THE EFFECTS OF MULTIPLE LEADER EMERGENCE ON TEAM PERFORMANCE

By

Heather A. Hayes

Virginia Polytechnic Institute and State University

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

Industrial-Organizational Psychology

Dr. Roseanne Foti

Dr. Neil Hauenstein

Dr. John Donovan

April 23, 2003

Blacksburg, Virginia

Keywords: leadership emergence, team performance, team mental models, social intelligence

THE EFFECTS OF MULTIPLE LEADER EMERGENCE ON TEAM PERFORMANCE

Heather A. Hayes

Abstract

The purpose of this study was to aggregate the findings of three distinct areas of research into one model of team effectiveness. Specifically, it was hypothesized that, in accordance with prior research findings, aspects of personality related to social intelligence would predict informal leadership emergence. Furthermore, it was predicted that multiple leaders within a team would positively influence that team's subsequent level of performance, through the mediating influence of team mental model similarity and team mental model accuracy. Participants included 40 computer science and engineering teams, who completed their surveys at time one, whereas performance criterion measures were collected at time two. Contrary to prediction, results indicated that social intelligence was not a significant predictor of leadership emergence, and leadership dispersion did not directly impact team performance. However, leadership dispersion positively impacted team mental model accuracy, and team mental model accuracy and similarity positively affected subsequent team performance, as hypothesized. Therefore, the current study provides partial support for a model of team performance that takes into account multiple leadership within teams and its positive influence on the dissemination and development of important, task-related knowledge structures among team members.

TABLE OF CONTENTS

Chapter

I. INTRODUCTION AND LITERATURE REVIEW 1

Leader Emergence and Social Intelligence. 4
Leader Emergence and Team Performance 9
Team Mental Models and Team Performance 13
Hypotheses. 19

II. METHODS 22

Participants. 22
Measures. 22
Procedure. 30

III. RESULTS 32

IV. DISCUSSION 35

Social Intelligence and Leader Emergence. 37
Leadership Dispersion and Team Mental Models 40
Team Mental Models and Team Performance 41
Leadership Dispersion and Team Performance 43
Limitations. 45
Conclusions. 47

Tables

1. Descriptive Statistics, Zero-order Correlations, and Internal Reliabilities for Individual-level Variables. 48

2. Descriptive Statistics and Zero-order Correlations for Group-level Variables. 49

3. Regression Estimates for Predicting Leadership Emergence. 50

CHAPTER ONE

INTRODUCTION AND LITERATURE REVIEW

Work teams have recently become a prevalent method of organizing and carrying out job tasks in a vast amount of organizations. For example, Fortune magazine estimated that half of America's largest companies are experimenting with teams, and it has also been estimated that 68% of Fortune 1000 firms employ work teams (Lawler, Mohrman, & Ledford, 1995). There are various justifications for the use of work teams in organizations, which include improved quality of production, reduced production costs, the development of new products, to aid in coping with competition, and to adjust to restricted external funding (Pfeffer & Veiga, 1999; Salem & Banner, 1992). As a consequence of their prevalence and growing significance, work teams have received an exorbitant amount of attention and scrutiny by researchers in the fields of psychology, management, and business administration.

Work teams have been operationally defined in a variety of ways. For example, work teams have been defined according to two criteria: as a group of individuals having 1) mutual awareness, the belief that these individuals belong together and form an identifiable unit, and 2) mutual interaction, working together toward achieving a common goal (McGrath, 1984). Also, work teams have been studied in a variety of contexts, including sports team, simulation flight and tank crews, production engineering groups, and military groups and range in size from two to fourteen (i.e., Stewart & Barrick, 2000; Whitney, 1994).

In order to understand and explain team performance, one of the most prominent models adopted by researchers is the input-process-output model (Guzzo & Shea, 1992; Hackman, 1987**)**. According to this model, a team's level of performance is a function of various group processes (i.e., social interactions, communication), which are in turn influenced by numerous

input variables (i.e., member personality, skills, abilities) (Barrick, Stewart, Neubert, & Mount, 1998; Campion, Medsker, & Higgs, 1993; Campion, Papper, & Medsker, 1996; Hackman, 1987**;** Van Vianen & De Dreu, 2001). Process variables, which have most consistently demonstrated strong relationships with team performance, include communication strategies that emphasize cooperation and coordination among team members (i.e., Barker, Abrams, Tiyaamornwong, Seibold, Duggan, Park, & Sebastian, 2000).

In an attempt to ascertain which input and other process variables predict and influence communication processes, and thus indirectly affect team performance, researchers have delved into the realm of team mental models (Klimoski & Mohammed, 1994). Specifically, they have studied the extent to which individual mental models, which are knowledge structures concerning, for example, the requirements of completing the task and the roles and expectations of other team members, are accurate and overlap, and whether the degree of accuracy and overlap improves communication, coordination, and cooperation among team members. Research has supported this notion, as well as suggesting that through their fostering of cooperation and coordination within the team, shared, or team, mental models improve team performance (i.e., Marks, Zaccaro, & Mathieu, 2000).

An additional variable that has demonstrated a considerable amount of influence on team processes and performance as both an input variable and a process variable is informal, emergent leadership (i.e., Taggar, Hackett, & Saha, 1999). Leadership has been described as a two-way process of influence between both the leader and the followers that persists throughout the lifetime of that team (DeSouza & Klein, 1995). In other words, leaders need followers who perceive and recognize them as leaders, and in exchange for this recognition, the followers expect the leaders to produce favorable outcomes for the team, such as increased

levels of productivity (Fisher, 1985). This is particularly true for autonomous work teams, who to an extent must fend for themselves, sometimes establishing their own goals and resolving their own conflicts as the team strives over time to accomplish their task. Therefore, the informal, emergent leader's purpose and function in the team becomes the organization and direction of the team toward attainment of mutual goals through the completion of a task (Hollander, 1985), which is why some researchers have labeled the role of leader as "one of the most important positions within any small group" (Latham, 1987).

There are various reasons for why an individual consistently emerges across situations as leader over other members of the team. For example, individual differences in personality may enable that individual to be accepted as leader based on followers' implicit cognitive and personality theories. In other words, the other members will more likely recognize members as a leader if they display the personality characteristics that those other members associate with a typical or effective leader (Hall, Workman, & Marchioro, 1998). However, recent attention has been awarded to the role of integrated multiple intelligences, particularly social intelligence, in predicting leadership emergence (Zaccaro, 1999). Aspects of social intelligence, such as behavioral flexibility and social perceptiveness have demonstrated positive relationships with leadership emergence in both theory (i.e., Hooijberg, 1996; Hooijberg & Schneider, 2001; Zaccaro, 1999) and empirical investigations (i.e., Ellis, 1988; Hall et al., 1998; Zaccaro, Foti, & Kenny, 1991).). In fact, consistent with the aforementioned view of leadership (see above, Hollander, 1985), leadership emergence has been conceptualized as an ongoing process that parallels team development and progression toward achievement of a goal or task, in which individual who most consistently is able to appropriately adapt their behavior to meet the

demands of each changing situation or stage in the development will be accepted as leader by the other members (Dies, 1977).

Although both leadership emergence and team mental models have been empirically linked to performance through their influence on group processes, the relationship between these two variables has not been extensively scrutinized. Additionally, although relationships between social intelligence and the process of leadership emergence have been found, social intelligence has not been tested as a predictor of team processes and performance. Consequently, the potential mediating role of leadership emergence and team mental models between social intelligence and team performance has not been examined. Therefore, this study proposes an input-process-output model of team performance, in which the level of social intelligence is the input variable, both leadership emergence and team mental models are the process variables, and level of team performance is the output variable.

Specifically, level of social intelligence among the members of a team should influence both who emerges as a leader as well as the degree of accuracy and similarity of team mental models. Furthermore, leadership emergence and the development of team mental models may be simultaneously occurring and ongoing processes in the development and progression of a team toward attaining goals or completing tasks. However, over time the similarity and accuracy of team mental models should be enhanced as leaders, particularly if there is more than one leader, emerge and exert an increasing amount of influence over team processes. Consequently, the level of team performance should improve.

Leadership Emergence and Social Intelligence

One of the most infamous and long-lasting debates in the literature on leadership is whether or not traits or individual differences are adequate in explaining the emergence and

effectiveness of leaders in work groups. At one point in time, the trait approach to explaining leadership was widely investigated and dominant in leadership literature (Stogdill, 1948). However, subsequent reviews undermined the trait approach and labeled it inadequate in explaining leadership, interpreting the results from hundreds of studies connecting leadership to personality traits as tenuous (Mann, 1959). As a result, many researchers suggested that leadership emergence and effectiveness was instead a function of situational demands and group characteristics, and that consequently those who emerge as leaders in one situation may not emerge as leaders in another situation (Barnlund, 1962; Fiedler, 1967; Stogdill, 1948; Wexley & Yukl, 1978). However, some researchers challenged this latter perspective and the criticisms of the trait approach. For example, Kenny and Zaccaro (1983) re-analyzed Barnlund's investigation of the correlations between traits and leadership emergence and found methodological and measurement limitations which adversely affected his results. Furthermore, Lord, De Vader, and Alliger (1986) performed a meta-analysis, which further supported the trait approach to predicting leadership emergence. These responses prompted the emergence of various seminal perspectives, one of which emphasizes individual differences in behavioral flexibility or the ability of an individual to appropriate adjust their behavior across various situations and therefore consistently emerge as a leader (Hall, Workman, & Marchioro, 1998; Zaccaro et al., 1991). Consequently, the trait approach to explaining individual differences in leadership emergence has had resurgence in the literature, as many researchers have resumed their investigations of the predictive value of personality traits and multiple types of intelligence for leadership emergence (i.e., Tagger, Hackett, & Saha, 1999; Zaccaro, Gilbert, Thor, & Mumford, 1991).

Personality has also been defined as an integration of one's multiple intelligences (Bass, 1999). Multiple types of intelligences have been instrumental in explaining individual differences in leadership emergence. Intelligence has been generally defined by many researchers as the adaptation to one's environment, in which one adjusts his or her own behavior to fit the environment, but can also include the shaping of one's environment, in which one alters the environment to fit his or her own behavior, beliefs, needs, and the selection of one's environment, in which one leaves chooses a completely different environment while abandoning their present one (Sternberg, 2002; Sternberg, 2000). Many researchers have interpreted the results from studies investigating the relationship between leadership and general intelligence to be inconsistent and inconclusive. For example, studies have found that leaders exceed followers in general intelligence, but in some situations if the gap in intelligence is too wide team effectiveness may diminish because followers cannot relate to the leader (Riggio, 2002). An example of a context in which leaders do not necessarily need to be higher in general intelligence than followers is in sports teams. Furthermore, it has been posited that leaders exceed members not only in abilities such as intelligence, scholarship, situational insight, verbal facility, and adaptability, but also in interpersonal factors such as activity and social participation, cooperation, and popularity (Stogdill, 1948). This proposition, combined with the inadequacy of general intelligence alone to explain individual differences in areas such as leadership, prompted researchers to look to other types of intelligence, particularly social intelligence, as an additional and important predictor of leadership emergence (Sternberg, 2000).

Social intelligence was suggested by some researchers in the early twentieth century to be a form of intelligence, distinct from general cognitive ability, in an attempt to elucidate

knowledge, skills, and competencies specific to social settings, as well as to account for why individuals who scored high on general intelligence measures seemed to exhibit poor social skills and vice-versa (Thorndike, 1920). Although early attempts to discern social intelligence from general intelligence produced mixed results due to questionable measures, a significant amount of more recent research has consistently demonstrated discriminant validity for social intelligence from general forms of intelligence (i.e., Sternberg, 2000; Wong, Day, Maxwell, & Meara, 1995). Furthermore, although it has not been extensively tested by research, social intelligence differs from emotional intelligence in that while social intelligence encompasses one's ability to attain goals and succeed in all social and interpersonal situations, emotional intelligence focuses on those interpersonal interactions that involve emotional expression and understanding.

Social intelligence has been conceptualized in a multidimensional fashion as both social-cognitive and behavioral in nature (Ford & Tisak, 1983; Jones & Day, 1997; Keating, 1978; Marlowe, 1986; Schneider, Ackerman, & Kanfer, 1996; Wong, Day, Maxwell, & Meara, 1995; Zaccaro, Gilbert, Thor, & Mumford, 1991). The social-cognitive aspect of social intelligence involves social perception, the ability to decode verbal and non-verbal cues, and social insight, the ability to make accurate social inferences and interpret social behavior (Ford & Tisak, 1983). In addition, some researchers include social knowledge, the awareness of rules of etiquette in social situations (Wong, Day, Maxwell, & Meara, 1995). On the other hand, the behavioral aspect has been defined as the effectiveness or adaptiveness of one's social behavior in order to accomplish goals in a social setting (Ford & Tisak, 1983), as well as the effectiveness in dealing with other people (Stricker & Rock, 1990). These two aspects of social intelligence are interrelated but as demonstrated by discriminant validity, still maintain their

distinctiveness one another as two separate dimensions (Wong, Day, Maxwell, & Meara, 1995) and it is hypothesized that an individual cannot be considered socially intelligent without possessing both qualities (Zaccaro, 1999; Zaccaro, et al., 1991).

