertheless, use of texting language did explain significant amounts of unique variance in several perceptual variables. Thus, while several measurement and methodological issues were encountered over the course of the study, much of the overall theoretical model was confirmed by the results of this study.

The future of research in this area is bright with possibility. I outlined several avenues for potential research areas related to this study – surely, there are countless others. Likewise, I believe that the implications of the study's findings for virtual teams in practice are important – organizational-level managers that oversee the formation and development of virtual teams, as well as team leaders that are responsible for the day-to-day activities of their teams, may benefit from one or more of the conclusions derived from this study. It is an exciting area of research, and one that I am certain will continue to grow in relevance and importance well into the future.

Table 5.1. Objective Performance and Leadership Ratings

for Ten Lowest Performing Teams

	Team Level		**Individual Leader Ratings**			
ID	Leader Density	Performance	TM1	TM2	TM3	TM4
118	3.583	150.00	*4.13*	*4.07*	*3.60*	**2.53**
164	3.417	150.00	*3.93*	*3.60*	*3.53*	**2.60**
102	3.455	181.62	*4.33*	*3.60*	*3.47*	**2.47**
178	3.650	272.21	*4.47*	*3.73*	**3.53**	**2.87**
126	4.067	327.40	*4.27*	*4.27*	*4.13*	**3.60**
162	3.283	343.26	*4.07*	*4.00*	*3.73*	**1.33**
147	3.350	350.52	*3.80*	*3.67*	**3.20**	**2.73**
104	3.833	357.28	*3.93*	*3.87*	*3.87*	**3.67**
177	3.733	363.90	*4.60*	*4.13*	*4.00*	**2.20**
132	3.450	364.22	*3.87*	*3.73*	**3.40**	**2.80**

Note. 1) Individual ratings are composite ratings for each individual team member, sorted highest to lowest from left to right (TM1 = highest rating, TM4 - lowest); 2) Records (rows) of team-specific data is sorted by team performance (low to high); 3) Ratings in italics are above the team mean (i.e., Leader Density), while ratings below the team mean are in bold

Table 5.2. Descriptive Statistics for Team-Level Data,

Grouped by the Number of Team "Leaders"

Variable	# Leaders [a]	N	Mean	SD	SE	95% CI for Mean	
						Lower	Upper
Leader Density	1	7	**3.47**	0.34	0.13	3.15	3.79
	2	52	**3.60**	0.32	0.04	3.51	3.69
	3	27	**3.64**	0.30	0.06	3.52	3.76
	Total	86	3.60	0.32	0.03	3.54	3.67
Team Virtuality	1	7	**4.71**	1.38	0.52	3.44	5.99
	2	52	**4.46**	1.15	0.16	4.14	4.78
	3	27	**4.56**	1.05	0.20	4.14	4.97
	Total	86	4.51	1.12	0.12	4.27	4.75
Team Performance	1	7	**486.58**	47.76	18.05	442.41	530.75
	2	52	**455.88**	59.12	8.20	439.42	472.34
	3	27	**403.64**	103.65	19.95	362.64	444.65
	Total	86	441.98	79.33	8.55	424.97	458.99

Note: [(a)] Number of team members with aggregate leader score above team mean

Table 5.3. ANOVA Results for Team-Level Data, Grouped by the Number of Team "Leaders"

ANOVA

Variable		SS	df	MS	F	Sig.
Leader Density	Between Groups	0.17	2	0.08	0.82	0.444
	Within Groups	8.38	83	0.10		
	Total	8.54	85			
Team Virtuality	Between Groups	0.47	2	0.24	0.18	0.834
	Within Groups	107.02	83	1.29		
	Total	107.49	85			
Team Performance	Between Groups	63656.19	2	31828.10	5.61	0.005
	Within Groups	471243.23	83	5677.63		
	Total	534899.42	85			

Table 5.4. Post-Hoc Bonferroni Test Results

Post Hoc Bonferroni Test

	# of Leaders		
Variable	**1**	**2**	**3**
Leader Density	3.47	3.60	3.64
Team Virtuality	4.71	4.46	4.56
Team Performance	486.58 (a)	455.88 (b)	403.64 (a,b)

Note: Letters in parentheses represent significant differences in means between categories

Table 5.5. Chat Transcript Excerpt for Low Performing Team

Time	Team Member	Message
0:17:20	TM4	How do you think we should do this next segment?
0:17:26	TM2	should we take more time to read them or plan?
0:17:48	TM3	right now shysters is looking the best to me it has high scores in all categories
0:17:57	TM1	I think it's important to have the background from having read them all before we proceed.
0:18:09	TM2	alright
0:18:12	TM4	This is 10 minutes where we plan our decision-making process.
0:18:12	TM2	give me a second
0:18:34	TM4	What do you guys think is going to be the best way to go about this?
0:18:39	TM1	Does anyone have any they would like to rule out right away?
0:19:12	TM4	Would a total pros and cons list work well?
0:19:19	TM1	Yes
0:19:20	TM2	i would say malled should be ruled out
0:19:36	TM2	the one that takes place at a mall
0:19:41	TM2	anyone agree?
0:19:49	TM1	I agree
0:20:05	TM4	I think it might be effective to decide how we are going to rate our movies before we choose which to pursue and which to drop.
0:20:21	TM1	Okay, let's discuss them in order

Table 5.5 continued

Time	Team Member	Message
0:29:49	TM3	has everyone finished their analyses?
0:30:02	TM4	I'm close, just wrapping up my portion right now.
0:31:23	TM1	Does anyone know how we're doing on time?
0:31:43	TM4	We should have around 25 minutes left for this portion.
0:32:09	TM2	ok so what does member 3 have?
0:33:06	TM3	well it looks like the movies with the best combo of acting directing and script would be shysters and the colony
0:33:32	TM2	alright so do we wanna say yes to those?
0:33:35	TM4	Did you total all of the movies and rank them from best to worst?
0:33:57	TM3	yeah i put averages for all the different categories
0:34:13	TM4	Awesome.
0:34:51	TM3	how about we go down the list of movies and we each give our opinions
0:34:59	TM2	i think thats a good idea

Table 5.5 continued

Time	Team Member	Message
0:43:45	TM2	why dont we put it in the maybe pile and keep going, im nervous about time
0:43:55	TM3	i wouldnt think so, but it is a drama and that does mean it has the most variability
0:43:57	TM3	I agree
0:44:00	TM4	Ok sounds good to me.
0:44:04	TM2	then once we pick all the definite yeses we should figure out the costs
0:44:10	TM4	What is the next movie on our list?
0:44:12	TM3	shysters is a def yes
0:44:34	TM2	ok murder.com
0:44:46	TM4	Are we doing Murder.com first?
0:44:52	TM1	Content appeal was the lowest for shysters...
0:45:07	TM3	bad director average acting and low script
0:45:10	TM3	i say no
0:45:22	TM2	no for what, #3?
0:45:33	TM4	Just to clarify, what movie are we talking about now?
0:45:43	TM3	murder
0:45:49	TM4	Ok, sorry about the confusion.
0:46:12	TM2	ok so is this a no?

Table 5.6. Chat Transcript Excerpt for High Performing Team

Time	Team Member	Message
0:23:05	TM3	Why don't we come up with our choice of top 3 movies, and see if we agree
0:23:23	TM4	i agree with that
0:24:45	TM1	the shysters sounds good
0:24:58	TM2	Shysters, My lai, the winner
0:25:39	TM4	the shysters, the colony, my lai
0:25:49	TM4	those are my picks
0:25:59	TM2	TM3?
0:26:06	TM3	my lai, shyster, and hearts and minds
0:26:20	TM1	sheysters, my lai and the winner
0:27:01	TM1	ok lets find and out the common and work on numbers
0:27:08	TM3	ok so shyster is 37million,
0:27:32	TM4	colony is $81 mil
0:28:01	TM3	I'm not sure about the winner..., it has a pretty low viewer appeal potential rating
0:28:16	TM1	but how can we find out the revenues..these are just costs..idk
0:28:26	TM2	okay 1st movie: can we all agree on Shyster? yes or no
0:28:33	TM3	yes
0:28:36	TM1	yes
0:28:41	TM4	yes

Table 5.7. Communication Levels of Leaders and Non-Leaders in "Three Leader" Teams

Mean Frequencies of Computer-Mediated Communication			
		Leadership Category	
		Non-Leader	Leader
Configuration (Virtuality)	VL	13.80	10.00
	L	15.25	21.79
	H	17.25	23.91
	VH	29.33	41.44

Note: Leadership categories:
Non-Leader = composite leadership rating below team mean
Leader = composite leadership rating above team mean.

