The Influence of Training and Structure Transitioning

On Command and Control Team Performance:

A Final Report

Daniel R. Ilgen and John R. Hollenbeck

Michigan State University

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14. ABSTRACT

The work described in this report is part of an ongoing research program looking at the effects of team structure on the effectiveness of decision making teams. Team structures are investigated with respect to their fit to situational demands and to the characteristics of team members. Fit is considered both statically and dynamically. In the latter case, teams performing under one structure encounter situational demands that either are or are not consistent with the structure and, in the latter case, must reconfigure their structure to fit better the situations. During the time period intra-team processes of teamwork and learning also were investigated along with team task performance.

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Control Team Performance: A Final Report

Introduction

The research conducted by our research team over the last three years focuses on

the nature of team architectures with respect to their impact on team effectiveness. Ours is

a structural contingency view where structures are construed in terms of task allocation and

precedent relationships as they are linked to positions and to people in teams. The primary

focus of the work is on the fit among team architectures, task/mission demands and team

member characteristics. We look specifically at the human component of functioning in

command and control teams. The work is predicated on the assumption that command and

control teams that function effectively in demanding environments with shifting

requirements must recognize the need to change structures, identify more appropriate

structures when old structures fall short, shift to new structures, and perform effectively in

the new structure all within very limited amounts of time.

The research was designed to speak to two issues. The first objective was to extend

behavioral science knowledge of teams and team effectiveness as that knowledge relates to

team structure, changes in team structure, and the fit of team members to the team as a

whole and the demands of the team tasks. This work is published and presented in

behavioral science journals and conferences where the primary concern is with knowledge

creation. In the time period covered by this grant, published work was in the form of

seventeen articles in refereed journals, two book chapters, one edited book, and twenty

conference presentations (See the Appendix for a listing of these works).

The second purpose of the research was to complement and inform work that was being conducted by a number of other researchers, all of whom made up a larger project entitled Adaptive Architectures for Command and Control (A2C2). The centerpiece of this work was human-in-the-loop simulation of command and control scenarios carried out by naval officers enrolled in masters' programs at the Naval Postgraduate School. Our contributions to that research effort were through interactions as part of the multi-disciplined A2C2 team and through conducting parallel studies and/or ones that refine and replicate issues identified in those simulations that could be addressed better in our laboratory where larger numbers of teams can be run under more controlled conditions for shorter time periods.

Much of the empirical research carried out as part of this grant used a modification of the distributed dynamic decision-making task (DDD) developed by David Kleinman and his colleagues at the University of Connecticut (Miller, Young, Kleinman & Serfaty, 1998) and used in a number of human-in-the-loop experimental studies of team decision making with Naval personnel. The military simulation involves defending an airspace with a number of assets with different capabilities. The simulation is very flexible allowing for numerous structural configurations varying asset assignments to platforms, persons to positions, and hierarchical authority structures among individuals. The modification (MSU-DDD) used in our research allows for inexperienced participants to reach criterion on the task with from 1 to 1½ hours of training and to track individual and team performance over a small set of scenarios in ways that allow for between group comparisons on identical simulation experiences.

Although the current report is a final report for the period of time of the grant, the work conducted during this time period is part of a continuing effort that predates the granting period and continues beyond it. For that reason, this report will simply highlight the major findings of this time period. Also, because much of the work is available in refereed journals, we do not go into detail regarding specific studies. For those wishing to read specific reports, the appendix lists these sources and the outlets in which they are published.

Team Structure and Process

Structure

Organizational structure describes how large numbers of persons are differentiated into smaller groups as well as how the independent actions of these differentiated groups are coordinated. Choices regarding structure have a direct impact on the nature of the groups or subunits, which in turn, influences the nature of the individual roles within the subunits. The structure of the group or team serves as a bridge between organization-level strategy decisions and staffing decisions regarding the people who are expected to occupy organizational roles. For an organization to be successful, the organization's structure needs to be aligned both internally, in terms of who performs the work, and externally, in terms of the environment in which the work takes place. Thus, structure becomes the central link in a three-facet model of fit; it is the key linking element in terms of internal fit and external fit.

External fit: Matching structure and environment. One of the most critical dimensions of structure is departmentation (Wagner, in press). Departmentation deals with the division of labor and refers to the degree to which work units are grouped based upon

functional similarity or on geographic/product market differentiation. In functional departmentation schemes, people are grouped based upon the similarity of the work they perform, whereas divisional departmentation groups people based upon either the type of product produced or the geographic region served. At the team level, functional departmentation tends to create narrow and specialized roles, with high interdependence requirements, relative to divisional departmentation. By contrast, divisional departmentation creates broader and more independent roles (Burns & Stalker, 1961).