In an attempt to explain leadership emergence and effectiveness in organizations, social intelligence has been similarly conceptualized from an organizational perspective. Zaccaro (1999) described leadership as a social phenomenon, in which effectiveness is defined as how well leaders operate in complex organizational dynamics. Specifically, it involves 1) their ability to interpret the social problems that they encounter and 2) subsequently generate and implement solutions to these problems in the process of leading their team or organization toward achieving a goal. Drawing from this conceptualization, Zaccaro (1991 & 1999) defined social intelligence as the possession of both social perceptiveness and behavioral flexibility. Social perceptiveness involves the ability to correctly ascertain the needs, goals, and problems of an organization, its individual members, and the relationships between the organization and external environments. The two mandatory substrates of social perceptiveness are social awareness, the ability to identify relevant social cues, and social acumen, an understanding of social dynamics. Behavioral flexibility is denoted by the possession of a large response repertoire, as well as the ability to choose the most appropriate response for a particular situation (i.e., generating and implementing the proper solution to a problem), based on social knowledge structures such as scripts and rules. Hooijberg (1996) similarly emphasizes the importance of behavior repertoire and behavioral differentiation in predicting leadership emergence and effectiveness.

Leadership emergence and effectiveness has been linked to social intelligence through the various correlates of social intelligence, particularly interpersonal or functional flexibility, self-

monitoring, and androgyny. Interpersonal or functional flexibility refers to the ability to appropriately alter one's behavior, using a large repertoire of behavior, to suit different interpersonal situations (Paulhus & Martin, 1988). Self-monitoring involves the ability to monitor and adjust one's behavior based on cues from the social environment, such as non-verbal, behavioral cues from others, out of a concern for appropriateness (Snyder, 1974; Lennox & Wolfe, 1984). High self-monitors behave inconsistently across situations, which has earned them the label "social chameleons" (Snyder, 1974), implying that they too have a large repertoire of responses for different social situations. Androgyny involves the culmination of both feminine and masculine traits into a presumably socially well-adjusted individual, who has a wide range of behavior and responses for situations as well (Heilbrun, 1984). Interpersonal functional flexibility, measured by the Battery of Interpersonal Capabilities, has demonstrated a positive relationship with leadership emergence (Hall, Workman, Marchioro, 1998). A strong relationship has also been found between measures of self-monitoring and leadership emergence (Ellis, 1998; Ellis, Adamson, Deszca, & Cawsay, 1988; Hall, Workman, Marchioro, 1998; Zaccaro, Foti, & Kenny, 1991). Finally, androgyny has exhibited a positive correlation with leadership emergence (Hall, Workman, & Marchioro, 1998). As a result of the substantial amount of evidence associating leadership emergence with these variables, which so closely resemble and capture various aspects of social intelligence, as defined by Zaccaro (1991 and 1999), it is reasonable to deduce that social intelligence is an adequate predictor of who will or will not emerge as a leader in teams and organizations.

Leadership Emergence and Team Performance

It has been stated that leadership is a process of social exchange between the leader and followers. Hollander (1985) elucidated this claim by saying that in exchange for being

recognized as a leader, the leader is expected by the followers to produce favorable outcomes for the team. Therefore, the leader makes an increased effort to facilitate team processes and elevate team performance. In fact, studies have shown that teams in which leaders emerge out-perform teams where leaders do not emerge (DeSouza & Klein, 1995). By the same token, it has been theorized and empirically demonstrated that the effects of installing an appointed leader or allowing external leadership to intervene in the team's processes rather than allowing an informal leader to emerge may be detrimental to the performance of that team (Pescosolido, 2001).

Although it is traditionally accepted that work teams have one established leader, recent studies focusing on autonomous work teams have supported the notion that multiple leaders emerge. A term used to describe the amount of leaders within a group is "leadership dispersion" (Neubert, 1999). When there is a high dispersion of leadership, team members indicate that many informal leaders exist within the group, which results in a more decentralized authority structure. On the other hand, in conditions of low dispersion, team members indicate the presence of only one, dominant informal leader, thereby centralizing the authority structure within the team. It has been hypothesized that a higher dispersion of leadership can prove either detrimental or beneficial to team performance. For example, some researchers believe high dispersion to be more harmful for teams because the higher centralization that is characteristic of low dispersion fosters higher agreement and fewer conflicts, regarding for example roles, thereby facilitating the accomplishment of the team's task (Festinger, Schachter, & Back, 1950). Alternatively, other researchers argue that high dispersion is more beneficial to teams because a larger number of leaders would enable an increased quantity of information to circulate and spread within the team, as well as providing a

variety of perspectives. Also, more participation would occur, resulting in higher levels communication, conflict management, satisfaction and performance, while avoiding the detriment of groupthink that can occur when only a few leaders administer a strong influence on decisions (Manz & Sims, 1987; McGrath, 1984; Stewart & Manz, 1995).

This argument has been tentatively resolved by recent research findings, in which higher levels of leadership dispersion exhibited a positive correlation with team cohesion (Neubert, 1999), which is well established as a contributing factor to team performance (Mulvey & Klein, 1998; Podsakoff, MacKenzie, & Ahearne, 1997; Whitney, 1994). Furthermore, Taggar, Hackett, & Saha (1999) demonstrated a strong relationship between leadership dispersion and team performance. Specifically, they showed that the highest individual leadership score (denoted as the leader) alone would not improve performance, but that a combined high leadership score for the leader as well as all of the other members would result in higher levels of performance. In other words, the performance level of each member was crucial in accomplishing the task as effectively as possible, and that the failure of one member could detract from the team's performance and result in negative outcomes for the team. Additionally, research has demonstrated that a similar concept, team self-leadership, which refers to the extent to which teams have freedom and authority without external supervision and usually results in decentralization within the group, is also positively related to team performance (i.e., Stewart & Barrick, 2000).

In investigating the relationship between leadership emergence and team performance, leadership emergence has served as an input variable, a moderator variable, and a process variable, from an input-process-output perspective of team functioning. For example, leadership emergence's role as an input variable is evidenced by the findings that emergent

leaders in autonomous work teams exert influence on various aspects of the work team, such as member beliefs and expectations, which can subsequently influence team processes and performance. This is evidenced in a recent study by Kickul and Neuman (2000), who demonstrated that the input of leader behavior, represented by measures of cognitive ability and conscientiousness, accounted for variance in team knowledge, skills, and ability, as well as contributing positively to team effectiveness. Additionally, Pescosolido (2001) found that the role of informal leaders in autonomous work teams is manifested as an input of information, or in other words, to offer explanations and meaning relevant to the task at hand when the members have no prior experience or understanding regarding the task or context.

An example of a study demonstrating the moderating effect of leadership, the extent to which leaders fostered the acceptance of team goals and succeeded in getting team members to cooperate with one another moderated the relationship between team cohesiveness and team productivity (Podsakoff et al., 1997). Specifically, the relationship between cohesiveness of the team and team productivity was stronger in a positive direction when leaders attempted to foster goal acceptance and succeeding in enhancing cooperation among the team members.

Finally, studies illuminating the role of leadership emergence as a process variable in teams cast leadership emergence as the mediating variable between input and process variables such as personality and team performance. For example, Taggar, Hackett, and Saha (1999) found that scores on cognitive ability, extraversion, openness to experience, conscientiousness, and neuroticism predicted leadership emergence, and the more leaders (individuals who scored highly on the aforementioned measures) that emerged in the team, the higher the level of performance by the team. Furthermore, Kickul and Neuman (2000) found that measures of cognitive ability, extraversion, and openness to experience predicted who would emerge as an

informal team leader over other members of the team and that cognitive ability was also related to the level of team performance. These results of both these studies are congruent with previous findings (Lord, De Vader, & Alliger, 1986). However, other studies depicting leadership emergence as a process variable deal with goal commitment and establishment as the input and output variables, respectively. For example, DeSouza & Klein (1995) discovered that members highly committed to the goals (input) that were experimentally assigned to the team were more likely to emerge as leaders, and once they did emerge as leaders (process) they had a greater influence on the establishment of team goals (output) than did non-leaders. Taken together, these results generally support the idea that leadership emergence, whether an input, moderator, or process variable, in work teams enhances team productivity and performance.

Team Mental Models and Team Performance

Team processes and performance

While the process aspect of the input-process-output model encompasses a wide variety of variables, social cohesion and interpersonal communication have received an extensive amount of attention and support in the literature for their relationships with group (i.e., Campion, Papper, & Medsker, 1996).

Cohesion in groups has been defined and operationalized in various ways. For example, multiple types of cohesion have been recognized, such as task cohesion and social or interpersonal cohesion. Task cohesion is described as an attraction to the group due to an affinity for the task or a motivation to complete a task, whereas social, or interpersonal cohesion, is defined as an attraction to the group in order to maintain social relationships and friendships with other members of the group (Carless & DePaola, 2000; Festinger, et al., 1950; Widmeyer, Brawley, & Carron, 1985). Both types of cohesion have been positively associated

with team performance (Evans & Dion, 1991). Furthermore, social cohesion has been found to increase team performance on its own (Van Vianen & De Dreu, 2001), and by enhancing team flexibility, communication, sharing, and conflict-reduction (Barrick, Stewart, Neubert, & Mount, 1998).

An additional team process, which has been labeled as the most predominant process within the input-process-output model is social interactions and interpersonal communication (Hackman, 1987). Team communication and interaction has been described as the primary mechanism by which team members collectively attain a common team goal, and that the quality of communication is more important than quantity (Marks, Zaccaro, & Mathieu, 2000). As such, social interactions and interpersonal communication among group members can take on various forms, for example being either task-oriented or socially-oriented. The task-oriented aspect of member interactions involves only interactions that are directly related to the group's task and is considered efficient to the extent in which member capabilities are used appropriately, whereas the socially-oriented aspect refers to emotionally-charged and direct task-irrelevant interpersonal transactions that occur between members (Hackman, 1987). The extent to which these interactions occur within groups has been measured through variables such as openness-in-communication and conflict for socially-oriented interactions and shirking or workload sharing and team member flexibility (i.e., the ability of group members to perform each others' tasks) for task-oriented interactions (Stewart & Barrick, 2000). The importance and usefulness of all these intragroup processes for enhancing group performance due to their synergistic qualities and their fostering of coordination among group members has been firmly established by research (Barry & Stewart, 1997; Campion, Medsker, & Higgs, 1993; Campion, Papper, & Medsker, 1996; Stewart & Barrick, 2000).

In addition to being either task-oriented or socially-oriented in nature, interpersonal communication in groups can be classified as either cooperative or competitive. Cooperative styles of communication have historically been recognized as a strong predictor of group performance for various reasons, such as improved quality of decision-making and heightened democracy in group discussions (Barker et al., 2000; Gladstein, 1984). Furthermore, cooperative styles of communication have long been recognized as more beneficial to group outcomes than competitive styles of communication (Jewell & Reitz, 1981; Sillars, Coletti, Perry, & Rogers, 1982). For example, cooperation has been shown to be superior to competition in diminishing conflict in self-managed work teams, and consequently strengthening performance, by inducing higher levels of conflict efficacy among team members (Alper, Tjosvold, & Law, 2000). Additionally, research has shown that cooperation improves group performance as a result of individual member commitment to maximizing group performance as opposed to his or her own individual performance, and that this relationship strengthens as the interdependence of the task increases (Crown & Rosse, 1995).

The social cohesion and cooperative styles of cooperation that occur within the group context seem to converge in that they each emphasize coordination and synchronicity among team members in how tasks are to be organized and accomplished. This is evidenced in their conceptualizations as well as their empirical ties with group performance directly and through their relationships with correlates or their roles as mediating and moderating variables. Due to the extensive amount of literature supporting these relationships and reiterating the aforementioned conceptualizations, it is reasonable to assume that cooperation and coordination is a powerful antecedent and predictor of group performance. A burgeoning new approach to explaining and predicting these coordinated work team processes and subsequent

performance involves assessing a construct that deals with the mental coordination of members' beliefs and perceptions of how team tasks should be executed and completed, a phenomenon known as team mental models.

Team Mental Models

Team mental models are a derivation of the term "mental models" that is well-established at the individual level of analysis in the area of cognitive psychology. Mental models generally refer to organized knowledge structures pertaining to an individual's surrounding environment that enable that individual to more easily interact with the environment (Klimoski & Mohammed, 1994). Team mental models, on the other hand, have been more specifically defined as the shared organized understanding or mental representation of knowledge and beliefs about key elements of the team's relevant environment among team members (Cannon-Bowers, Salas, & Converse, 1993; Klimoski & Mohammed, 1994; Mohammed, Klimoski, & Rentsch, 2000).

Recent literature has produced valuable information on the nature, antecedents, and importance and usefulness of team mental models. For example, four domains of team mental models have been recognized by researches (Cannon-Bowers et al., 1993). One type of model is the equipment model, which refers to a shared understanding and knowledge of the tools involved in the group task. A second type is the task model, which involves a shared understanding and belief about various aspects of the group task, including goals, any requirements for completing the task, and any problems that may arise. The third domain focuses on team members, particularly the similarity among members in how they perceive each other on dimensions of skills, preferences, habits, beliefs, and knowledge. Finally, team interaction is a domain of team mental models, which emphasizes the overlap in team members'

belief in the most appropriate or effective steps necessary to complete the group's task. In addition to delineating the types of team mental models that exist, researchers have discerned four antecedents of team mental models, which include environmental (e.g., individualistic versus collective orientation around task completion), organizational (e.g., training and reward systems), team (e.g., type of task, collective efficacy), and individual (e.g., personality, skills, and abilities) (Kraiger & Wenzel, 1997).

Relating the types of team mental models to their antecedents is provided in a study by Stout, Cannon-Bowers, Salas, & Milanovich (1999), in which better quality planning and pre-briefing of team members (organizational antecedent) led to a more extensive development of team mental models among team members of each other's information requirements for completing the team's task (task model). Also, another study found that trained team interaction (organizational antecedent) led to higher degrees of similarity and accuracy of member beliefs concerning the steps necessary to complete the task (team interaction model), as well as flexibility and adaptability of these steps (team interaction models) for changing situations (Marks, Zaccaro, & Mathieu, 2000).