VL = Very low, L = Low, H = High, VH = Very high

Table 5.8. Entire Chat Transcript for “Three Leader” Team with Non-Leader Isolate

Time	Team Member	Message
0:44:31	TM3	TM4 wa are so sorry that we have not been in contact with you but we would like to hear your imput and we will share you ours
0:44:41	TM3	we*
0:45:45	TM4	I'm still looking through the numbers. Go ahead and tell me what you all are thinking.
0:46:41	TM3	we have come to the conclusion that My Lai with the most marketing and He Shysters with the most marketing will create the most profit.
0:48:04	TM3	We believe that the two will bring in a large number because My Lai is a war movie with a good director and actors. Also The Shysters is a comedy that will draw in the other crowd that is not interested in a war movie.
0:48:41	TM3	overall the two movies together will cost a total of 140 million leaving 10 million left over
0:49:11	TM1	and that is with us spending $20 million for marketing on both movies
0:49:34	TM2	And although shysters does not have the highest content appeal it does have the high star appeal. My lai is also the second highest content and star appeal
0:50:23	TM1	The Shysters is the top rated movie for script quality an My lai is rated 3rd
0:50:45	TM4	yeah, I'm good with choosing those two
0:51:20	TM1	Do you have other comments or concerns about it before we concer?
0:52:14	TM1	if not we are all in agreement on concering then?
0:52:35	TM3	I concer
0:52:38	TM1	I concer
0:52:39	TM4	I concur
0:52:40	TM2	I concer

Table 5.9. Team Performance – Categorized by Level of Virtuality and Number of Leaders

Team Performance					
		Number of Leaders			
		1	2	3	**Total**
Configuration (Virtuality)	VL	513.97	481.43	476.18	**483.28**
	L	487.75	463.44	405.83	**443.59**
	H	522.30	421.34	376.33	**409.00**
	VH	456.03	452.69	376.70	**432.42**
	Total	**486.58**	**455.88**	**403.64**	**441.98**

Note. VL = Very low, L = Low, H = High, VH = Very high

Table 5.10. ANOVA of Team Performance by Condition,

and Post Hoc LSD Test for Significant Differences

ANOVA

	SS	df	MS	F	Sig.
Between Groups	60726.19	3	20242.06	3.50	0.02
Within Groups	474173.23	82	5782.60		
Total	534899.42	85			

Dependent Variable: Team Performance

Test	(I) Virtuality	(J) Virtuality	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
LSD	VL	L	39.69	23.20	0.09	-6.47	85.84
		H	74.28	23.47	0.00	27.60	120.96
		VH	50.86	23.20	0.03	4.70	97.01

Table 5.11. Communication-Related Measures –

Descriptive Statistics and Correlates with Team

Performance, by Level of Virtuality

Descriptives

	Number of Messages				**Total Time in Activity**			
Virtuality	Mean	SD	Min	Max	Mean	SD	Min	Max
VL	48.3	23.19	20	118	2844.7	505.17	1743	3454
L	78.6	32.95	33	142	2832.8	504.69	1657	3584
H	86.6	29.63	31	155	2840.7	429.79	1970	3589
VH	125.0	40.06	68	232	2853.6	475.44	1886	3566

Note: Units for total time in activity = seconds
VL = Very low, L = Low, H = High, VH = Very high
Min = Minimum, Max = Maximum
All conditions are significantly different ($p < .05$) from one another in regards to number of messages, except for the low (L) and high (H) virtuality conditions.

Bivariate Correlations

Virtuality	N	# Msgs	Time
VL	21	0.20	0.43
L	22	0.11	-0.14
H	21	-0.06	-0.24
VH	22	-0.40	-0.15

Note: Dependent variable\: Objective team performance

VL = Very low, L = Low, H = High, VH = Very high

Table 5.12. Initial Chat Transcript of Ineffective Team in 2x2 Configuration

Time	Team Member	Message
0:24:16	TM4	How do you guys think about the 5 elements' rank?
0:24:44	TM4	I think ATP is the last one
0:25:12	TM1	what's ATP?
0:25:21	TM4	average ticket price
0:26:33	TM1	we thought forecasting the rankings for the viewers is the first
0:27:18	TM1	so i'm calculating the script quality + actor Q + Director Q of each movies
0:27:33	TM4	you are smart!
0:27:41	TM3	good idea i agree
0:29:11	TM2	Right now, we are making a table of the viewer appeal, movie quality, markieting, MPAA Rating, and Ticket price. Then across the top we have the movies. Also, we are calculating the movie quality and then we are going to look at the totals once this is done. What are you guys doing?
0:29:35	TM4	you have done most of all
0:29:53	TM4	but we also will figure out another way to do so
0:31:09	TM3	isn't marketing something we should worry about after we determine what movie(s) we want to go with?
0:31:30	TM3	because if we pick a bigger movie we are going to have to market it on a bigger scale
0:32:15	TM4	also, the genre with the audience should be matched
0:34:49	TM4	scranton, may not be a right one, a horror movie. the audience is teens?
0:41:17	TM3	the colony is looking pretty good to me so far...i made a chart kind of like you guys did
0:41:18	TM1	teen male and some women but i think it's hard to calculate that way..
0:44:46	TM3	does anyone know how much time we have left?

Table 5.13. Mean Perceptual Ratings by Condition and Type of Dyad

Comparison of Means across Conditions and Dyadic Configurations

Condition (Configuration)	Dyadic Ratings	N	Trust	N	GMA	N	Ldrshp
VL Virtuality (3x1)	Total	252	5.09	252	5.48	252	3.50
	Collocated	126	5.99	126	6.24	126	4.09
	Non-Collocated	126	4.19	126	4.73	126	2.91
	Collocated->Isolate	*63*	*4.77*	*63*	*5.30*	*63*	*3.07*
	Isolate->Collocated	*63*	*3.61*	*63*	*4.16*	*63*	*2.75*
L Virtuality (2x2)	Total	262	5.32	259	5.69	264	3.69
	Collocated	88	5.97	87	6.20	88	3.91
	Non-Collocated	174	4.99	172	5.43	176	3.58
H Virtuality (2x1x1)	Total	252	5.03	252	5.24	251	3.56
	Collocated	42	5.85	42	6.01	42	3.71
	Non-Collocated	210	4.86	210	5.09	209	3.54
	Collocated->Isolate	*84*	*4.90*	*84*	*5.41*	*84*	*3.58*
	Isolate->Collocated	*84*	*4.83*	*84*	*4.85*	*83*	*3.45*
	Isolate->Isolate	*42*	*4.83*	*82*	*4.91*	*42*	*3.60*

Note: Rows in italics represent subgroups of the non-collocated dyad ratings.
GMA = General mental ability; Ldrshp = Emergent leadership

APPENDIX A: INTRODUCTORY INFORMATION AND CONSENT DOCUMENTATION

You are invited to participate in a research study. The purpose of the study is to learn more about how people interact in a virtual team environment. We are inviting you to participate in this study because you are an undergraduate student in the Tippie College of Business. Approximately 400 people will take part in this study at the University of Iowa.

If you agree to participate in the study, we would like you to participate in a team-based activity, complete two diagnostic tests and two short surveys. The diagnostic tests will consist of a typing aptitude test and the Wonderlic general mental ability test. The first survey will ask you questions about your experience in the decision-making activity. The second survey will ask for basic demographic information, as well as self-report personality items. The team-based activity will be a decision-making task with three other participants. You may be videotaped during the group task. Before I start the videotaping, I will ask you ask you if it is OK to turn on the video recorder. Please tell me Yes or No. Any electronic communications that you have during the group task will be recorded. The entire process is estimated to take two hours to complete.