Team mental models have been predominantly useful in explaining team performance through their influence on various team processes, such as coordination and cooperative communication. Theoretically, team mental models, or the overlap of individual mental models, translates into a greater shared expectations and explanations within the team, which fosters higher levels of coordination, communication, adaptation, and other beneficial team behaviors, leading to an improvement in overall group performance (Rouse, Cannon-Bowers, & Salas, 1992), and this has generally been supported by research findings. Furthermore, studies investigating team mental models have characterized team mental models as either an

input variable or process variable within the input-process-output framework. For example, various studies have determined that the convergence of team mental models predicts such team processes as social cohesiveness, cooperation and frequency of communication (Forgas, 1981; Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000). Furthermore, studies have shown that the input of similar and accurate mental models positively influenced team performance in addition to their relationship with team process variables. For example, Marks et al., (2000) demonstrated that higher levels of mental model accuracy, and especially similarity, not only predicted observer ratings of the quality of team communication processes, but also enhanced subsequent team performance. An additional study by Carley (1997) involving software engineering teams revealed that the mental models of the members of the more successful teams tended to contain more concepts and their causal maps, cognitive maps representing causal links between concepts, were larger than members of the unsuccessful teams. Also, successful teams exhibited a higher degree of similarity in individual mental models.

Studies have also characterized team mental models as a process variable. In particular, a study conducted by Marks et al., 2000, demonstrated that team mental models mediated the relationship between both the input of leader briefings and the team process of cooperative communication and the output of team performance. Specifically, the study demonstrated that when teams received valuable information regarding crucial elements in their task environment from team leaders, they tended to develop more accurate and similar mental models. Consequently, teams with a higher degree of accuracy and overlap in mental models exhibited higher levels of cooperative interactions and also exhibited a higher level of performance. Collectively, these findings support the notion that team mental models significantly contribute

to team performance, particularly through their affects on cohesiveness, cooperation communication among members, and coordination of team member knowledge, skills, abilities, and efforts.

Hypotheses

This study proposes an input-process-output model of team performance in which social intelligence scores predict who will emerge as a leader, and that these input and process variables, respectively, collectively influence the output of team performance by increasing the accuracy and convergence of team mental models. It has been theorized by researchers (i.e., Zaccaro, 1991) that emergent and effective leaders are more socially intelligent than their followers, which means that they must be both 1) more socially perceptive, and 2) be more flexible behaviorally (see figure 1). A positive relationship has consistently been found between leadership emergence and the behavioral flexibility aspect of social intelligence (Ellis, 1988; Ellis et al., 1988; Hall et al., 1998; Zaccaro et al., 1991). However, little research has directly investigated the relatedness of leadership emergence specifically to social perceptiveness, from an organizational perspective (see Zaccaro, 1991). Both facets of social intelligence have not been directly and specifically connected to leadership emergence in an empirical study. *Therefore, the first hypothesis is that higher levels of both social perceptiveness and behavioral flexibility dimensions of social intelligence will predict leadership emergence (hypothesis 1).*

Leaders have been recognized as having accurate social knowledge structures or cognitive models of their social environment. For example, Zaccaro et al. (1991) claimed that leaders have a more fully developed and complex knowledge structure about people and situations, and that their episodic knowledge structures contain wider ranges of scripted problems, and

furthermore that by having more problem scripts with various corresponding action rules, they are capable of exhibiting more situational appropriateness in their behavior. Furthermore, evidence suggests that leaders are pivotal in instigating team communication and the spreading of information throughout the team and aiding in the understanding of ambiguous or unfamiliar situations, especially in the early formation of the team or the start of a new task (Pescosolido, 2001). Also, research findings suggest that when leaders are more thoroughly briefed about a task before interaction with the team, their ability to communicate information to the members leads the team members to develop similar, accurate, and flexible team mental models (Marks, et al. 2000). Therefore, it follows that if there are more leaders in a team, a greater amount of important, relevant information is being disseminated, and if these leaders share the same social knowledge structures (social intelligence), this information will most likely be accurate and similar, thereby increasing the similarity and accuracy of the team mental models. *Therefore, it is hypothesized that leadership dispersion will predict the degree of team mental model similarity (hypothesis 2a) and accuracy (hypothesis 2b).*

Although the research linking team mental models and team performance is scant and considered by some to be tenuous, it is agreed by most researchers that team mental models shows a substantial amount of promise as a concept for explaining team performance and various measures have been deemed adequate in measuring team mental models (Mohammed, Klimoski, & Rentsch, 2000). Furthermore, in explaining the relationship between team mental models and team performance, it is urged that communication processes, strategies, coordinated use of resources, and interpersonal relations or cooperation are important influential factors to be considered (Klimoski & Mohammed, 1994), and research has demonstrated their mediating nature between team mental models and team performance (i.e., Mathieu, at al. 2000).

Additionally, although no prior studies have tested the interactive effects of team mental model similarity and accuracy on team performance, the current study investigated these relationships. The rationale for this analysis is that team mental model similarity may not necessarily positively impact performance. For example, all members of a team may have a high degree of overlap in their team mental models, but these mental models may in fact be erroneous. Therefore, a high degree of similarity among team members' mental models may have no significant effect on subsequent team performance unless the team mental models are accurate. *Therefore, to complete the model, it is hypothesized that the degree of team mental model similarity and team mental model accuracy will predict the level of team performance (Hypothesis 3a). However, the interaction term of team mental model similarity and team mental model accuracy will predict team performance above and beyond the main effects of team mental model similarity and accuracy alone (Hypothesis 3b).*

Furthermore, both leadership emergence and dispersion have been empirically linked to team performance (Taggar et al., 1999). In fact, both have been related to team performance through their positive relationships with team processes, particularly cooperative communication and cohesion, both in speculation and in empirical findings (Neubert, 1999). *Therefore, it is hypothesized that leadership dispersion will predict the level of team performance (hypothesis 4).* In other words, the relationship between leadership dispersion and team performance will only partially be mediated by team mental model similarity and accuracy because studies have shown that there are variables other than team mental model accuracy and similarity (e.g., personality characteristics, knowledge, skills, and abilities) that mediate and influence the relationship between leadership dispersion and team performance (i.e., Taggar et al., 2000).

CHAPTER TWO

METHODS

Participants

Participants included 40 student project teams, 30 of which were computer science teams from universities throughout the northeast United States participating in a regional competition and 10 of which were engineering students participating in teams as part of a grade requirement in an upper-level electrical engineering designs course. The size of the teams ranged from two to four members per team, and the amount of time that the teams have been intact prior to participation in this study ranged from one to three months. Furthermore, although the specific tasks being performed by both types of teams were not identical, they were indeed comparable in that both teams were primarily engaged in technically-oriented, problem-solving tasks. Also, in exchange for participation, there was a lottery drawing in which two of the participating teams were randomly selected to each receive $100.

Measures

Social Intelligence: Social Perceptiveness and Behavioral Flexibility. The Revised Self-Monitoring Scale (Lennox & Wolfe, 1984) contains 13 items, which measure two factors: a) the ability to modify self-presentation (7 items) and b) sensitivity to the expressive behavior of others (6 items). The 7 items measuring the ability to modify self-presentation were used to measure the behavioral flexibility aspect of social intelligence, whereas the 6 items measuring sensitivity to the expressive behavior of others were used to measure the social perceptiveness aspect of social intelligence. The latter was justified because social perceptiveness involves social awareness, the ability to identify relevant social cues, and social acumen, an understanding of social dynamics, and being able to accurately attend to and interpret the

behavior of others' as socially-relevant and appropriate is a crucial first step for a high self-monitor. Participants were asked to indicate on a 6-point Likert scale the extent to which they feel the items are accurate regarding their behavior, where 1=certainly, always false, and 6=certainly, always true. An example item for the behavioral flexibility factor is, "In social situations, I have the ability to alter my behavior if I feel that something else is called for". An example item for the social perceptiveness factor is "I am often able to read people's true emotions correctly through their eyes". The coefficient alpha for the behavioral flexibility facet of the Revised Self-Monitoring Scale was .78 and .76 for the social perceptiveness facet (See Appendix A for items).

The Bem Sex Role Inventory (Bem, 1974) consists of three subscales: masculinity, femininity, and social desirability, each containing 20-personality characteristics. Participants were asked to indicate on a 7-point scale how well each of the characteristics describes him or herself, anchored by "Always, or almost always true" (7) and "Never, or usually never true" (1). High self-ratings on masculine characteristics correspond with a masculine personality, or tendency to exhibit masculine behavior, whereas high self-ratings on feminine characteristics indicate a feminine personality, or tendency to exhibit feminine behavior. An androgynous individual would rate both masculine and feminine characteristics as self-descriptive, and therefore exhibit both masculine and feminine behavior. Several researchers (e.g., Hall, Workman, & Marchioro, 1998 & Paulhus & Martin, 1988) have interpreted the androgynous individual's tendency to exhibit both masculine and feminine behavior as a possession of wide range of behaviors, and consequently interpersonal flexibility. Therefore, for the purposes of this study, the Bem Sex Role Inventory was used to measure the behavioral flexibility aspect of social intelligence. The coefficient alpha for this measure was .89 (See Appendix A for items).

The Battery of Interpersonal Capabilities (Paulhus & Martin, 1987) also measures one's repertoire and flexibility of behavior. However, unlike the Bem Sex Role Inventory, which emphasizes an individual's trait, or typical, average ability to perform certain behaviors, the BIC assesses an individual's capability, or the ease of performing particular behaviors when the immediate, current situation requires it. Furthermore, whereas an individual who typically behaves as "cold" cannot also be typically "warm", it is possible for an individual who has the capability of being "cold" in one situation to also have the capability of being "warm" in a completely different situation. The BIC includes 16 interpersonal attributes, and for each one, participants were asked, for example, "How capable are you of being *dominant* when the situation requires it?" The participant indicated their degree of capability for each attribute on a 7-point scale, where 1=not at all, and 7=very much. The BIC was also utilized as a measure of the behavioral flexibility aspect of social intelligence. Coefficient alpha for this measure was .80 (See Appendix A for items).

A Social Judgment measure was also included to measure the social perceptiveness aspect of social intelligence (Zaccaro, Mumford, Connelly, Marks, & Gilbert, 2000). The measure contains two scenarios involving descriptions of negative organizational outcomes that resulted from a leader's failure to acknowledge complex social cues within the environment. The participants were asked to read the two scenarios and answer three questions: 1) why did this situation occur? 2) What was the central mistake made by the manager in this scenario? 3) What would you do if you were the manager in this situation? An expert (e.g., trained coder) evaluated these responses on a rating scale from 1to 6 in terms of overall social judgment skill (1 = low amount; 6 = high amount). In prior research employing this measure, evaluation of each response has typically been based on ratings of seven separate dimensions of social

judgment skills: self-objectivity, self-reflection, sensitivity to fit, judgment under uncertainty, systems perception, systems commitment, and overall social judgment skill (Zaccaro et al., 2000). The justification for utilizing only one dimension of social judgment skills in the current study was that a) due to the nature of the answers being more task-oriented, short, and narrow in depth and description it was impossible to rate each of the answers on all of the nine dimensions outlined in Zaccaro et al (2000), and b) the correlations among the seven dimensions have been reported as high enough (ranging from .80 to .90) to suggest a lack of distinction and independence between them and therefore a lack of necessity to include them all in the final ratings (Shane Connelly, personal communication, 2003). Furthermore, although participants in the current study completed both scenarios, the second scenario was discarded for two reasons. First, the correlation between the two scenarios was only .34 ($p < .01$). Therefore, the two scenarios were not adequately interrelated to warrant including them both. Furthermore and secondly, although neither scenario demonstrated significant positive relationships with any of the other Social Intelligence measures, the second scenario exhibited negative relationships with most other Social Intelligence measures and in one case a significant negative relationship (with the BIC, -.21; $p < .05$). Therefore, scenario two was considered inappropriate as a measure of Social Judgment. The coefficient alpha for scenario 1 was .81 ($p < .01$) (See Appendix A for items).

Emergent Leadership. The General Leadership Impression Scale (Lord et al., 1984) contains 5 items measuring leadership emergence. A sample item includes "How much did this member contribute to the effectiveness of the task?" Team members were asked to complete all 5 items for each member of the team, with response options ranging from 1= "Nothing" to 5= "Extreme amount". The coefficient alpha for this measure was .90 (See Table 1).

Leadership dispersion is being defined in the current study as the overall level or degree of leadership behaviors being exhibited within a team. Therefore, the first step in calculating leadership dispersion scores for each team consisted of determining the average leadership scores on the GLI among all members of each team. However, mean GLI scores alone may not precisely or adequately reflect the amount of leadership being exhibited in the teams. For example, two teams may have the same average GLI score (e.g., 18), but in one team all three members may have the same GLI score (18) whereas in the other team one member scores very high (25), one member scores very low (11), and one member scores average on the GLI (18). In other words, a high average GLI score for a team may not necessarily indicate that all members are exhibiting a high degree of leadership. Therefore, because a goal of this study is to demonstrate that the more members demonstrating high levels leadership the better, it was necessary to include a variance in team member GLI score for each team with team average GLI in the calculation of leadership dispersion. Specifically, the product of these two scores was determined for each team because it was expected that in the current study, a high mean GLI and low variance in GLI for each team would most positively affect that team's performance. (See Appendix B for items)

Team Mental Models

In this study, the content to be included in the team mental model measure was acquired from professors who work closely with the teams, have thorough understanding and knowledge of the nature or technology of the tasks, and who participate in evaluating the team's performance. Because the specific type of team mental model being emphasized in this study was a team interaction model, the method of acquiring this information involved requesting from the professor a detailed written or typed description of the tasks and the most crucial activities and steps necessarily in order to complete the task. By requesting a written description, the possible biases and differences in interviewing that may obstruct reliability was theoretically be minimized. The written descriptions for each type of team were then read by the researcher and reduced to nine concepts, each concept ranging from being very closely related to not at all related to the other concepts.