As you complete the surveys, you are free to skip any questions that you would prefer not to answer. If you would prefer not to participate, please notify the study administrator at this time. You are free to leave the study at any time; however, course credit will only be provided to participants who remain for the entire duration of the experiment.

We will keep the information you provide confidential; however, federal regulatory agencies and the University of Iowa Institutional Review Board (a committee that reviews and approves research studies) may inspect and copy records pertaining to this research. You will not put your name on any surveys, and you will not enter your name in any online diagnostic tests. Instead, you will enter the four digit ID number provided on a post-it note that has been placed at your workspace. We will ask for your name and email address at the end of the study for the purpose of providing course credit for your participation in the experiment – this will not be linked to any other information collected over the course of the study.

You will be asked to provide some information over the Internet. Information provided via the Internet may be viewed by individuals who have access to the computers where the information is collected or stored. It is also possible that your responses could be viewed by unauthorized persons. Again, we will not collect any information in the diagnostic tests or surveys that would identify you.

By participating for the full duration of this study, you will receive credit equivalent to two hours of research support towards your final course grade, as stipulated in the course syllabus for your section of 06J:048. If you do not want to participate in the

study, there are other ways in which you can earn extra credit. You may also qualify for a cash drawing to be held at the completion of the overall study, based on your team's performance. You will not have any costs for being in this research study. Taking part in this research is completely voluntary. If you decide not to be in this study, you will not be penalized or lose any benefits for which you would otherwise qualify.

If you have any questions about the research study itself, please contact Steven Charlier, 108 Pappajohn Business Building, University of Iowa, Iowa City, IA 52242; (319) 335-1011; steven-charlier@uiowa.edu. If you experience a research-related injury, please contact Steven Charlier. If you have questions about the rights of research subjects, please contact the Human Subjects Office, 105 Hardin Library for the Health Sciences, 600 Newton Road, University of Iowa, Iowa City, IA 52242-1098; (319) 335-6564; irb@uiowa.edu. To offer input about your experiences as a research subject or to speak with someone other than the research staff, call the Human Subjects Office at the number above.

Thank you very much for your consideration. Completion of the first online survey will indicate your willingness to participate in the study.

Sincerely,

Steven D. Charlier
Ph.D. Candidate – Dept. of Management & Organizations
Tippie College of Business
University of Iowa

APPENDIX B: ADDITIONAL MEASUREMENT ITEMS NOT INCLUDED IN FORMAL DISSERTATION

General mental ability. Participants completed the 30-item, timed Wonderlic Quicktest (WPT-Q). Raw scores were obtained by adding the number of correct responses within the given time constraints (range 0-50). Subject matter of the test includes general knowledge, vocabulary, visual-spatial reasoning, mathematics, and deductive reasoning (Bell et al., 2002). While the WPT-Q is a new form of the Wonderlic test, previous versions of the Wonderlic Personnel Test have exhibited high levels of reliability (α = .88-.94, test-retest = .82-.94; Dodrill, 1981; Wonderlic, 1992).

Text-based communication ability. Participants completed a three-minute typing test. Three data points were captured for each participant, based on the results of their diagnostic test. First, *average words per minute (WPM)* was calculated by totaling the number of characters typed and dividing that figure by 15 (3 minutes * average of 5 characters per word). Second, *typing error rate* was determined by tallying the number of misspelled words, dividing that figure by 3 (to calculate the average number of misspelled words per minute), and then dividing that figure by average WPM to arrive at the average percentage error for the typist. Third, *net WPM* was calculated by taking the average WPM and subtracting the average number of misspelled words per minute. The free online software (http://www.assesstyping.com) performed each of these calculations automatically.

Verbal communication apprehension. Participants completed the 24-item Personal Report of Communication Apprehension (PRCA; McCroskey, 1982; McCroskey, Beatty, Kearney, & Plax, 1985) using a 5-point Likert scale. The scale features six questions for each of four communication contexts – dyadic conversations, meetings, group discussions, and public speaking. Raw scores on the 24 items were aggregated to provide an overall score (range of 24-120), where higher scores represent

greater levels of communication apprehension. Internal consistency for the scale in previous research has been shown to be very high, with coefficient alphas generally falling in the .93 to .95 range. For analytical purposes, two forms of the data will be used. First, the raw scores were captured for each participant and used as an ordinal measure. Second, based on previous research, participants were grouped into one of three categories based on raw score (>83 = high apprehension, 55-83 = medium apprehension, <55 = low apprehension).

Propensity to trust. Participants completed five items from the International Personality Item Pool (2001), as used in Colquitt, Scott, Judge, and Shaw (2006). The five items are "I trust others," "I trust what people say," "I am wary of others," "I suspect hidden motives in others," and "I distrust people". The final three items were reverse coded. Participants used a 5-point Likert scale to respond.

Big Five personality traits. Participants completed Goldberg's (1992) 50-item transparent bipolar inventory using a 9-point Likert scale. This inventory consists of five sets of 10 bipolar adjective pairs, where each set corresponds to a Big Five trait. Adjective pairs will be presented in two columns; column A will list all adjectives consistent with low levels of Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Openness to Experience, whereas column B will list adjectives that are roughly the opposite of the adjectives listed in column A and are consistent with high levels of Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Openness to Experience. Respondents were asked to indicate their perception of level for each pairing of adjectives, in which scores of "1" will represent very strong linkages to the adjective in Column A (i.e., low level of the Big Five trait), scores of "9" will represent very strong linkages to the adjective in Column B (i.e., high level of the Big Five trait), and "5" will represent neutrality towards the pairing of adjectives (i.e. moderate level of the Big Five trait). The scores on each set of 10 bipolar adjectives were

averaged to form five overall trait ratings, one for each Big Five trait, with a high score indicating a high level of that trait.

Emergent leadership. Beyond the 5-item GLI-based scale, a second measure of leadership emergence was also used. Derived from the procedure as outlined in Neubert & Taggar (2004), participants were asked the one-item general question "Has anyone emerged as a leader within the team (someone who is both a team member and a leader)? If so, who?" Respondents were able to select multiple team members as emergent leaders, a single individual, or no team members as an emergent leader within the team. Participant responses were aggregated for each team member; thus, potential scores on this measure of emergent leadership ranged from 0 to 4.

Subjective team performance. Along with the objective measures provided in chapter 3, participants also completed the two-item scale employed in Chang & Bordia (2001) to subjectively rate the team's performance – items will be responded to using a 7-point Likert scale. The two items are 1) "How productive was this team? (1 = not productive at all, 5 = very productive), and 2) "How well do you think this team worked together?" (1 = very poor, 5 = very good). Item responses were averaged to produce a composite perceived team performance score.

Satisfaction with team. Participants completed the four-item Team Satisfaction Scale adapted from Park & DeShon (2010) and Cook, Hepworth, Wall, & Warr (1981), using a 7-point Likert scale (1 = extremely dissatisfied, 7 = extremely satisfied). The items are: "All in all, how satisfied are you with your members in your team?" "All in all, how satisfied are you with your team's performance in the activity?" "How satisfied are you with the progress you made in the activity?" "Considering the effort you put into the activity, how satisfied are you with your team's performance?". Scores on the four items were averaged to produce a composite "satisfaction with team" score for all individual participants. At the team level, the average scores of the four participants of a given team were also averaged to determine each team's overall satisfaction level.

APPENDIX C: AMENDED INSTRUCTIONS FOR DECISION MAKING EXERCISE (DEVINE ET AL., 2004)

The activity that you are about to begin is a simulation in which participants play the role of a top management team in a fictional Hollywood movie studio. Your team's task is to decide which movies to produce out of a group of 11 possible screenplays, and achieve the highest possible profit.

Each of you has received this notebook – after the divider tab is the simulation information, which begins with a general memo from the CEO that provides information about how to determine the movies with the best profit potential and summaries of 11 screenplays that you can choose to purchase and turn into a movie. In addition, you each have received memos addressed to the 4 Vice Presidents in the top management team: VP Marketing, VP Industry Research, VP Talent Appraisal, and VP Script Evaluation. Brief overviews of the 11 potential screenplays are provided as well. Your team should use this information to make decisions about what movies to produce and how much to spend marketing each one. You may use your personal experience and intuition to fill in the gaps. However, when this conflicts with the information provided by the simulation, you should defer to the simulation. **Do not turn the page until instructed to do so!**

When instructed to begin, we will start with a period of 15 minutes where each team member will have the opportunity to silently and individually review the information at their disposal. No discussion or interaction is permitted during this time. You may take notes on the scratch paper provided, but may not discuss this information with other participants during this period.

After the 15 minutes of individual review is over, you will have 10 minutes as a team to plan your decision-making strategy. At this point, you may communicate with your teammates via the chat tool and/or verbally (if you are at the same location as other team members). Once the 10 minute planning period is over, you will have 30 minutes to discuss the task and reach agreement concerning which movies to produce and how much money to spend on marketing them.

You must all be in agreement regarding your choices, and <u>each person will indicate their agreement by typing "I Concur" in the chat tool</u>. You will need to elect someone from the team to record the agreed-on recommendations on the provided form marked "Final Recommendation Sheet" by placing a check in the box next to a movie and circling a marketing amount (0, 5, 10, or 20 million dollars) to the right. <u>The total cost of a movie is its production cost plus its marketing cost</u>; sum these two values for each movie and indicate the total in corresponding space. **You may choose as many movies as you would like, subject to the constraint that you cannot spend more than 150 million dollars in any decision period.** Therefore, the total at the bottom right of the Final Recommendation Sheet must be less than or equal to 150 million dollars. This form is located in the back pocket of this notebook, along with some blank paper that you may use to help with your analysis.

You will receive further instructions from the Administrator via the chat tool once everyone is seated and ready to begin. If you have any questions at any time during the experiment, please send a message to the Administrator (username: UIVTAdmin), and we will respond either with a private chat message or we will visit you in person.

If you have no questions at this point, please type and send the message "I am ready" in the chat session at this time.
Do not send any other messages via the chat tool until instructed!

APPENDIX D: INFORMATION MEMOS FOR DECISION MAKING EXERCISE

GENERAL MEMO

To: TinselTown Top Management Team
From: Stan Friedman, CEO
RE: Choosing films for production next year

Thanks for agreeing to meet on such short notice. As usual, the task in front of you is one of picking the movies that we will produce and release in the upcoming year. The fiscal solvency of our studio is riding on the decisions you make. Pick the best movies and we (as well as our stockholders) will be swimming in profit; pick the wrong ones and we may go belly up.

As you all know, profit from the movies we make is determined by taking the revenue earned by each film and subtracting its cost:

Movie Profit = Movie Revenue – Movie Cost

Movie cost is estimated by adding the production cost (which is fixed) to the marketing cost (which is under our control):

Movie Cost = Production Cost + Marketing Cost

Movie revenue is estimated by multiplying the number of viewers by the average ticket price for a particular film:

Movie Revenue = # of Viewers * Average Ticket Price

As you are well aware, the number of viewers for any given film depends on five main factors: (1) Viewer Appeal, (2) Movie Quality, (3) Marketing, (4) MPAA rating, and (5) Average Ticket Price. *Viewer Appeal* is basically a function of popular interest in the film's content (i.e., setting, plot, special effects), as well as the popularity of the talent involved (i.e., director and actors/actresses). *Movie quality* is a function of the script quality, director's skill, and actor/actress' skill. All of these things interact with one another, and each one is important. If a movie has a good script and good actors/actresses but a terrible director, the movie will not be very good. Similarly, if a movie has a good director and good stars but a poor script, it will also be bad. It probably goes without saying that a movie that is poor in all three categories will just plain stink. *Marketing* obviously increases public awareness of our movie, and the *MPAA rating* constrains the size of our audience base. The *average ticket price* reflects the age of the average viewer

and, to a certain extent, the time of day that the typical viewer goes to see the movie. Movies with the highest average ticket prices draw mostly adults who go to see the movie in the evening; movies with lower average ticket prices attract younger viewers and people who go when matinees prices are in effect. ***The point here is that all five factors must be considered when estimating how much revenue a film will bring in.***

Our spending allowance for this year is $150 million. It's hard to tell from a brief summary how much a film is going to cost because it depends on many factors, including star salaries, shooting location and duration, and special effects. However, our screenplay reviewers are pretty good and the estimates they provide should be very close.

I would like you to examine the information at your disposal and figure out how to spend our $150 million to maximize total profit for the year. As usual, I don't care if you spend the $150 million on one blockbuster or divvy it up over 10 little art-house projects – just figure out the ones that will bring in the most profit. While a film's total revenue is important, keep in mind that it's return on investment that is critical. *In other words, the most important value to estimate is a potential film's profit divided by its cost (i.e., profit/cost, or profit ratio). Profit ratio reflects the number of dollars of profit we get for every dollar we spend.* A good film will end up making about twice as much as it cost (including marketing), and a great film may end up making three to four times as much.

And don't bother trying to save any money – it's there to be spent, so use as much as you can.

I know that picking movies isn't an easy task, but do the best you can. Your staffs have provided you with a good deal of useful information, and I think our screening team has identified a good set of potential choices for you. Feel free to use your personal experiences and gut feelings, but let the hard numbers provided by our research team have the final say. I look forward to seeing your recommendations on my desk next week. Good luck!

MEMO

To: TinselTown Top Management Team
From: Industry Research Staff
RE: Viewer Appeal ratings

Here is the market research that you requested on potential movies for next year. We pulled together 10 focus groups as usual to get this data. Each focus group was led by someone on our staff and involved a roundtable discussion of the movie's premise and cast, plus formal ratings of content and star appeal by each member of the focus group. We gave the focus groups the same movie capsules that your committee is using to make your decisions. See Table 1 for a summary of the findings from the focus group research.

Table 1 contains two separate estimates of a film's appeal based on its *content* and *stars*. We asked people in the focus group to discuss (and rate) Content Appeal and Star Appeal separately. **Content Appeal** concerns a movie's premise, plot, character development, and special effects; the film's genre and emergent themes play a role as well. **Star Appeal** has to do with the popularity of the actors/actresses as well as the director. Industry research suggests that content is roughly twice as important as stars in determining who goes to see a movie, so we scaled Content Appeal values from 0-200, and Star Appeal values from 0-100. Basically, a Content Appeal score of 200 means that the movie should have a very broad demographic appeal and the focus group participants were dying to see the screenplay get turned into a movie. In contrast, a Content Appeal score of 0 means that no one was interested in seeing the movie get made based solely on its subject matter. A Star Appeal score of 100 means that basically every role in the film has A-List stars that people want to see; a score of 0 means that the cast is essentially unknown to the audience. Star Appeal is based on physical attractiveness, charisma, and the success of recent films and has little to do with talent – it only reflects "popular demand."

Films with unusual situations and big-name stars tend to have more appeal to viewers. In particular, action/adventure, war, science-fiction, and suspense films tend to interest people more than dramas or comedies. Animated films almost always do well with families and often become blockbusters – they have a built-in audience if based on a book or story familiar to the audience. Horror movies do well with males (especially younger ones) and some pull in women as well. Comedies do well if the situation is right and the casting is good. Dramas are the most variable; they tend to draw discriminating viewers from all groups, but usually have much lower content appeal because their situations are more ordinary. More importantly, movies with lots of special effects are very attractive regardless of their genre – in part because of extensive repeat viewing.

To summarize, the Content Appeal and Star Appeal values quantify the appeal of a film based on its subject matter and cast, respectively. **A good overall index of the "buzz" surrounding a potential movie is to add up its Content Appeal and Star Appeal**.