Also, most of the concepts used for each type of team were slightly general in nature, in an attempt to maintain terms that overlapped among all participating teams. For example, both types of teams had an item pertaining to working independently from the other team members ("Work on a problem independently" for the computer science teams and "Work independently of the other team members" for the engineering teams), working collectively with other team members ("Work on a problem collectively" for the computer science teams and "Hold team meetings" for the engineering teams), checking and/or supervising each other's work ("Check/Supervise each others' work" for both teams), creating steps to solving the problems ("Ranking questions in the order they will be worked on" for computer science teams and "Decide on specific steps that will be taken to complete the project"), assigning duties among team members ("Assign questions/problems to team members" and "Decide who will use

computer" for the computer science teams and "Divide steps/aspects of project among team members" for the engineering teams).

However, it was necessary for the remaining concepts included to be more specific to the each type of team order to maintain accuracy and richness in descriptiveness of the team's interactions and task performance. For example, for the computer science teams, "Discard a question that has been answered correctly", "Rank order the questions in terms of level of difficulty", and "Continue working on a question after it's been deemed incorrect by the judges" were included. For the engineering teams, "Refer to classroom materials to complete aspects of the project", "Trouble-shooting and more detailed problem-solving on specific aspects of project", "Prepare presentation for class", and "Work outside the lab (e.g., home, library, etc.)" were included.

The participants then completed the questionnaire with the nine newly coded items, as did the professor or expert who provided the original content. (See Appendix C for Team Mental Model concepts and matrix). In the matrix questionnaire, each concept was placed on both vertical and horizontal aspects of a matrix (creating a 9 X 9 matrix), and participants were asked to indicate the relatedness of each pair of concepts on a scale from 1 (not related) to 9 (very related).

Similarity. Similar to the method referred to by Kraiger and Wenzel (1997) and employed by Marks et al. (2002), the degree of team mental model similarity was assessed as follows. First, because each participant rated the relatedness of each pair of concepts twice (i.e., once above the diagonal of the matrix, and once below the diagonal) only the data from above the diagonal was used to operationalize mental model similarity. Second, the data from each team member's team mental model matrix was entered into the Pathfinder program. Next

a similarity index was computed for each pair of team members per team. For example, if there were three members in a team, three similarity indices were computed: one similarity index between members one and two, a similarity index between members one and three, and finally a similarity index between members two and three. The similarity index computation is similar to a Pearson product-moment correlation coefficient (r). Specifically, the index is computed as the number of links, or concept associations, in common divided by the number of links that are in either network minus the common links, where links represent the connection between two nodes and nodes represent the concepts of which there were nine in the present study (Schvaneveldt, 1990)`. Therefore, two identical networks will yield a similarity of 1, whereas two networks that share no links will yield a similarity of 0. For a further example, team member one's model may include 25 links, while team member two's model includes 26 links and the number of links they have in common is 14. Therefore, the similarity index is computed as follows: 14/ (25+26-14) = 0.378. For the final step in determining the team's level of team mental model similarity, these similarity values (one for each pair of team members in each team) were averaged to produce an overall team mental model similarity score.

Accuracy. Accuracy was calculated similarly to the similarity method. However, instead of calculating the similarity index for each combination of team members per team to produce an overall team mental model similarity score for that team, team mental model accuracy was determined by calculating the similarity index between each individual member's model and the expert's (their professor's) model. For example, if there were three members in a team, three similarity indices were calculated, each representing the similarity between the team member and the expert (e.g., professor) team mental models. Then the similarity scores

of all members in each team were averaged for an overall team mental model accuracy score. Therefore, the team mental model accuracy score represents an overall average degree of profile similarity of team mental models between each team and the expert, rather than the distance from a target matrix. .

Team performance

Team performance was measured differently for each type of team. For the computer science teams, the measure of team performance for each team was their final score in the regional competition. The score is a calculation that takes into account the number of problems each team attempted (out of a total 20 problems possible), the number of problems each team accurately completed, and the amount of time taken to complete each problem so that the more problems completed in the shortest amount time, the higher the team's score. Scores ranged from 1 to 142. For the engineering teams, the team project grade given after participation in this study (three in all) was collected and represented an overall grade for each team. In order to combine the two performance measures across both types of teams, all scores were transformed into Z-scores.

Procedure

Each team member completed seven measures in a two-step process in order to allow an adequate amount of time for the input and process variables to have an effect on the output variables. At time one, the team members completed a packet containing six measures: the Revised Self-Monitoring Scale (Lennox & Wolfe, 1984), the Bem Sex Role Inventory (Bem, 1974), the Battery of Interpersonal Capabilities (Paulhus & Martin, 1987), Social Judgment Measure (Zaccaro, et al, 2000), a mental models measure, and the General Leadership Impression Scale (Lord, et al., 1984) for each member of the team. The order of the first five

measures were counterbalanced across participants, with the leadership emergence measure always being last in order to prevent the salience of leadership qualities from influencing or distorting self-ratings on the social intelligence measures. Once the researcher had received the completed packets, there was a random drawing of two teams, and each received $100. At time two, the objective measures of team performance were requested from the professors.

CHAPTER THREE

RESULTS

Interrater agreement was examined in order to establish the appropriateness of aggregating team members' ratings of each other on the GLI. In order to determine interrater agreement for the GLI, three steps were involved. First, for each individual participant, ratee variance on GLI scores, calculated as the variance in GLI score ratings across raters within the group (the variance of ratings from the other two raters for the computer science teams and either two or three other raters for the engineering teams) was determined. However, for the two teams with only two members, there was no calculation of agreement. This is because in two-member teams, since each team member is not allowed to rate him or herself on the GLI, he or she is only being rated by one person, the other team member. Therefore, unlike the three- or four-member teams in which there are multiple raters for each team member and therefore a threat of inconsistency and distortion when combining multiple ratings, a team with only one rater for each team member can not produce interrater inconsistency and therefore does not allow for a calculation of agreement. Second, the mean and standard deviation of ratee variance in the ratings on the GLI were calculated. Third, individual participants' ratee variance scores, which were one standard deviation above the mean rate variance, were located. Fourth, the number of individuals within each team, which were in the previous step determined to have high ratee scores, was examined. There were no teams in which more than one individual had a high ratee variance. In other words, no teams were classified as having low interrater agreement and therefore none of the teams were dropped from further analysis.

The descriptive statistics and zero-order correlations among individual-level variables are reported in Table 1, and the descriptive statistics and zero-order correlations among group-level variables are reported in Table 2. Hypothesis one stated that higher levels of both social

perceptiveness and behavioral flexibility dimensions of social intelligence would predict leadership emergence. In order to test this hypothesis, the five measures meant to capture social intelligence were divided into two separate regression models, one for each facet of social intelligence. Scores on the "sensitivity to the expressive behavior of others" subscale of the RSMS and the Social Judgment measure were standardized and combined as the social perceptiveness facet. Scores on the "ability to modify behavior" subscale of the RSMS, Androgyny, and the BIC were standardized and combined as the behavioral flexibility component. However, before dividing these measures in this manner, it was important to first establish the discriminant and convergent validity of these measures by examining the intercorrelations among the measures. The correlations among the social intelligence measures (Self-monitoring, Androgyny, BIC, and Social Judgment Scale) were generally significant. However, the correlations that were significant were quite weak, being only in the .20 range, which is noticeably lower than the .30 and .40 range reported in prior studies (e.g., Hall et al., 1998). Furthermore, the measures that were intended to capture the social perceptiveness component of social intelligence (Self-monitoring subscale and Social Judgment Scale) did not correlate with one another more strongly than they did with the measures meant to capture the behavioral flexibility component (Androgyny, BIC, Self-Monitoring subscale), and vice-versa (See Table 1). In other words, discriminant and convergent validity were not found, and I concluded that the measures were not appropriately and sufficiently interrelated to warrant grouping them into the two social intelligence dimensions of social perceptiveness and behavioral flexibility. Therefore, the relationship between each individual measure of Social Intelligence and leadership emergence scores on the GLI was examined by regressing leadership scores onto all Social Intelligence measures simultaneously, in one model. Contrary

to prior research, the regression coefficients for the prediction of leadership emergence by the Social Intelligence measures were insignificant (See Table 3). Therefore, hypothesis one was not supported.

Hypothesis 2a stated that leadership dispersion would predict the degree of team mental model similarity. In order to test this hypothesis, team mental model similarity was regressed onto leadership dispersion, calculated as the product of the mean of all team member leadership scores and the variance of all team member leadership scores, in one single regression model. There was no significant regression coefficient for leadership dispersion when attempting to predict team mental model similarity (See Table 4). Therefore, there was no support for hypothesis 2a. In other words, teams in which high levels of leadership were exhibited did not necessarily have a high degree of overlap in team mental models among their members. Hypothesis 2b stated that leadership dispersion would predict the degree of team mental model accuracy. In order to test this hypothesis, team mental model accuracy was regressed onto leadership dispersion in one regression model. As hypothesized, leadership dispersion significantly positively predicted the level of team mental model accuracy ($R^2 = .052$, $p < .01$) (See Table 4). Therefore, hypothesis 2b was supported. In other words, the more leadership being exhibited within a team, the more accurate, or degree of profile similarity to expert's team mental model, the team's members' mental models were.

Hypothesis 3a stated that the degree of team mental model similarity and team mental model accuracy would predict the level of team performance. In other words, there would be significant main effects for both team mental model similarity and team mental model accuracy. In order to test this hypothesis, team performance was regressed onto both team mental model similarity and team mental model accuracy simultaneously in one model. As

predicted, this model significantly predicted team performance ($R^2 = .132$, $p < .01$) (See Table 5). However, only the regression coefficient for team mental model accuracy was significant, which corresponds to the finding for the bivariate relations reported in Table 2. Therefore, hypothesis 3a was partially supported, because only team mental model accuracy predicted team performance. Hypothesis 3b stated that the interaction between team mental model similarity and team mental model accuracy would also significantly predict team performance, and in addition that it would provide incremental prediction over the main effects of team mental model similarity and team mental model accuracy. In order to test this hypothesis, the product term of team mental model similarity and team mental model accuracy was added as step 2 to the first model containing team mental model similarity and team mental model accuracy. The second model itself was non-significant, as well as the regression coefficient (See Table 5). Therefore, the interaction between team mental model similarity and team mental model accuracy did not add any significant variance in team performance scores above and beyond the main effects of team mental model similarity and team mental model accuracy. Therefore, hypothesis 3b was not supported. In other words, the positive effect of team mental model similarity on team performance does not depend on the accuracy of the team mental models.

Finally, hypothesis four stated that leadership dispersion would predict the level of team performance. Regressing team performance onto leadership dispersion tested this hypothesis. The regression coefficient for leadership dispersion was non-significant (See Table 6). Therefore, support for hypothesis four was not found. In other words, high levels of leadership within teams did not significantly improve team performance.

CHAPTER FOUR

DISCUSSION

The purpose of this study was to further illuminate, from an IPO model of team functioning, the process by which teams utilize the personality traits and skills that members bring to the team in order to enhance team performance. Specifically, the model predicted that the level of social intelligence, defined as skills in both social perceptiveness and behavioral flexibility, would predict which members of the team emerged as informal team leaders. Furthermore, I proposed that leadership emergence could be considered a team process in that multiple leaders could emerge throughout the team's process of task preparation and completion, such that the members may take turns in exhibiting leadership and exerting influence over the team's activities when their specific expertise or knowledge are considered most helpful or appropriate. Consequently, I believed that if there were more leaders emerging within a team, there would be a higher degree of similarity and accuracy among the team members' team mental models, or the team members' perception of what is required of them for the team as a whole to more effectively complete their task. The reasoning behind this proposition was that each leader should possess potentially unique and beneficial knowledge of the team's task that could improve the accuracy of the team members' team mental models. Furthermore, because part of a team leader's role is to aid in the dissemination of useful, task-related knowledge within the team, the occurrence of multiple leaders would expedite this process. Subsequently, higher degrees of team mental model accuracy and similarity would lead to a higher level of performance, most likely due to a more efficiency in overall team functioning and an improvement in coordination and cooperation among team members.

Social Intelligence and Leadership Emergence

The first aspect of the model of team performance proposed in this study stated that the levels of social intelligence would predict leadership emergence in the teams. This hypothesis was not supported. Although no prior studies have specifically tested the relationship between the construct of social intelligence and leadership emergence, studies have shown that the same measures used in this study to represent the facets of social intelligence do in fact exhibit positive, significant relationships with measures of leadership emergence. Ellis (1988), Ellis, et al (1988), and Zaccaro, et al (1991) found positive, significant relationships between Self-Monitoring and leadership emergence, and Hall, et al (1998) found positive, significant relationships between Self-Monitoring, the Battery of Interpersonal Capabilities, Androgyny, and leadership emergence. In fact, the only measure used in this study to reflect a facet of social intelligence that has not found prior support for predicting leadership emergence is the Social Judgment Measure, which has only been investigated for its relationship with leadership effectiveness among formally appointed leaders in organizations (e.g., Zaccaro, et al., 2000). However, the Social Judgment Measure exhibited no significant relationship with any of the other measures chosen for this study to reflect social intelligence. Furthermore, due to the lack of variability in responses and high intercorrelation reported among dimensions in prior findings, only an overall rating of social judgment was given for each response in the current study. Therefore, the validity of this measure, at least for this particular sample and this study, is questionable.