Table 1: Focus Group Research on Viewer Appeal of Potential Movies

Movie Title	Content Appeal	Star Appeal	Staff Comments
The Colony	195.00	100.00	What's not to like? Interesting premise, great special effects, stellar cast. Huge demographic appeal; can't-miss territory.
My Lai	180.00	70.00	Oliver Stone goes back to Vietnam to dissect a real cover-up. Quite a buzz on this one in the industry.
Hybreed	110.00	55.00	*Charlie's Angels* meets *Alien*. Should appeal to young male demographic.
1-900	110.00	45.00	Low budget, funny, kinky. Sex always sells, but target audience is fairly narrow.
Murder.com	100.00	50.00	Film about the growing connection between criminals and the Internet. Will definitely appeal to younger viewers.
Scranton	100.00	35.00	Sam Raimi knows how to do horror films, but the focus groups didn't like the stars in their roles.
The Winner	95.00	70.00	A tragedy for the 21st century – with an ambiguous ending that will have everyone talking. Leads had people drooling.
Hearts & Minds	95.00	50.00	A "chick flick" that didn't turn away men. Soderbergh and intriguing leads will bring people out.
Malled	85.00	60.00	Classic teen-oriented date movie that spoofs the American mall. Likeable leads and colorful supporting cast.
The Caddy	80.00	55.00	Low budget drama pushes the envelope with big names and a movie about sexual orientation.
The Shysters	75.00	65.00	Good spoof of religion; focus groups thought the cast was a great mix.

MEMO

To: TinselTown Top Management Team
From: Script Evaluation Staff
RE: Script Quality ratings for potential movies

Here is the information you requested regarding the movie screenplays that were sent to us for evaluation. We generated quality ratings by having two of our most experienced readers go through each screenplay and assign a rating on a scale of 1 to 10, then we averaged the ratings.

When we made our ratings, as always, we paid attention to the quality of the dialogue, plot coherence, pacing, and factors appropriate to each type of movie. For example, for dramas we considered character development and plot twists, whereas for science fiction films we looked for a unique vision of the future and a realistic extrapolation from current society. In other words, we took into account that what makes one kind of movie good is not necessarily the same thing that makes another kind of movie good.

We don't have to tell you that Script Quality is very important to the success of a movie – everything is riding on it. We can have all the big-name stars we want but if the script is terrible, it's not going to make back the money needed to pay all those stars! Make sure the other execs realize this.

Script Quality Ratings and Expected MPAA Ratings for Potential Movies

Movie Title	Script Quality	Expected MPAA Rating
The Shysters	10	R
The Colony	9	R
My Lai	8	R
Hearts & Minds	7	R
1-900	7	NC-17
Murder.com	6	PG-13
The Winner	6	R
The Caddy	5	PG-13
Hybreed	4	PG-13
Scranton	4	R
Malled	3	PG

MEMO

To: TinselTown Top Management Team
From: Talent Appraisal Staff
RE: Skill Ratings for Actors, Actresses, and Directors

We were finally able to compile the information regarding actor and director skill values. It took quite a bit of work, but we now have the data you requested.

Basically, we surveyed a panel of movie critics and asked them to rate a list of actors, actresses, and directors for their professional skill. For directors, we asked the critics to consider things like artistic vision, ability to inspire actors and actresses, work ethic, and capturing the "feel" of situations. For those in front of the camera, skill consists of raw acting talent, intensity, emotional expressiveness, and range.

Director Skill pertains to the ability of a director to create a unified artistic vision and get the most out of the actors and actresses. Director ratings were made on a scale of 1-10, with 1 indicating a true hack with no talent and 10 indicating a director who could make an Oscar-winner with volunteers from regional theater. Some of these ratings may surprise you. Acting Skill is primarily a function of an actor/actresses' ability to credibly display a range of emotions. Some actors/actresses are very good in limited roles, but the truly great ones can yearn, pine, lust, cry and rage with amazing ability. Actors and actresses are rated on a 5-point scale, with 1 indicating an actor/actress who would be challenged to do well on a soap opera and 5 indicating an actor/actress that can do any role with convincing authority.

With regard to how the Acting Skill of the various actors/actresses affects the overall Acting Quality of the movie, here is what our research seems to suggest:

(1) The Acting Skill of supporting actors can pretty much be ignored – these people are usually not on screen long enough for their flaws to do much damage.

(2) Acting Quality can be estimated by averaging the Acting Skill ratings for the Lead Roles. When there are only two lead roles, however, it's actually a little less than average if there is a large discrepancy in the Acting Skill values of the leads. In other words, the lesser actor weighs the film down.

Table 1: Director Skill Ratings

Director	**Skill Rating (0-5 stars)**
John Carpenter	3.5
Chris Columbus	2
Stanley Eider	3
Nora Ephron	4
Milos Foreman	4.5
William Friedkin	3
Jonathan Glazer	3.5
Ron Howard	4
Jean Jacques-Annaud	3.5
Stephen King	2.5
Neil LaBute	4
Mimi Leder	3.5
Ang Lee	5
Barry Levinson	4
Michael Mann	4
Garry Marshall	3.5
John McTiernan	4
Sam Mendes	3.5
Mike Nichols	4
Wolfgang Peterson	3.5
Sam Raimi	3
Harold Ramis	3
Brett Ratner	2
Ivan Reitman	2.5
George Romero	3
Joel Schumacher	1.5
Ridley Scott	5
Bryan Singer	2.5
Steven Soderbergh	5
Oliver Stone	5
Billy Bob Thornton	3.5
Simon West	2
Robert Zemeckis	4.5

Table 2: Acting Skill Ratings for Lead Actors (0-5 Stars)

Actor/Actress	Skill	Actor/Actress	Skill	Actor/Actress	Skill
Ben Affleck	3 ½	Josh Hartnett	3	Freddie Prinze, Jr.	3
Jessica Alba	3 ½	Ethan Hawke	3 ½	Dennis Quaid	3 ½
Kevin Bacon	4	Katie Holmes	3	Daniel Radcliffe	3 ½
Alec Baldwin	4 ½	Jeremy Irons	4 ½	Len Randall	4 ½
Tom Berenger	4	Samuel L. Jackson	4	Christina Ricci	5
Halle Berry	3 ½	Angelina Jolie	3	Denise Richards	2
Sandra Bullock	2 ½	Ashley Judd	4	Chris Rock	3
Steve Buscemi	4	Nastassia Kinski	4 ½	Keri Russell	3 ½
Nicholas Cage	3 ½	Shia LaBeouf	3 ½	Kurt Russell	4
Hayden Christensen	3	Eriq La Salle	3 ½	Elisabeth Shue	4
Jennifer Connelly	4 ½	Jude Law	4 ½	Gary Sinise	4 ½
Russell Crowe	5	Donal Logue	4	Tom Skelton	4 ½
Emily Cryton	5	Jennifer Lopez	3	Kevin Spacey	5
Matt Damon	4 ½	John Malkovich	4 ½	DeWayne Stevens	4
Keith David	4	Julianna Margulies	4	Sharon Stone	3
Daniel Day-Lewis	4 ½	James Marsden	3 ½	Madeline Stowe	4 ½
Vin Diesel	3 ½	Dylan McDermott	3	Kiefer Sutherland	3
Richard Dreyfuss	4	Rose McGowan	3 ½	Mena Suvari	3 ½
Eliza Dushku	4	Tobey McQuire	4 ½	Uma Thurman	4
Charles Dutton	3 ½	Teri Miller	4 ½	Amber Valletta	4 ½
Dakota Fanning	4 ½	Bill Murray	5	Mark Wahlberg	4
Will Ferrell	4	Liam Neeson	4 ½	Denzel Washington	5
Linda Fiorentino	4	Ronda Nelson	4	Damon Wayans	3
James Franco	3 ½	Edward Norton	5	Sigourney Weaver	5
Morgan Freeman	5	Chris O'Donnell	2 ½	Elijah Wood	4 ½
John Goodman	4	Haley Joel Osment	4	Michelle Yeoh	3 ½
Gene Hackman	5	Jason Owens	5	Catherine Zeta-Jones	3 ½
Tom Hanks	5	Anna Paquin	4 ½		
Ed Harris	4 ½	Natalie Portman	4 ½		

MEMO

To: TinselTown Top Management Team
From: Marketing Staff
RE: Impact of Marketing Strategy, MPAA Rating, and Expected Ticket Prices

Table 1: Marketing Strategy Information.