A possible explanation for the overall failure of these "social intelligence" measures to predict leadership emergence is that for these particular teams, social intelligence was not perceived as a prerequisite for informal leader emergence, and therefore individuals exhibiting

high levels of social intelligence were not necessarily perceived as leaders by the other team members. Furthermore, the teams were composed of junior and senior level engineering and computer science students with at least a few years of education and the teams were involved in highly technical, specialized, and scientifically-complex tasks. Therefore, perhaps task-related knowledge and expertise, rather than social and interpersonal skills, were more relevant and crucial factors for the team's functioning. Therefore, cognitive ability or general intelligence was more predictive of who emerged as a leader. Cognitive ability has consistently demonstrated a significant and positive relationship with leadership emergence throughout the literature (e.g., Kickul & Neuman, 2000; Lord et al., 1986; Kaess, Witryol, & Nolan, 1961). Furthermore, studies have demonstrated that general cognitive ability does exhibit a superior relationship with leadership emergence as compared to other personality traits such as the big five (e.g., Kickul & Neuman, 2000; Taggar et al., 1999), which have been suggested by some to tap into some form of social and interpersonal aptitude (Hogan, Curphy, & Hogan, 1994). Therefore, cognitive ability may actually be a better predictor of leadership emergence overall, when compared to social intelligence.

An additional explanation for the failure of these "social intelligence" measures to predict leadership emergence involves the method in which the construct of social intelligence was conceptualized and measured in the current study. In the present study, social intelligence was classified as a trait. In other words, social intelligence represents a consistent, individual difference variable. Furthermore, it was measured by self-report. There has been a voluminous amount of dissent as to the true nature of the social intelligence construct as well as the appropriate method of measurement for the construct. For example, some psychologists purport that social intelligence is a trait or a consistent individual difference variable, while

other psychologists argue that social intelligence is not a stable trait but rather a social-cognitive structure that is situationally-provoked (e.g., Cantor & Kihlstrom, 1989; Sternberg, 2002; Sternberg, 2000). Psychologists adhering to the trait operationalization of social intelligence tend to support a multiple intelligences perspective and therefore classify social intelligence as a distinct type of intelligence (e.g., Sternberg, 2002; Sternberg, 2000). In other words, according to these psychologists, social intelligence accounts for a significant unique amount of variance in various other traits and behaviors as compared to, for example, general intelligence or emotional intelligence. For example, social intelligence accounts for variance in social skills and interpersonal behavior, whereas general intelligence or cognitive ability is more associated with, for example, math and general verbal (e.g., language, reading, writing comprehension) skills.

However, attempts to measure social intelligence from this perspective have been problematic. For example, measures of social intelligence have generally and consistently only demonstrated discriminant validity from general intelligence or cognitive ability when measured with self-reports. When attempting to measure social intelligence with more objective types of measures, such as problem-solving and verbal or written responses to objective questions or scenarios, these measures correlate so highly with measures of general intelligence, cognitive ability, or verbal skills so as to question the distinction between social intelligence and general intelligence (e.g., Wong, Day, & Meara, 1995). The inability of these two methods of measuring social intelligence to converge has held the theory of social intelligence as a unique, stable trait in partial abeyance and led to other, different conceptualizations of the construct of social intelligence. An example of an alternative conceptualization is the social-cognitive perspective, which holds that social intelligence is

merely a cognitive structure activated by the situation and therefore not stable over time and across individuals (Cantor & Kilstrom, 1989). Therefore, appropriate methods of measurement include more cognitively-oriented techniques such as detecting schemas, mental models, and other knowledge structures relevant to cognitive functioning by recording and comparing reaction times to various primed versus irrelevant stimuli (e.g., words, descriptions, adjectives on a computer screen, objects or personal characteristics in a video). Perhaps measuring social intelligence according to this alternative conceptualization is more accurate in terms of measurement (e.g., reliability, validity, predictiveness), and consequently a perhaps also in contributing support to a more adequate theory concerning the nature of social intelligence.

Leadership Dispersion and Team Mental Models

The second aspect of the model proposed in this study included leadership dispersion as a predictor of the degree of similarity and accuracy of the team members' team interaction mental models. This prediction was partially supported in that leadership dispersion significantly predicted the level of team mental model accuracy, but leadership dispersion did not significantly predict the level of team mental model similarity. There is no previous research that has investigated the relationship between leadership dispersion and team mental models. The only study which has investigated leadership and team mental models in tandem involved formally appointed leaders who, in a controlled lab setting, gave a pre-established, standard briefing to the other team members before beginning a task simulation (Marks et al., 2000). The findings of that study indicated that leadership aided in the development of both similar and accurate team mental models among team members.

Therefore, the results of the current study are partially consistent with prior findings concerning the relationship between leadership and team mental models. However, the prior

study utilized single appointed leaders in each team as opposed to multiple informally emerging leaders. This discrepancy may somehow account for the failure of the current study to demonstrate a significant positive relationship between leadership and team mental model similarity. Perhaps having only one leader per team, who formally and simultaneously briefs all of the other team members contributed to the development of similar team mental models, whereas having informal leaders who may not have formally or simultaneously instructed all of the other team members may have obstructed the opportunity to develop high levels of similarity among team members' mental models. For example, it is likely that different team members emerged as leaders at different points in time during the team's tenure when those members' skills and expertise were most useful (e.g., Hollander, 1985). If this occurred, perhaps team mental model development was slightly inconsistent and erratic over time due to a change in leadership and task instruction.

Team Mental Models and Team Performance

The third aspect of the model proposed in this study involves the relationship between team mental model similarity and accuracy and subsequent team performance. It was hypothesized that higher degrees of team mental model similarity and accuracy would enhance team performance. This hypothesis was generally supported. A model that regressed team performance onto both team mental model similarity and team mental model accuracy simultaneously demonstrated a significant R-square. However, the team mental model accuracy beta coefficient was significant, whereas the team mental model similarity beta coefficient was insignificant. Therefore, although team performance can be predicted by team mental model similarity and team mental model accuracy together, team mental model accuracy exerts more influence on team performance than team mental model similarity.

It was also hypothesized that there would be a significant interaction effect for team performance by team mental model similarity and team mental model accuracy. Specifically, it was predicted that team mental model similarity would only significantly positively affect team performance when team mental model accuracy was also high. In other words, team mental model similarity mostly likely would negatively affect team performance if a very low degree of team mental model accuracy exists within a team. The interaction between team mental model similarity and team mental model accuracy in affecting team performance was tested by adding a model containing the product term of team mental model similarity and team mental model accuracy as step two to the first model containing both team mental model similarity and team mental model accuracy individually. This second model was insignificant, and did not add significant explained variance in team performance above and beyond the main effects of team mental model similarity and accuracy. Therefore, the current offers no support for the proposition that the positive effects of team mental model similarity on team performance depends on the level of accuracy in team mental models. In other words, team mental model similarity appears to have little impact on team performance one way or another. Team mental model accuracy is the strongest predictor of team performance, regardless of the level of team mental model similarity.

Prior research on team mental models have generally found support for the relationship between team mental model similarity and team performance (Carley, 1997; Marks et al., 2000; Marks et al., 2002; Mathieu, et al., 2000), as well as the relationship between team mental model accuracy and performance (Marks et al., 2000). Therefore, the findings of this study that team mental model similarity and accuracy positively affects performance are in concordance with previous findings. However, the failure of this study to find a significant beta coefficient

for team mental model similarity can be explained by the fact that in prior studies, the effects of team mental model similarity were typically related to performance only indirectly. In other words, team mental model similarity enhanced team coordination and cooperation, which then had a direct, positive effect on performance. Otherwise, team mental model similarity itself most likely did not necessarily affect performance one way or another unless the models were accurate because all of the team members of a team could theoretically have highly similar team mental models which are in actually incorrect. In line with this reasoning, there was no significant relationship found between team mental model similarity and accuracy in the present study. Therefore, it is likely that team mental model similarity requires a mediating variable, such as improved team coordination and cooperation, in order to have any influence on team performance. However, because these mediating variables weren't investigated in this study, it is impossible to establish further support for this possibility.

Leadership Dispersion and Team Performance

Finally, it was hypothesized that leadership dispersion would directly influence team performance so that the more leaders that emerged within a team, the higher the level of team performance due to the numerous positive influences prior literature has suggested and demonstrated leaders to exert on team processes which were not included in the current model. Only two studies have specifically tested this proposition, and both found support (Neubert, 1999; Taggar et al., 1999). On the other hand, an array of literature has suggested the opposite; that multiple leaders co-existing in a team would negatively affect outcomes as a result of competitive and conflicting team processes that may occur (e.g., Festinger, Schachter, & Back, 1950). However, contrary to both propositions, the findings of the current study suggest that a higher dispersion of leadership within a team has no impact on team performance. In other

words, leadership appears to not be important enough of a factor to directly influence the team's performance.

However, in the present study, it is possible that leadership dispersion exerted its influence on team performance only indirectly, through its significant, positive effects on team mental model accuracy. Perhaps due to the more technical nature of the tasks being performed (e.g., solving technical computer-related problems, building engineering devices), the dispersion of cognitive ability and the processes involved in completing the tasks themselves were of a more immediate and profound significance in impacting team performance. Studies have found support for the proposition that cognitive ability of team members directly affect team performance (e.g., Kickul & Neuman, 2000). Also, cognitive ability has demonstrated superiority in the prediction of leadership emergence. Therefore it is possible that leadership has positively impacted team performance due in part to its strong relationship with cognitive ability (Kickul & Neuman, 2000).

Furthermore, it is possible that although highly interrelated, cognitive ability of team members substituted for leadership within the team, when taking into account the variables that affect team performance. Prior research has found that there may indeed be situations in which there are variables that substitute for leadership, in terms of team processes that directly affect subsequent team performance. For example, a theory known as the "Substitutes for leadership theory" (SLT) proposed by Kerr and Jermier (1978) has received mixed support for its validity and prevalence in organizations (e.g., Howell, 1997; Podsakoff & MacKenzie, 1997; Podsakoff, Niehoff, MacKenzie, & Williams, 1993). However, a meta-analysis by Podsakoff, MacKenzie, and Bommer (1997) concluded that substitutes for leadership have on the whole predicted several criteria variables (e.g., job attitudes, role perceptions, task and contextual

performance) above and beyond leadership behaviors. Therefore, the findings of the present study are still consistent with the findings of prior research investigating the relationship between leadership and team performance, with the suggestion that technical skills and mental ability represent a more significant predictor of team performance than leadership.

Limitations

There are a number of factors that may limit the generalizability and validity of the results of this study. First of all, the teams included in the sample were drawn from a population of junior and senior college level engineering and computer science students, which may be more specialized and technically advanced than the general population of work teams in organizations. Second, the type of tasks that the teams were required to perform was more technical and therefore perhaps disjunctive in nature, allowing for the most capable members to perform the majority of the work. Therefore, testing a model of team performance in which a large amount of emphasis was placed on the importance and interrelatedness of social intelligence, interpersonal team member interactions, and a dispersion of leadership in positively affecting team performance might have been inappropriate. Perhaps it would be more useful to test a model of this nature on teams that perform more general, less specialized, additive tasks, in which all members must contribute expertise and effort in order for the team to succeed. Conversely, it would be useful to test the possibility that cognitive ability is the most predictive trait of emergent leaders, as well as team performance, in these types of teams as well.

A third limitation involves the social intelligence measures employed in the current study. They were not originally developed with the intention of measuring social intelligence as defined in this study. Development and establishment of a valid measure of social

intelligence, as defined in this study and other literature as both social perceptiveness and behavioral flexibility, would prove more useful in attempting to ascertain its true relationship with leadership emergence, as well as predicting other phenomena it is hypothesized to affect, such as leader effectiveness. Or perhaps utilizing a different conceptualization of intelligence (e.g., social-cognitive structure as defined by Cantor & Kihlstrom, 1989) would be more appropriate. A fourth issue involves the method used to measure the team mental models. Although Pathfinder is the most extensively established method of measurement one of its limitations is that only associative links among concepts, not causal links, can be established. A second limitation of Pathfinder is that the concepts rated by the participants are provided by the researcher and not chosen by the participants themselves. Therefore perhaps a depth and richness of information is lost by using this method, as compared to using methods such as concept mapping, which both measures causation among concepts as well as allowing participants to choose their own concepts or select a subset of concepts from a larger pool provided by the researcher (Mohammed et al., 2000). A final issue is that, due to time constraints enforced by professors and an inability to contact participants a second time, there was only one measure of team performance employed, and it was an objective measure. Many team studies recently conducted in the field use multiple measures of team performance that capture many aspects of team functioning, such as planning/organization, effective interpersonal interaction, and team viability (e.g., Barrick et al., 1998). Perhaps a measure of this nature would yield slightly different results, especially with respect to both team interaction models and leadership dispersion, phenomena that were proposed to instigate team cooperative and communicative behaviors.