Strategy	Cost (in millions)	Impact on Viewer Appeal
Word-of-Mouth	$0	+0%
Print + Outdoor	$5	+30%
Pre-Release TV	$10	+55%
Saturation TV	$20	+75%

As shown in Table 1, there are four feasible marketing strategies we can employ, each with a given cost and impact. Note that, as our marketing strategy gets more sophisticated, the costs and the positive change in viewers go up. Basically, the more expensive the strategy, the more effective it is. It is important to note, however, that marketing is most effective when there is a movie with high Viewer Appeal – marketing doesn't help much if the content of the film isn't all that intriguing or if there are no big-name stars. If we're going to produce any "small" high-quality films, it's probably better to just rely on word-of-mouth to spread the news. Overall, a good strategy is to spend money marketing a movie in proportion to its cost – cheap ones we can get away with little or no marketing; expensive ones can benefit from saturation TV marketing.

Table 2: Impact of MPAA Movie Rating on Size of Potential Viewer Base.

MPAA Rating	Projected Impact
G	0%
PG	-10%
PG-13	-15%
R	-25%
NC-17	-40%

As you can see, "R" or "NC-17" movies take a big hit in that a good proportion of people who go to see movies are excluded from the start. Even if those movies are good, we won't get as many people coming to see them simply because the potential viewer base is smaller! Obviously, "G" films give us the largest possible base, so we should keep an eye out for any of those.

Table 3: Average Ticket Price in Dollars for Potential Movies.

Movie Title	Average Ticket Price
1-900	$ 7.50
The Winner	$ 7.50
Hearts & Minds	$ 7.25
My Lai	$ 7.25
The Caddy	$ 7.25
The Shysters	$ 7.25
The Colony	$ 7.00
Murder.com	$ 6.75
Hybreed	$ 6.50
Malled	$ 6.50
Scranton	$ 6.50

We had the bean-counters in Finance use their fancy regression models to predict the average ticket price for each potential movie based on projected demographics. These financial models take into account a host of factors and they're usually pretty accurate. As you can see from Table 3, the potential movies for next year are predicted to have average ticket prices ranging from $6.50 to $7.50.

Screenplay Profile

Title: ***1-900***

Genre: Drama

Audience: Couples; older men

Plot Summary:

The movie opens with a man and a woman planning their wedding. However, at the last minute, the woman decides she doesn't want to get married and leaves the man at the altar. Utterly dejected, the man turns to 1-900 numbers to console his grief. After many explicit conversations with various phone sex operators, the man begins to fall in love with a young operator on his favorite line. The man and woman engage in some steamy conversations and the man becomes increasingly enraptured. Through illegal means, the man learns of the woman's real name and address. He begins to follow her and becomes obsessed with meeting her. Eventually he meets her and seduces her. In the process, he learns that she has been equally infatuated with him, has been having him followed, and knows he has become obsessed with her. This initiates a kinky affair that plays out regularly at the woman's apartment as she takes calls from her clients. The routine works so well that they eventually decide to get married and go into a specialized niche of the phone sex business.

Talent	Role	Type
Angelina Jolie	Phone Sex Operator	Lead
Dylan McDermott	Caller	Lead
Penelope Cruz	Roommate	Support

Director: Jean-Jacques Annaud

Cost: $18 million

Screenplay Profile

Title: ***The Colony***

Genre: Science Fiction

Audience: Diverse

Plot Summary:

In 2119, a spaceship from over-populated Earth departs for a far-away solar system on a colonization mission. On the way to an ideal planet, a civil war erupts on the colony ship and the spacecraft is forced to land on a barren and hostile planet. Two factions emerge, one basically good and the other evil. Spilling out of the ship, the two sides struggle against each other and the hostile environment. The planet has a tremendous gravitational pull that makes movement grotesque, a poisonous atmosphere that results in death with any breach of spacesuit integrity, and a hostile alien species that lives off human brain matter. A three-way war ensues, with the evil faction learning to communicate with the aliens and attempting to partner with them. In a brutal encounter, members of the evil faction are ambushed and wiped out by the double-crossing aliens. The aliens then turn on the good faction and threaten to overrun the colony, but the humans win a pitched battle when the central hive is destroyed by one of the few remaining humans who manage to infiltrate the alien defenses. As the battle ends, a relief ship arrives and takes away the survivors, who have mixed feelings about abandoning the planet. Loaded with special effects.

Talent	Role	Type
Ed Harris	Ship Commander	Lead
Ashley Judd	Co-leader of Good faction	Lead
Mark Wahlberg	Co-leader of Good faction	Lead
Gary Sinise	Leader of Evil faction	Lead
Sarah Michelle Gellar	Stowaway	Support

Director: John McTiernan

Cost: $81 million

Screenplay Profile

Title: ***The Caddy***

Genre: Drama

Audience: Adults

Plot Summary:

Aidan is a recently turned golf pro dealing with all the stress and pressures of trying to make it big. He spends his days, rain or shine, on the course, hitting ball after ball to perfect his swing. The two things that he makes time for are women and his lifelong friend and caddy, Eric. The first part of the film chronicles Aidan's many brief affairs with women who follow him on tour. In a moment of weakness, he falls for one, they marry, and soon have a daughter by accident. The stress of the professional circuit and the new child rapidly sour the relationship and the breaking point comes when Aidan decides to play in a tournament on their five-year anniversary. Aware all along that something was not quite right, his wife files for divorce and leaves. He is initially devastated but through many low-key talks with his friend, the caddy, Aidan begins to realize that his approach to relationships – all relationships – has been very self-serving. In a climactic scene where the two endure a ferocious rainstorm to finish a round, Aidan realizes that he loves Eric and that his friend has been patiently waiting for him all along. The film traces the path of personal discovery and the difficulties of being true to oneself.

Talent	Role	Type
Matt Damon	Golf Pro	Lead
Ben Affleck	Caddy	Lead
Amanda Peet	Wife	Support

Director: Sam Mendes

Cost: $26 million

Screenplay Profile

Title: ***My Lai***

Genre: Action/Adventure

Audience: Diverse

Plot Summary:

Based on the real-life massacre of a Vietnamese village by U.S. troops in 1968. Led by Lt. William Calley, U.S. troops belonging to C Company, "Americal" Division, enter the village of My Lai (pronounced "Me-Lie") on a routine "search and destroy" mission and ending up killing over 400 people. The movie begins by depicting the training of the unit, its deployment to Vietnam, and its increasing frustration and hatred toward Vietnamese civilians stemming from the continual loss of life in and around Vietnamese villages. The movie focuses on the triggering events that led to the first civilian deaths, the spread of the killing mindset, and the choices that individual soldiers had to make about their participation in the killing. The first half of the movie details the actions of Lt. Calley, Sgt. Menken (a soldier who refused to participate and tried to stop the killing), and Nee Wa Gin, a young Vietnamese peasant who led a group of villagers in their attempt to first hide, then escape, from the village. The second half of the movie highlights alleged efforts by the Army to hide the massacre from the American people, as well as the resulting trial in which Lt. Calley was acquitted of murder.