Conclusions

In conclusion, this study proposed that team members' levels of social intelligence would predict whether or not each team member was perceived by the other members of their team as a leader, and consequently the more leaders emerging within a team, the more similar and accurate that team's team interaction model would be. As a result of both a high dispersion of leadership and a high degree of team interaction model similarity and accuracy, the team would subsequently be more effective (Figure 1). However, results suggest that social intelligence was not indicative of which team members would emerge as leaders within a team. Although, the more team members perceived as leaders by the other members within their team, the more accurate that team's interaction model was, and in turn the more accurate the team's mental models, the more highly the team performed. Therefore, the model proposed in the present study was mostly supported. Although social intelligence was not effective in predicting which team mates eventually emerged as team leaders, the degree of leadership dispersion and team interaction mental models did indeed enhance team performance as expected. However, leadership dispersion only indirectly affected performance through its positive effect on the development of accurate team mental models among team members. Investigations of more appropriate methods and theoretical conceptualizations of social intelligence, as well as measures of other traits or skills that might be equally or even more predictive of leadership emergence in teams, are urged and highly recommended.

Table 1

Descriptive Statistics, Zero-order correlations, and Internal Reliabilities for Individual-level Variables

	Variable	Mean	SD.	1	2	3	4	5	6	7	8	9
1	Behavior Flexibility (RSMS)	27.44	3.33	.78								
2	Social Perceptiveness (RSMS)	25.52	4.44	.50**	.76							
3	Androgyny	141.28	21.11	.17	.28**	.89						
4	BIC	76.71	13.61	.26**	.10	.23*	.80					
5	SJ scenario 1	23.84	7.11	.03	.13	-.02	-.08	.81				
6	SJ scenario 2	31.55	9.42	-.03	-.04	-.03	-.21*	.34**	.87			
7	RSMS	52.83	6.66	.82**	.90**	.26**	.17	.10	-.06	.83		
8	SJ composite	55.29	13.60	.00	.05	-.03	-.18	.76**	.87**	.02	.88	
9	GLI	17.93	3.08	.18	.02	-.07	-.05	.13	.08	.10	.12	.90

$N = 120$.

Note. Internal Reliabilities are reported in the diagonal.

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

Table 2

Descriptive Statistics and Zero-order correlations for Group-level Variables

	Variable	Mean	SD	1	2	3	4	5
1	GLI group mean	18.00	1.88	--				
2	GLI group variance	5.71	5.82	-.20*	--			
3	TMM-similarity	.27	.09	.07	.00	--		
4	TMM-accuracy	.21	.05	.21*	.23*	.17	--	
5	Performance	65.78	42.28	-.04	.06	.04	.47**	--

N = 40 teams.

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

Table 3

Regression Estimates for Predicting Leadership Emergence

	b	*(95% CI))* *Lower Bound*	*(95% CI)* *Upper Bound*	R^2
SI composite				.056
RSMS composite	.082	-.008	.173	
Androgyny	-.016	-.043	.012	
BIC	.003	-.045	.050	
SJ scenario 1	.043	-.045	.132	

N = 120.

Note. b = unstandardized regression coefficient.

Table 4

Regression Estimates for Predicting Team Mental Model Similarity and Accuracy

	Similarity	Similarity	Similarity	Similarity
	b	*(95% CI)*	*(95% CI)*	R^2
		Lower Bound	*Upper Bound*	
Leader Dispersion	.000	.000	.000	.000

	Accuracy	Accuracy	Accuracy	Accuracy
	b	*(95% CI)*	*(95% CI)*	R^2
		Lower Bound	*Upper Bound*	
Leader Dispersion	.001**	.000	.002	.052**

N = 40 teams.

Note. *b* = unstandardized regression coefficient.

* * *p* = <.01.

Table 5

Regression Estimates for Predicting Team Performance

	b	*(95% CI) Lower*	*(95% CI) Upper*	R^2	ΔR^2
Step 1: Team Mental Model Similarity (TMMS)	.320	-2.868	3.508	.132**	
Team Mental Model Accuracy (TMMA)	.959**	-3.614	5.532		
Step 2: TMMS X TMMA	.188	-15.885	16.261	.132	.0001

N = 40 teams.

Note: *b* = unstandardized regression coefficient.

** *p* = < .01.

Table 6

Regression Estimates for Predicting Team Performance

	b	*(95% CI) Lower*	*(95% CI) Upper*	R^2
Leader Dispersion	.001	-.001	.002	.003

N = 40 teams.

Note. *b* = unstandardized regression coefficient.

References

Alper, S., Tjosvold, D., & Law K. S. (2000). Conflict management, efficacy, and performance in organizational teams. Personnel Psychology, 53(3), 625-640.

Barker, V. E., Abrams, J. R., Tiyaamornwong, V., Seibold, D. R., Duggan, A., Park, H. S., & Sebastian, M. (2000). New contexts for relational communication in groups. Small Groups Research, 31(4), 470-503.

Barnlund, D. C. (1962). Consistency of emergent leadership in groups with changing tasks and members. Speech Monographs, 29, 45-52.

Barrick, M. R., Stewart, G. L., Neubert, M. J., & Mount, M. K. (1998). Relating member ability and personality to work-team processes and team effectiveness. Journal of Applied Psychology, 83(3), 377-391.

Barry, B. & Stewart, G. L. (1997). Composition, process, and performance in self-managed groups: the role of personality. Journal of Applied Psychology, 82, 76-78.

Bass, Bernard M. (2002). Cognitive, social, and emotional intelligence of transformational leaders In R.E. Riggio, S.E. Murphy, & F. Pirozzolo (Eds.), Multiple Intelligences and Leadership. LEA's organizational and management series. Mahwah, NJ, US: Lawrence Erlbaum Association, Inc.

Bem, S. L. (1974). The measurement of Psychological Androgyny. Journal of Consulting and Clinical Psychology, 42, 155-162.

Campion, M. A., Medsker, G. J., & Higgs, A. C. (1993). Relations between work group characteristics and effectiveness: implications for designing effective work groups. Personnel Psychology, 46 (4), 823-850.

Campion, M. A., Papper, E. M., & Medsker, G. J. (1996). Relations between work team characteristics and effectiveness: a replication and extension. Personnel Psychology, 49(2), 429-452.

Cannon-Bowers, J. A., Salas, E. & Converse, S. A. (1993). Shared mental models in expert team decision making. In N.J. Castellan (Ed.), Individual and group decision making. Hillsdale, NJ: Lawrence Erlbaum.

Carless, S. A. & DePaola, C. (2000). The measurement of cohesion in work teams. Small Group Research, 31(1), 71-88.

Carley, K. M. (1997). Extracting team mental models through textual analysis. Journal of Organizational Behavior, 18, 533-558.

Crown, D. F. & Rosse, J. G. (1995). Yours, mine, and ours: facilitating group productivity through the integration of individual and group goals. Organizational Behavior and Human Decision Processes, 64(2), 138-150.

DeSouza, G. & Klein, H. J. (1995). Emergent leadership in the group goal-setting process. Small Group Research, 26(4), 475-496.

Dies, R. R. (1977). Pragmatics of leadership in psychotherapy and encounter group research. Small Group Behavior, 8(2), 229-248.

Ellis, R. J. (1988). Self-monitoring and leadership emergence in groups. Personality and Social Psychology Bulletin, 14, 681-693.

Ellis, R. J., Adamson, R. S., Deszca, G. & Cawsay, T. F. (1988). Self-monitoring and leader emergence. Small Group Behavior, 19, 312-324.

Evans, C. R. & Dion, K. L. (1991). Group cohesion and performance: a meta-analysis. Small Group Research, 22(2), 175-186.

Festinger, L., Schachter, S., & Back, K. W. (1950). Social pressure in informal groups. New York: Harper.

Fiedler, F. E. (1967). A theory of leadership effectiveness. New York: McGraw-Hill.

Fisher, B. A. (1985). Leadership as medium: treating complexity in group communication research. Small Group Behavior, 16(2), 167-196.

Ford, M. E. & Tisak, M. S. (1983). A further search for social intelligence. Journal of Educational Psychology, 75(2), 196-206.

Forgas, J. P. (1981). Social episodes and group milieu: a study in social cognition. British Journal of Social Psychology, 20, 77-87.

Gladstein, D. L. (1984). Groups in context: a model of task group effectiveness. Administrative Science Quarterly, 89, 499-517.

Guzzo, R. A. & Shea, G. P. (1992). Group performance and intergroup relations in organizations. In MD Dunnette & LM Hough (Eds.), Handbook of industrial and organizational Psychology (2nd ed.). Palo Alto, CA: Consulting Psychologist Press.

Hackman, J. R. (1987). The design of work teams. In J. Lorsch (Ed.), Handbook of Organizational Behavior. Englewood Cliffs, NJ: Prentice-Hall.

Hall, J. H., Workman, J. W., & Marchioro, C. A. (1998). Sex, task, and behavioral flexibility effects on leadership perceptions. Organizational Behavior and Human Decision Processes, 74(1), 1-32.

Heilbrun, A. B. (1984). Sex-based models of androgyny: A further cognitive elaboration of competence difference. Journal of Personality & Social Psychology, 46(1), 216-229.

Hogan, R., Curphy, G. J., & Hogan, J. (1994). What we know about leadership: Effectiveness and personality. American Psychologist, 49(6), 493-504.

Hollander, E. P. (1985). Leadership and power. In G. Lindzey & E. Aronson (Eds.), Handbook of Social Psychology (3rd ed.). New York: Random House.

Hooijberg, R. (1996). A multidirectional approach toward leadership: An extension of the concept of behavioral complexity. Human Relations, 49(7), 917-946.

Hooijberg, R. & Schneider, M. (2001). Behavioral complexity and social intelligence: How executive leaders use stakeholders to form a systems perspective. In S. J. Zaccaro & R. J. Klimoski (Eds.). The Nature of Organizational Leadership: Understand the Performance Imperatives Confronting Today's Leaders. The Jossey-Bass business & management series. San Francisco, CA, US: Jossey-Bass, Inc.

Howell, J. P. (1997). Substitutes for leadership: Their meaning and measurement: An historical assessment. Leadership Quarterly, 8(2), 113-116.

Jewell, L. N. & Reitz, H. J. (1981). Group Effectiveness in Organizations. Glenview, IL: Scott, Foresman.

Jones, K. & Day, J. D. (1997). Discrimination of two aspects of cognitive-social intelligence from academic intelligence. Journal of Educational Psychology, 89(3), 486-497.

Keating, D. P. (1978). A search for social intelligence. Journal of Educational Psychology, 70(2), 218-223.

Kaess, W. A, Witryol, S. L., Nolan, R. E. (1961). Reliability, sex differences, and validity in the leaderless group discussion technique. Journal of Applied Psychology, 45, 345-350.

Kenny, D. A. & Zaccaro, S. J. (1983). An estimate of variance due to traits in leadership. Journal of Applied Psychology, 68, 678-685.

Kerr, S., Jermier, J. M. (1978). Substitutes for leadership: Their meaning and measurement. Organizational Behavior & Human Decision Processes, 22(3), 375-403.

Kickul, J. & Neuman, G. (2000). Emergent leadership behaviors: the function of personality and cognitive ability in determining teamwork performance and KSAs". Journal of Business and Psychology, 15(1), 27-51.

Klimoski, R., & Mohammed, S. (1994). Team mental model: Construct or metaphor? Journal of Management, 20(2), 403-437.

Kraiger, K. & Wenzel, L. H. (1997). Conceptual development and empirical evaluation of measures of shared mental models as indicators of team effectiveness. In M. T. Brannick & E. Salas (Eds.). Team Performance Assessment and Measurement: Theory, Methods, and Application. Series in applied psychology. Mahwah, NJ, US: Lawrence Erlbaum Associates, Inc.

Latham, V. M. (1987). Task type and group motivation: implications for a behavioral approach to leadership in small groups. Small Group Behavior, 18(1), 56-71.

Lawler, E. E. III, Mohrman, S. A., & Ledford, G. E. (1995). Creating High Performance Organizations: Practices and Results of Empirical Involvement and Total Quality Management in Fortune 1000 Companies. San Francisco: Jossey-Bass.

Lennox, R. D. & Wolfe, R. N. (1984). Revision of the self-monitoring scale. Journal of Personality and Social Psychology, 46, 1349-1364.

Lord, R. G., Foti, R. J., & De Vader, C. L. (1984). A test of leadership categorization theory: Internal structure, information processing, and leadership perceptions. Organizational Behavior & Human Decision Processes, 34(3), 343-378.

Lord, R. G., DeVader, C. L., & Alliger, G. M. (1986). A metal-analysis of the relationship between personality traits and leadership perceptions: an application of validity generalization procedures. Journal of Applied Psychology, 71, 402-410.

Mann, R. D. (1959). A review of the relationship between personality and performance in small groups. Psychological Bulletin, 56, 241-270.

Manz, C. C. & Sims, H. P. (1987). Leading workers to lead themselves: the external leadership of self-managing work teams. Administrative Science Quarterly, 32, 106-128.

Marks, M. A., Zaccaro, S. J., & Mathieu, J. E. (2000). Performance implications of leader briefings and team-interaction training for team adaptation to novel environments. Journal of Applied Psychology, 85(6), 971-986.

Marks, M. A., Sabella, M. J., Burke, C. S., & Zaccaro, S. J. (2002). The impact of cross-training on team effectiveness. Journal of Applied Psychology, 87(1), 3-13.

Marlowe, Jr., H. A. (1986). Social intelligence: evidence for multidimensionality and construct independence. Journal of Educational Psychology, 78(1), 52-58.

Mathieu, J. E., Heffner, T. S., Goodwin, G. F., Salas, E., & Cannon-Bowers, J. A. (2000). The influence of shared mental models on team process and performance. Journal of Applied Psychology, 85, 273-283.

McGrath, J. E. (1984). Group Interaction and Performance. Englewood Cliffs, New Jersey: Prentice-Hall.

Mohammed, S., Klimoski, R., & Rentsch, J. R. (2000). The measurement of team mental models: we have no shared schema. Organizational Research Methods, 3(2), 123-165.