Talent	Role	Type
Tobey McQuire	Sgt. Menken	Lead
James Marsden	Lt. Calley	Lead
Denzel Washington	Capt. Rand	Lead
Michelle Yeoh	Vietnamese villager	Lead

Director: Oliver Stone

Cost: $63 million

Screenplay Profile

Title: ***The Shysters***

Genre: Comedy

Audience: Diverse

Plot Summary:

A trio of con artists (two men and a woman) decides to try to make money by creating their own church, a "Near-Far Eastern" combination of Buddhism and Christianity. The plan is to scam money with a bogus fund-raiser supposedly intended to raise cash for a new church building. One of the three takes on the role of pastor of the fake religion; another creates a variety of outrageous religious artifacts for sale; and the third bills himself as an "Eastern Guru," healing the sick and performing exorcisms. Much to their chagrin, the ministry grows in popularity and they become increasingly uneasy with their deception. To make matters worse, the Eastern Guru then falls in love with one of the parishioners and begins to have doubts about the hustle. In a touching scene where a couple comes seeking a miracle for their dying child, the pastor feels ashamed as he looks into the pleading eyes of the parents who have walked from miles away because they had a half-off coupon for one miracle, good only for that day. The pastor cannot go through with the sham and simply says a genuine prayer for the child without charging the parents. Miraculously, the child gets better and, after this, things change. The trio takes steps to legitimize their religion and the guru ends up getting married in the "bogus" church that he helped establish. The movie ends with a hilarious Near-Far Eastern wedding ceremony with all the townspeople in attendance. The film starts out as a parody and ends up being a feel-good movie, all the while taking a penetrating look at the nature of faith and the behavior it inspires.

Talent	Role	Type
Will Ferrell	Church Pastor	Lead
Uma Thurman	Living Saint	Lead
Bill Murray	Eastern Guru	Lead
Elizabeth Hurley	Spiritual Advisor	Support

Director: Robert Zemeckis

Cost: $37 million

Screenplay Profile

Title: ***The Winner***

Genre: Drama

Audience: Couples; adults

Plot Summary:

Chronicles the rise, fall and rebirth of a lottery winner. Madeline Stowe plays a good person and wonderful mother who is working a dead-end job but dreams of making it rich. One night, the dream comes true when she and her children hit the lottery jackpot. Overnight, the woman has more money than she could've imagined. She buys a large house and several cars, engages in torrid love affairs, and progressively isolates herself while alienating everyone who matters to her. When her children decide to run away to be with the father they have never known, the grief-stricken woman finally realizes what she has done. She decides to spare no expense in finding the children, but over the course of months the search is undercut by the greed of everyone around her. Unknown to the woman, one of her "one-night stand" lovers falls for her and initiates a search, finally locating the children on the other side of the country. The man tries to get word of the good news to the woman, but various problems prevent him from doing so; meanwhile, the despairing woman prepares to kill herself. She ends up hearing the message on her answering machine as she sits in a bathtub with slashed wrists. She struggles to get out while a next-door neighbor pounds at the door. The scene lingers and fades out to another where the woman, the neighbor and the children are playing together happily as a family. The movie leaves in doubt whether this image is the future or a final hallucination before her death.

Talent	Role	Type
Madeline Stowe	Lottery Winner	Lead
Daniel Day-Lewis	Neighbor	Lead
Jon Bon Jovi	Lover	Support
Joseph Fiennes	Lover	Support

Director: Nora Ephron

Cost: $32 million

Screenplay Profile

Title: ***Hybreed***

Genre: Horror

Audience: Teens, especially males

Plot Summary:

Researchers at a prestigious medical research firm are getting very close to a cure for cancer. A team of top researchers has been creating new cells that would replace the cancerous cells and reproduce completely to restore the individual to health. Before completing the last steps of the process, one of the lead researchers is discovered embezzling money from the research funds. The researcher is fired but, before leaving, combines many types of cancerous cells into an amphibian body with remarkable genetic reproductive capacity. Over the next week, an increasingly bizarre series of substances are discovered in different parts of the lab and many of the lab animals used for research are found mauled or eaten. When a female researcher is working alone late one evening, the audience finally sees a gruesome creature, which attacks and drags her off, unconscious, after an extended fight. Two other researchers working that night team up with an enterprising janitor to save all of their lives. In a grisly fight that ends up with two of the three humans dead, the creature is killed with the help of a rigged-up flamethrower and an acid sprayer. The movie ends with the strong hint that the first researcher is not dead, but rather infected and incubating somewhere in the facility.

Talent	Role	Type
Julianna Margulies	Researcher	Lead
Halle Berry	Researcher	Lead
Nastassia Kinski	Researcher	Lead
Jon Voight	Disgruntled researcher	Support
James Caan	Janitor	Support

Director: George Romero

Cost: $16 million

Screenplay Profile

Title: ***Hearts & Minds***

Genre: Drama

Audience: Couples; women

Plot Summary:

A female attorney at a large law firm has her sights set on the ultimate career objective – becoming a partner in the firm. The early portion of the film establishes the woman's superb credentials and demonstrates her ability to develop relationships with important clients. Although the woman doesn't realize it, she poses a threat to the old boy's network at the top and they decide to force her out. Even more than before, she finds herself exposed to cruel pranks and jokes, and physical intimidation by many coworkers with whom she had been friends. She is pulled off important cases, loses her office, and has her salary cut in half. With no one to turn to, she finally enlists the aid of her separated husband -- the only lawyer who believes in her, even though they can barely stand one another. Working together, the two begin to build a massive gender discrimination case. At first they can hardly communicate and every conversation turns into an argument as old wounds surface. After working in silence broken by many small moments, they slowly find themselves yearning to get back together – which they ultimately do. In the climactic scene, the woman tricks her boss into admitting everything, but realizes that she no longer wants to work for the firm. Although they can prove their case and win in court, they drop it – after arranging for the female attorneys at the firm to file a class-action lawsuit.

Talent	Role	Type
Rose McGowan	Rising Attorney	Lead
Jude Law	Estranged Husband	Lead
Brian Dennehey	Firm Partner	Support
Donald Sutherland	Firm Partner	Support
Peter Coyote	Firm Partner	Support

Director: Steven Soderbergh

Cost: $32 million

Screenplay Profile

Title: ***Murder.com***

Genre: Suspense

Audience: Teens; males

Plot Summary:

Sam Kurtis, a psychotic sociopath and connoisseur of cyberspace, has taken to picking up lonely women in chat rooms. He derives joy from eventually meeting them in person and breaking their heart, but then he meets Sara. They hit it off and have an intense relationship through their computers, but Sara eventually decides she is not interested and ends the relationship. Sam is crushed and becomes very angry, the trauma pushing him over the brink into madness. He begins spending 24 hours a day in the chat rooms in the vain hope of finding Sara. Along the way, he convinces many women to meet him and then brutally murders them. Phillip Kent, an FBI agent leading the investigation, decides that someone will need to go undercover to lure the killer out in the open. Agent Rachel Brown is called in to make contact with Sam. She ends up in the same chat room with him and they agree to meet, but problems arise and the police are unable to prevent him from abducting Rachel and getting away. Attempting to buy time, Rachel persuades Sam that she is actually the Sara he is looking for, and draws him into a game where she will try to seduce him and win him back in the online chat room where she ended the relationship. Frantically monitoring the chat rooms at FBI headquarters, Agent Kent figures out what is going on by piecing together clues sent by Agent Brown, and the FBI arrives just in time to arrest Sam as he prepares to kill Rachel at the conclusion of her seduction.

Talent	Role	Type
Ethan Hawke	Sam Kurtis	Lead
Elisabeth Shue	Rachel Brown	Lead
Donal Logue	Phillip Kent	Lead

Director: Bryan Singer

Cost: $26 million

Screenplay Profile

Title: ***Malled***

Genre: Romantic Comedy

Audience: Teens; couples

Plot Summary:

This movie follows the zaniness of American life as seen through the lens of the typical suburban mall. The plot unfolds as a low-key romance develops between 17-year-old Kerry, a new employee at the pet store, and Manny, a Hispanic kid who also works at the pet store and is one of the most popular people at the mall. As the days go by, their relationship deepens but then the stresses of an inter-racial relationship set in and become too great, so they decide to split. Of course, they soon realize they have made a mistake, but their reconciliation is impeded by the bizarre owner of the pet store, the long-winded food court manager, a nerdy gang leader, and a compulsive mall walker who is always in the wrong place at the wrong time. The lovers eventually realize that they make a pretty good team and open their own clothing store at the mall. The movie takes shots at the many stereotypes of people found in malls, as well as the difficulties of cross-racial dating.