Mulvey, P. W. & Klein, H. J. (1998). The impact of perceived loafing and collective efficacy on group goal process and group performance. Organizational Behavior and Human Decision Processes, 74(1), 62-87.

Neubert, M. J. (1999). Too much of a good thing or the more the merrier: exploring the dispersion and gender composition of informal leadership in manufacturing teams. Small Group Research, 30(5), 635-646.

Neuman, G. A. & Wright, J. (1999). Team effectiveness: Beyond skills and cognitive ability. Journal of Applied Psychology, 84(3), 376-389.

Paulhus, D. L. & Martin, C. L. (1988). Functional Flexibility: a new conception of interpersonal flexibility. Journal of Personality and Social Psychology, 55(1), 88-101.

Pescosolido, A. T. (2001). Informal leaders and the development of group efficacy. Small Group Research, 32(1), 74-93.

Pfeffer, E. & Veiga, J. F. (1999). Putting people first for organizational success. The Academy of Management Executive, 13, 37-48.

Podsakoff, P. M., MacKenzie, S. B. (1997). Kerr and Jermier's substitutes for leadership model: Background, empirical assessment, and suggestions for future research. Leadership Quarterly, 8(2), 117-132.

Podsakoff, P. M., MacKenzie, S. B., & Ahearne, M. (1997). Moderating effects of goal acceptance on the relationship between group cohesiveness and productivity. Journal of Applied Psychology, 82(6), 374-983.

Podsakoff, P. M., MacKenzie, S. B., Bommer, W. H. (1996). Meta-analysis of the relationships between Kerr and Jermier's substitutes for leadership and employee job attitudes, role perceptions, and performance. Journal of Applied Psychology, 81(4), 380-399.

Podsakoff, P. M., Niehoff, B. P., MacKenzie, S. B., Williams, M. L. (1993). Do substitutes for leadership really substitute for leadership? An empirical examination of Kerr and Jermier's

situational leadership model. Organizational Behavior & Human Decision Processes, 54(1), 1-44.

Riggio, R. E., Murphy, S. E., & Pirozzolo, F. J. (2002). Multiple Intelligences and Leadership. LEA's organizational and management series, Mahwah, NJ, US: Lawrence Erlbaum Association, Inc.

Rouse, W. B., Cannon-Bowers, J. A., & Salas, E. (1992). The role of mental models in team performance in complex systems. IEEE Transactions on Systems, Man, and Cybernetics, 22(6), 1296-1308.

Saavedra, R., Earley, P. C., & Van Dyne, L. (1993). Complex interdependence in task-performing groups. Journal of Applied Psychology, 78(1), 61-72.

Salem, M. A. & Banner, D. K. (1992). Self-managing work teams: an international perspective. Leadership and Organizational Development Journal, 13, 3-8.

Schneider, R. J., Ackerman, P. L., & Kanfer, R. (1996). To act wisely in human relations: exploring the dimensions of social competence. Personality and Individual Differences, 21 (4), 469-481.

Schvaneveldt, R. W. (1990). Proximities, networks, and schemata. In R. W. Schvaneveldt (Ed). Pathfinder associative networks: Studies in knowledge organization. Ablex series in computational sciences.

Sillars, A. L., Coletti, S., Perry, D., & Rogers, M. (1982). Coding verbal conflict tactics: nonverbal and perceptual correlates of the avoidance-distributive-integrative distinction. Human Communications Research, 9, 83-95.

Snyder, M. (1974). The self-monitoring of expressive behavior. Journal of Personality and Social Psychology, 30, 526-537.

Sternberg, R. J. (2002). Successful Intelligence: a new approach to leadership In R. E. Riggio, S. E. Murphy, & F. J. Pirozzolo (Eds.). Multiple Intelligences and Leadership. LEA's organizational and management series. Mahwah, NJ, US: Lawrence Erlbaum Association, Inc.

Sternberg, R.J. (2000). Handbook of Intelligence. New York, NY, US: Cambridge University Press.

Stewart, G. L. & Barrick, M. R. (2000). Team structure and performance: assessing the mediating role of intrateam processes and the moderating role of task type. Academy of Management Journal, 43(2), 135-144.

Stewart, G. L. & Manz, C. C. (1995). Leadership for self-managing work teams: a typology and integrative model. Human Relations, 48, 747-770.

Stogdill, R. M. (1948). Personal Factors Associated With Leadership: A Survey of Theory and Research. New York: Free Press.

Stout, R. J., Cannon-Bowers, J. A., Salas, E., & Milanovich, D. M. (1995). Planning, shared mental models, and coordinated performance: an empirical link is established. Human Factors, 41(1), 61-71.

Stricker, L. J. & Rock, D. A. (1990). Interpersonal competence, social intelligence, and general ability. Personality and Individual Differences, 11(8), 833-839.

Taggar, S., Hackett, R., & Saha, S. (1999). Leadership emergence in autonomous work teams: antecedents and outcomes. Personnel Psychology, 52, 899-926.

Thorndike, E. L. (1920). Intelligence and its uses. Harper Monthly Magazine, (January), 227-235.

Van Vianen, A. E. M. & DeDreu, C. K. W. (2001). Personality in teams: its relationship to social cohesion, task cohesion, and team performance. European Journal of Work and Organizational Psychology, 10(2), 97-120.

Wexley, K. N. & Yukl, G. A. (1978). Organizational Behavior and Personnel Psychology. Homewood, IL: Richard D. Irwin, Inc.

Whitney, K. (1994). Improving group task performance: the role of group goals and group efficacy. Human Performance, 7(1), 55-78

Widmeyer, N., Brawley, L., & Carron, A. (1985). The Measurement of Cohesion in Sports Teams: The Group Environment Questionnaire. London, Ontario, Canada: Sports Dynamics.

Wong, C. T., Day, J. D., Maxwell, S. E., & Meara, N. M. (1995). A multi-trait-multimethod study of academic and social intelligence in college students. Journal of Educational Psychology, 87(1), 117-133.

Zaccaro, S. J. (1999). Social complexity and the competencies required for effective military leadership. In J. G. Hunt & G. E. Dodge (Eds). Out-of-the-box leadership: Transforming the twenty-first-century army and other top-performing organizations. Monographs in leadership and management, 1.

Zaccaro, S. J. (2002). Organizational leadership and social intelligence In R. E. Riggio, S. E. Murphy, & F. J. Pirozzolo (Eds.). Multiple Intelligences and Leadership. LEA's organization and management series. Mahwah, NJ, US: Lawrence Erlbaum Association, Inc.

Zaccaro, S. J., Foti, R. J., & Kenny, D. A. (1991). Self-monitoring and trait-based variance in leadership: an investigation of leader flexibility across multiple group situations. Journal of Applied Psychology, 76(2), 308-315.

Zaccaro, S. J., Gilbert, J. A., Thor, K. K., & Mumford, M. D. (1991). Leadership and social intelligence: linking social perceptiveness and behavioral flexibility to leader effectiveness. Leadership Quarterly, 2, 317-342.

Zaccaro, S. J., Mumford, M. D., Connelly, M. S., Marks, M. A., & Gilbert, J. A. (2000). Assessment of leader problem-solving capabilities. Leadership Quarterly, 11(1), 37-64.

APPENDIX A: SOCIAL INTELLIGENCE MEASURES

SELF-MONITORING SCALE

DARKEN the circle of ONE of the six numbers following the statement that most accurately reflects your feeling about the statement.

1 – certainly, always false
2 – generally false
3 – somewhat false, but with exceptions
4 – somewhat true, but with exceptions
5 – generally true
6 – certainly, always true

PLEASE DARKEN IN ONLY ONE NUMBER (1, 2, 3, 4, 5 OR 6)

1. In social situations, I have the ability to alter my behavior if I feel that something else is called for.
2. I am often able to read people's true emotions correctly through their eyes.
3. I have the ability to control the way I come across to people, depending on the impression I wish to give them.
4. In conversations, I am sensitive to even the slightest change in the facial expression of the person I'm conversing with.
5. When I feel that the image I am portraying isn't working, I can readily change it to something that does.
6. My powers of intuition are quite good when it comes to understanding others' emotions and motives.
7. I have trouble changing my behavior to suit different people and different situations.
8. I can usually tell when others consider a joke to be in bad taste, even though they may laugh convincingly.
9. I have found that I can adjust my behavior to meet the requirements of any situation I find myself in.
10. I can usually tell when I've said something inappropriate by reading it in the listener's eyes.
11. Even when it might be to my advantage, I have difficulty putting up a good front.
12. If someone is lying to me, I usually know it at once from that person's manner of expression.
13. Once I know what the situation calls for, it's easy for me to regulate my actions accordingly.

BEM SEX ROLE INVENTORY

For each of the following descriptions, indicate on a scale from 1 to 7 how likely is it that you could be each of those descriptions if the situation required it?

For example, if you were in a situation where it was necessary for you to be agreeable in order to, for example, achieve a personal goal, how likely would you be able to actually be agreeable?

(Please circle only one number)

	Not at all						**Very much**
Dominant	1	2	3	4	5	6	7
Ambitious	1	2	3	4	5	6	7
Extraverted	1	2	3	4	5	6	7
Gregarious	1	2	3	4	5	6	7
Agreeable	1	2	3	4	5	6	7
Warm	1	2	3	4	5	6	7
Trusting	1	2	3	4	5	6	7
Unassuming	1	2	3	4	5	6	7
Submissive	1	2	3	4	5	6	7
Lazy	1	2	3	4	5	6	7
Introverted	1	2	3	4	5	6	7
Aloof	1	2	3	4	5	6	7
Quarrelsome	1	2	3	4	5	6	7
Cold	1	2	3	4	5	6	7
Calculating	1	2	3	4	5	6	7
Arrogant	1	2	3	4	5	6	7

BATTERY OF INTERPERSONAL CAPABILITIES

In this inventory you will be shown a large number of personality characteristics. We would like you to use those characteristics to describe yourself. That is, we would like you to indicate on a scale from 1 to 7, how true of you these various characteristics are. Please do not leave any characteristics unmarked.

EXAMPLE: Sly

Circle a 1 if it is NEVER OR ALMOST NEVER TRUE that you are sly.

Circle a 2 if it is USUALLY NOT TRUE that you are sly.

Circle a 3 if it is SOMETIMES BUT INFREQUENTLY TRUE that you are sly.

Circle a 4 if it is OCCASIONALLY TRUE that you are sly.

Circle a 5 if it is OFTEN TRUE that you are sly.

Circle a 6 if it is USUALLY TRUE that you are sly.

Circle a 7 if it is ALWAYS OR ALMOST ALWAYS TRUE that you are sly.

1	2	3	4	5	6	7
Never or usually never true	Usually not true	Sometimes but infrequently true	Occasionally true	Often true	Usually true	Always or almost always true

1. Acts as a leader	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. Affectionate	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. Aggressive	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. Cheerful	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5. Ambitious	**1**	**2**	**3**	**4**	**5**	**6**	**7**
6. Childlike	**1**	**2**	**3**	**4**	**5**	**6**	**7**
7. Analytical	**1**	**2**	**3**	**4**	**5**	**6**	**7**
8. Compassionate	**1**	**2**	**3**	**4**	**5**	**6**	**7**
9. Assertive	**1**	**2**	**3**	**4**	**5**	**6**	**7**
10. Does not use harsh language	**1**	**2**	**3**	**4**	**5**	**6**	**7**
11. Athletic	**1**	**2**	**3**	**4**	**5**	**6**	**7**
12. Eager to soothe hurt feelings	**1**	**2**	**3**	**4**	**5**	**6**	**7**
13. Competitive	**1**	**2**	**3**	**4**	**5**	**6**	**7**
14. Feminine	**1**	**2**	**3**	**4**	**5**	**6**	**7**
15. Defends own beliefs	**1**	**2**	**3**	**4**	**5**	**6**	**7**
16. Flatterable	**1**	**2**	**3**	**4**	**5**	**6**	**7**

17. Gentle	**1**	**2**	**3**	**4**	**5**	**6**	**7**
18. Dominant	**1**	**2**	**3**	**4**	**5**	**6**	**7**
19. Gullible	**1**	**2**	**3**	**4**	**5**	**6**	**7**
20. Forceful	**1**	**2**	**3**	**4**	**5**	**6**	**7**
21. Loves children	**1**	**2**	**3**	**4**	**5**	**6**	**7**
22. Has leadership abilities	**1**	**2**	**3**	**4**	**5**	**6**	**7**
23. Loyal	**1**	**2**	**3**	**4**	**5**	**6**	**7**
24. Independent	**1**	**2**	**3**	**4**	**5**	**6**	**7**
25. Sensitive to the needs of others	**1**	**2**	**3**	**4**	**5**	**6**	**7**
26. Shy	**1**	**2**	**3**	**4**	**5**	**6**	**7**
27. Individualistic	**1**	**2**	**3**	**4**	**5**	**6**	**7**
28. Makes decisions easily	**1**	**2**	**3**	**4**	**5**	**6**	**7**
29. Masculine	**1**	**2**	**3**	**4**	**5**	**6**	**7**
30. Soft spoken	**1**	**2**	**3**	**4**	**5**	**6**	**7**
31. Sympathetic	**1**	**2**	**3**	**4**	**5**	**6**	**7**
32. Self-reliant	**1**	**2**	**3**	**4**	**5**	**6**	**7**
33. Tender	**1**	**2**	**3**	**4**	**5**	**6**	**7**
34. Understanding	**1**	**2**	**3**	**4**	**5**	**6**	**7**
35. Self-sufficient	**1**	**2**	**3**	**4**	**5**	**6**	**7**
36. Strong personality	**1**	**2**	**3**	**4**	**5**	**6**	**7**
37. Warm	**1**	**2**	**3**	**4**	**5**	**6**	**7**
38. Willing to take a stand	**1**	**2**	**3**	**4**	**5**	**6**	**7**
39. Willing to take risks	**1**	**2**	**3**	**4**	**5**	**6**	**7**
40. Yielding	**1**	**2**	**3**	**4**	**5**	**6**	**7**

ORGANIZATIONAL SCENARIOS

Read the following descriptions of organizational situations and respond to the questions after each one.