Talent	Role	Type
Denise Richards	Kerry	Lead
Freddie Prinze, Jr.	Manny	Lead
Cheri Oteri	Pet Store Owner	Support
Ice-T	Gang Leader	Support
Billy Crystal	Food Court Manager	Support
Rosie O'Donnell	Mall Walker	Support

Director: Garry Marshall

Cost: $20 million

Screenplay Profile

Title: ***Scranton***

Genre: Horror

Audience: Teens

Plot Summary:

The scene is set in a small coal-mining town in Pennsylvania. A group of local children are playing around the coal mines against their parents' orders. One of the children, Sean, finds a small passageway into one of the mines and the children decide to investigate and don't come out. The parents of the children call a town meeting and organize a search party, but in the midst of discussion an older woman rises to speak. She says that, years ago, a coal miner went crazy and began kidnapping children and killing them within the confines of the coal mine. A group of parents went to the coal mine to seek revenge for their children and murdered the worker, and since that day people have said that his ghost remains in the coal mine. The old woman offers to lead the assault on the ghost, arguing that she is the only one that can do the job. A tense battle in the blackness of the caves gradually reveals the gruesome fate of the children. Most of the parents meet a similar fate but, in the end, the old woman destroys the murdering ghost, who turns out to be her father.

Talent	Role	Type
Kiefer Sutherland	Parent	Lead
John Malkovich	Ghost	Lead
Haley Joel Osment	Sean	Lead
Gloria Stuart	Old woman	Support

Director: Sam Raimi

Cost: $45 million

APPENDIX E: "FINAL RECOMMENDATIONS SHEET" FOR

EXERCISE

1. You may only use the amount of money budgeted for this session, **$150 million**. You cannot spend more than $150 million; if a plan that involves overspending is mistakenly submitted, your group will not be eligible to receive the performance bonus. It is your responsibility to make sure that your plan is valid.
2. Any unused money will count towards your revenue.
3. All team members must sign the document; if any signatures are missing, the document will be returned.
4. You have 25 minutes to make your choices; if your team has not completed its selection process within the allotted time, only the valid choices you have selected will count and the unused portion will be added to your revenue.
5. TO CHOOSE A MOVIE FOR PRODUCTION, DO THE FOLLOWING:
    a. Indicate your choice by checking the appropriate box below
    b. Choose a dollar amount to spend on marketing (the default is $0)

Title	**Production $ +**		**Marketing $**					**=Total $**
	(All amounts are in millions of dollars)							
❑ 1-900	$18	+	0	5	10	20	=	_____
❑ Hearts & Minds	$32	+	0	5	10	20	=	_____
❑ Hybreed	$16	+	0	5	10	20	=	_____
❑ Malled	$20	+	0	5	10	20	=	_____
❑ Murder.com	$26	+	0	5	10	20	=	_____
❑ My Lai	$63	+	0	5	10	20	=	_____
❑ Scranton	$45	+	0	5	10	20	=	_____
❑ The Caddy	$26	+	0	5	10	20	=	_____
❑ The Colony	$81	+	0	5	10	20	=	_____
❑ The Shysters	$37	+	0	5	10	20	=	_____
❑ The Winner	$32	+	0	5	10	20	=	_____

Total: _____

APPENDIX F: DEBRIEFING INFORMATION FOR PARTICIPANTS

You have just participated in an experiment involving virtual teams. The stated purpose of the experiment was to investigate how people interact in a virtual team environment. The actual purpose of the study was twofold: 1) to see how individuals emerge as leaders in virtual teams, and 2) to see how differences in leadership patterns across teams may impact team performance. To this end, individuals were randomly assigned to one of four experimental conditions, where teams differed in the configuration of team members across two or more physical locations. This deception was necessary to ensure that participants were not aware of the experiment's focus on leadership emergence and would not impact participant behavior during the experiment.

A second deception in regards to your team's performance in the group activity was also necessary. During the experiment, you were informed that if your team scored sufficiently high enough in the simulation, you and your teammates would qualify for a cash prize drawing. In reality, all participants in this experiment will qualify for the cash drawing, regardless of how well their team actually performed in the activity. This deception was done to help motivate individual performance and foster teamwork during the experiment. By providing the same information to all participants, and subsequently, entering all participants who completed the activity in the drawing for cash prizes, no individual was penalized based on any aspect of their fellow teammates' ability or performance.

The drawing will take place once the experiment is complete, and winners will be notified via email. At this time, we expect that the drawing will take place in January 2012.

If you have any questions regarding the study, please contact Steve Charlier at steven-charlier@uiowa.edu or at (319) 335-1011.

If you have questions about your rights as a research participant, you may contact the Human Subjects Office at irb@uiowa.edu, or via phone at (319) 335-6564.

For the integrity of the experiment, we ask that you do not discuss any aspect of the experiment or group activity with anyone until the experiment is completed. If you feel that you will not be able to comply with this request, please let the study administrator know at this time. Please write your name in the spaces provided below – this will be used to ensure that you receive course credit for your participation in the experiment (please allow 1-2 weeks for credit to be posted to ICON). Also, please ensure that the email address that you provide below will be valid until May 2012.

_____ _____

Name Email address

Management instructor(s): _____

We thank you once again for your participation in this study!

APPENDIX G: LETTER FROM IRB CHAIR REGARDING RESEARCH STUDY TEAM INCENTIVES

Hello Steven,

I am writing to you as Chair of the IRB with regard to your question about team incentives. Interestingly, I just had this question come up this am from another researcher. I'd be happy to talk with you about issues that arise when using a team based approach.

Briefly, two issues are initially problematic with a team incentive. First, compensation must be based on individual participation for time and effort, one cannot inequitably compensate a participant who took the time and effort because another participant did not. Second, there is clear guidance that one cannot use group pressure to incent a participant to complete a voluntary research activity.

Your latter method appears more acceptable, each participant receives as compensation the chance at a pay-out (compensation is the value of the chance, not the "winnings", chance to win is equitably distributed among the participants although the winnings are not). However, I think there would be a problem with deception involving the compensation because compensation for time and effort is part of making an informed choice.

Many times these types of studies are presented with no compensation (or course credit) but each team member has the chance to earn token money through the team's performance in the "competition" (The competition becomes the deception). In fact, each teams feedback is manipulated so each team and each member earns the same amount of money. The participants are debriefed as to the deception of the competition. In the consent document, it is indicated that each participant will be compensated by course credit (or not at all) however, in the description of the study it is indicated that each participant will be on a team and the team's performance could result in a $$ amount bonus. It is important on the application to separate out the competition and winnings as part of the methodology and not as a part of compensation. The problem with this is, of course, will early participants talk with latter participants., but this is a problem in all deception studies.

Feel free to call me Latter Monday or Tuesday am and we can talk about this issue.

John Wadsworth

John S Wadsworth PhD CRC
Associate Professor, Rehabilitation & Counselor Education
N362 Lindquist Center
THE UNIVERSITY of IOWA
Iowa City, Iowa

APPENDIX H: AFFECT- AND COGNITIVE-BASED TRUST MEASURES

For each team member (besides yourself), please rate them on a 1-7 scale (1 = Strongly disagree, 7 = Strongly agree) on the following six items:

A. I had a sharing relationship with Team Member X. We could freely share our ideas, feelings, and hopes.
B. I could talk freely with Team Member X about difficulties with the exercise and know that (s)he will listen.
C. If I shared my problems with Team Member X, I know (s)he would respond constructively and caringly.
D. Team Member X approached the exercise with professionalism and dedication.
E. Given Team Member X's track record, I see no reason to doubt his/her competence and preparation for future work.
F. I could rely on Team Member X not to make my role in the exercise more difficult by careless work.

APPENDIX I: EMERGENT LEADERSHIP ITEMS

For each team member, including yourself, please rate them on a 1-5 scale (1 = low, 5 = high) on the following five areas:

A. The amount of the team member's contribution to the team's performance
B. The level of leadership that the team member demonstrated during the activity
C. How willing you would be to choose the team member as a leader on a similar project
D. The extent to which the team member exerted control over the team's activities
E. The extent to which the team member exerted influence over other team members during the activity.

Source: Adapted from Yoo & Alavi (2004); Lord et al. (1994); Lord & Alliger (1995)

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