Suggested Completion Time: 10 Minutes

Scenario #1

A pharmacologist who worked for a competitive pharmaceutical company had been conducting tests on lab animals for a new type of steroid intended to aid the body's natural healing mechanisms. It was rumored that other companies were working on similar treatments. The drug had been something of a miracle - after administering it to rats, dogs, and monkeys for just one week, stomach ulcerations were healed. The drug seemed to speed up the healing process, preventing blood loss, dehydration and severe pain.

Although more than 50% of the animals behaved somewhat strangely afterward, acting quiet and withdrawn, the head of the department concluded that this was an obvious result of the healing process. The animals' energy was necessarily turned inward to help the body heal. He did not feel it necessary to include such an obvious effect in the lab reports. Human volunteers were administered small doses and also showed no noticeable side effects.

The drug was soon approved by the FDA for use in clinical situations and large doses were given to severely ill patients. However, 1 out of every 13 of these patients, seventy-five people total, suffered a severe and irreversible psychotic episode. The patients' families were filing suit against the company. The pharmacologist and the department head were the only ones who knew that the lab reports were somewhat incomplete, although their content was accurate.

1. Why did this situation occur?

2. What was the central mistake made by the Pharmacologist?

3. What would you do if you were the Pharmacologist in this situation?

Scenario #2

The Board of Directors made the decision to revise the entire sales effort of the company. Instead of depending on a few large accounts, a risky strategy liable to produce large swings in revenue, the company would move to support many small accounts. Salespeople were instructed to devote no more than 10 percent of their time to managing the large accounts that they had been servicing for more than 20 years, and to put the rest of their time into getting new accounts.

The first few months of the program had been moderately successful. New accounts were brought in, although not in anticipated numbers. However, sales reports indicated trouble and several large insurance brokers and the risk managers of two of their largest clients had expressed dissatisfaction with the speed of the company's paperwork and the general inattentiveness of the salespeople.

At the first sign of trouble, the director of sales had gone to the marketing vice-president to discuss the situation. The policy remained unchanged, and the complaints from the old clients grew increasingly stronger. Within a month, three of the companies' oldest and largest accounts had moved their business to New York companies. Another went with a British company. Two more went to Omaha. Although several small accounts had come in, revenue projections for the coming year were down by 16 percent.

The director of sales needed to take action. He was in constant disagreement with the vice president of marketing over the new sales program that wasn't working. He didn't have enough money to pay his staff of thirty-eight salespeople for the next year. He thought about going to the chief executive officer directly with his concerns. He thought about retiring early and moving with his wife to a tropical island. He thought about firing the seven salespeople who had previously serviced the large accounts that had been lost.

1. Why did this situation occur?

2. What was the central mistake made by the sales director?

3. What would you do as sales director in this situation?

APPENDIX B: LEADERSHIP EMERGENCE MEASURES

GENERAL LEADERSHIP IMPRESSION SCALE

The following questions concern your feelings toward and evaluations of GROUP MEMBER _____ . Please circle the answer which reflects your feelings.

1. How much does this member contribute to the effectiveness of the tasks and/or projects your group accomplishes?

Extreme amount	Substantial amount	Moderate amount	Very little	Nothing

2. What degree of influence does this member exert in determining the final outcome of the tasks and/or projects?

Extreme amount	Substantial amount	Moderate amount	Very little	Nothing

3. How much leadership does this member exhibit?

Extreme amount	Substantial amount	Moderate amount	Very little	Nothing

4. How much control over the group's activities does this member exhibit?

Extreme amount	Substantial amount	Moderate amount	Very little	Nothing

5. If you had to choose a leader for future projects or tasks, how willing would you be to vote for this member as leader?

Extreme amount	Substantial amount	Moderate amount	Very little	Nothing

APPENDIX C: TEAM MENTAL MODELS MEASURE

Engineering Teams

Each of the concepts in the matrix below represents aspects of your typical work team environment. There are 9 concepts total, and each are listed both across the top and down the side of the matrix. Starting at the top left corner and moving all the way to the right of each row, indicate how related each pair of concepts is when you are performing tasks or working on projects within your work team on a scale from 1 (not at all related) to 9 (very highly related).

For example, start by indicating how related "Decide on specific steps that will be taken to complete the project" is to "Refer to classroom material (text books, notes, Blackboard) to complete aspects of project", and then move to indicating how related " Decide on specific steps that will be taken to complete the project " is to "Hold team meetings" and so on down the entire first row. Then continue this pattern with rows 2, 3, 4, 5, 6, 7, 8, and 9 until all spaces within the matrix contain a number between 1 and 9.

Use the following scale:

Not at all related	Very slightly related	Slightly related	Some-what related	Related	Significantly related	Some-what highly related	Highly related	Very highly related
1	2	3	4	5	6	7	8	9

	Decide on specific steps that will be taken to complete the project	Refer to classroom materials (text books, notes, Blackboard) to complete aspects of project	Hold team meetings	Check/supervise each other's work	Work independently of the other team members	Trouble-shooting/problem-solving on aspects of project	Prepare presentation for class	Divide steps/aspects of project among team members	Work outside the lab (e.g., home, library, etc)
Decide on specific steps that will be taken to complete the project									
Refer to classroom materials (text books, notes, Blackboard) to complete aspects of project									
Hold team meetings									
Check/supervise each other's work									
Work independently of the other team members									
Trouble-shooting/problem-solving on aspects of project									
Prepare presentation for class									
Divide steps/aspects of project among team members									
Work outside the lab (e.g., home, library, etc)									

Computer Science Teams

Each of the concepts in the matrix below represents aspects of your typical work team environment. There are 9 concepts total, and each are listed both across the top and down the side of the matrix. Starting at the top left corner and moving all the way to the right of each row, indicate how related each pair of concepts is when you are performing tasks or working on projects within your work team on a scale from 1 (not at all related) to 9 (very highly related).

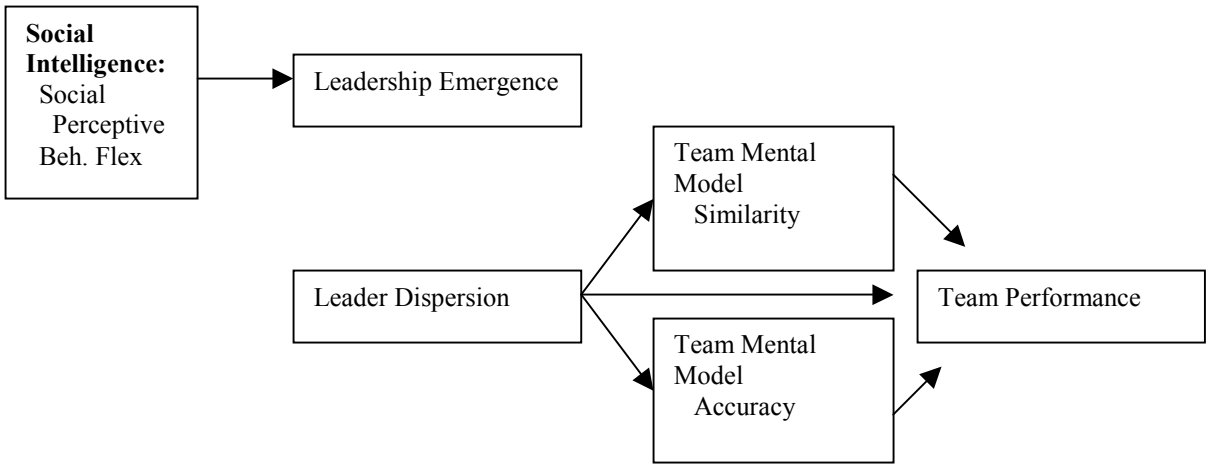
For example, start by indicating how related "Rank questions in the order they will be worked on" is to "Rank questions in terms of level of difficulty ", and then move to indicating how related "Rank order questions in the order they will be worked on" is to “Assign questions to team members" and so on down the entire first row. Then continue this pattern with rows 2, 3, 4, 5, 6, 7, 8, and 9 until all spaces within the matrix contain a number between 1 and 9.

Use the following scale:

Not at all related	Very slightly related	Slightly related	Some-what related	Related	Significantly related	Some-what highly related	Highly related	Very highly related
1	2	3	4	5	6	7	8	9

	Rank questions in the order they will be worked on	Rank order the questions in terms of level of difficulty	Assign questions to team members	Continue working on a question after it’s been deemed incorrect by the judges	Discard a question that has been answered incorrectly	Check Supervise each others’ work	Decide who will use the computer	Work on a problem collectively	Work on a problem independently
Rank questions in the order they will be worked on									
Rank order the questions in terms of level of difficulty									
Assign questions to team members									
Continue working on a question after it’s been deemed incorrect by the judges									
Discard a question that has been answered incorrectly									
Check Supervise each others’ work									
Decide who will use the computer									
Work on a problem collectively									
Work on a problem independently									

Figure One


Social Intelligence:
Social
Perceptive
Beh. Flex
Leadership Emergence
Team Mental Model Similarity
Leader Dispersion
Team Performance
Team Mental Model Accuracy

Curriculum Vitae

Heather Hayes
410 Houston St apt J
Blacksburg, VA 24060
hhayes@vt.edu

EDUCATION:

University of Tennessee
Knoxville, TN (1996-2001)
- BA in Psychology; minor in Music
- Cumulative GPA: 3.85; Major GPA: 4.0

Virginia Polytechnic & State University
Blacksburg, VA (2001- present)
- Pursuing an MA & Ph.D in Industrial-Organizational Psychology
- Expected graduation: May, 2003 & May, 2005, respectively
- Cumulative GPA: 3.61

RESEARCH EXPERIENCE:

University of Tennessee

Elephant and Baboon Research **Sept.-Dec. 1999**
Advisor: Dr. Richard Saudargas
- Observed elephants and baboons at the Knoxville zoo and on video tape, and recorded their behavior on a behavioral checklist
- Entered and analyzed observational data in Microsoft Excel and SPSS

Personality and Relationships Lab **Jan.-May 2000**
Advisor: Dr. Warren Jones
- Investigated the relationship between the traits of cynicism, hostility, and negativity and problems in interpersonal relationships
- Organized and administered personality questionnaires to research participants
- Entered and analyzed data in SPSS
- Presented research results in poster presentations at conferences

Work Team Performance Research **Jan.-May 2000**
Advisors: Dr. Eric Sundstrom, Tjai Nielsen
- Investigated the relationship between Organizational Citizenship Behavior and work team performance
- Entered and analyzed data in SPSS

Virginia Tech

Masters Thesis **April 2002- present**
Advisor: Dr. Roseanne Foti

- Investigating a model of leadership emergence and team performance in which personality traits predict leadership emergence, which through its influence on team mental models, affects the level of performance in autonomous work teams.

Work Team Performance Research **May 2002- present**
Co-researchers: Victoria Robson, Dr. Roseanne Foti
- Investigating a model of team performance in which team performance is predicted by leadership experience, success, and processes of feedback and goal-setting. Furthermore, this relationship is mediated by task cohesion and team efficacy and moderated by behavioral flexibility in the leader.

Goal Setting Research **April 2003- present**
Co-researchers: Kristina Meacham, Wan-yin Chang
Advisor: Dr. John Donovan
- Investigating the effects of goal self-concordance on self-set long-term goals, and the interactive effect of goal self-concordance and performance feedback on goal revision and final performance in individuals.

RELEVANT JOB EXPERIENCE

Undergraduate Teaching Assistant **Sept.1999-May 2001**
Introductory Psychology, University of Tennessee
- Assisted with proctoring exams
- Graded quizzes and exams and entered grades into Microsoft Excel
- Held regular office hours to assist students with questions, problems, concerns, etc.

Resource Associates, Inc. **May 2000-June 2001**
Selection Testing Company, Knoxville, TN
- Assisted with validation of various selection tests at participating organizations
- Administered selection tests to groups of 30-50 job applicants at various organizations
- Entered and analyzed data in SPSS; aided with database management and various other clerical responsibilities

Graduate Teaching Assistant **Sept.2001-present**
Virginia Tech, Introductory Psychology
- Teach and organize material for three Introductory Psychology recitation classes (labs) per week
- Proctor exams for Introductory Psychology Lecture class
- Hold regular office hours in order to aid students with questions, problems, and concerns

POSTER PRESENTATIONS

- Hayes, Heather & Hahn, Kathryn. "Cynicism, Hostility, and Vengeance". *Psi Chi convention, University of Georgia, April 2000.*
- Hahn, Kathryn & Hayes, Heather. "Vengeance: A Cycle of Negativity". *Exhibition of Social Science Research, University of Tennessee, May 2000.*

HONORS AND ACTIVITES

- Sigma Alpha Iota, Music Women's Fraternity: Member (1998-present); Sergeant at Arms (1998-1999); Vice-President, Membership (1999-2000)
- Psi Chi: Member (1999-present); Secretary & Webmaster (2000-2001)
- Award for "Outstanding Senior in Psychology", 2001
- Society for Industrial-Organizational Psychologists (SIOP): Student Affiliate (2002-present)

REFERENCES

Available upon request