According to Structural Contingency Theory (SCT), there is no "one best way" to structure groups or organizations (Burns & Stalker, 1961). In relatively predictable and stable environments, structures that employ functional departmentation tend to perform better than divisionally structured organizations. Functional structures are effective in this type of environment because they promote *efficiency*. Efficiency is created because redundancy across subunits is minimized, and high levels of functional expertise can be developed (Pennings, 1992).

Although functional structures are efficient in relatively stable and predictive environments, SCT proposes that these same structures tend to perform poorly in unstable and unpredictable environments. Unstable and unpredictable environments create changing and complex contingencies that overwhelm the simple and specialized subunits. In unstable and unpredictable environments, divisional structures tend to perform better because they promote *flexibility*. Divisional structures are flexible because subunits have broader capacities (i.e., they are less specialized) and their product or regional focus helps them react more quickly to local, idiosyncratic threats and opportunities.

SCT was developed in the context of large scale organizations, however, and the predictions it makes may not generalize to the team level. That is, size may serve as a boundary condition for this theory. The small size of teams implies that other forms of coordination are possible, and these may substitute for formal structure. For example, mutual adjustment, an alternative coordination mechanism, occurs when people simply communicate directly with each other in order to coordinate their vertical and horizontal responsibilities. Since mutual adjustment is less likely to occur within large organizations relative to small ones, some have argued that the generalizability of SCT to team contexts needs to be established (Galunic & Eisenhardt, 1994). Thus, one of the central purposes of our research was to establish the validity of this theory at the team level.

In addition to the role of structure in external fit, we were also interested in structure as it relates to the internal fit of people to teams. Relatively stable individual differences are frequently classified into two broad sets, traits and abilities (Costa & McCrae, 1992; Nunnally, 1978). In matching people to structures, these dimensions can be used to suggest how and why certain types of people are variably suited to different types of structures (Hollenbeck, 2000). As noted earlier, different organizational structures create different personnel requirements because the choice of organizational structure influences the nature of individual jobs within the organization. For example, the complex and semi-autonomous nature of jobs in divisional structures places a premium on cognitive ability (Gutenberg, Arvey, Osburn & Jeanneret, 1983). Thus, in staffing a divisional structure, a good internal fit would seem to require high levels of cognitive ability on the part of team members.

Whereas the holistic and autonomous nature of the roles in divisional structures tends to increase the need for cognitive ability, it minimizes the need for coordination among team members. On the other hand, the fragmented and interdependent nature of the roles in functional structures places a premium on coordination and mutual support. High levels of task interdependence among the specialized units in functional structures may increase the importance of some interpersonal traits. Costa and McCrae (1992) note that a person who is high in agreeableness is "sympathetic to others and eager to help them, and believes that others will be equally helpful in return" (p. 15). In contrast, someone low in agreeableness is described as "egocentric, skeptical of others' intentions, and competitive rather than cooperative." People who are cynical regarding the intention of others and who are generally unwilling to help out others would seem to struggle with the interdependence requirements associated with functional structures (Barrick, Stewart, Neubert, & Mount, 1998).

Within this theoretical framework, because internal fit is expressed in terms of individual differences and structure, and external fit is expressed in terms of environment and structure, structure becomes the common element across the two types of fit. Since the two types of fit have a common element that is fixed, any single structure could fit in one direction (internally) and yet remain a misfit in the other direction (externally).

Because most research has focused almost exclusively on issues related to internal fit, it is important to speculate on the implications of what a poor external fit might have on a good internal fit. For example, if either type of fit is *sufficient but not necessary* for performance, then certain types of internal fit may be able to *substitute* for a lack of external fit. For example, external misalignment of the team's structure with its

environment can cause stress. Within the framework of the five factor model of personality, emotional stability distinguishes individuals who are well adjusted, from those that are prone to experience high levels of psychological distress (i.e., negative affective states such as anxiety, fear, hopelessness and vulnerability). As Costa and McCrae (1992) noted that, "perhaps because disruptive emotions interfere with adaptation, men and women high in neuroticism (i.e., low in emotional stability) cope more poorly than others with stress" (p. 14). If this is the case, then the stress associated with working in a structure that is misaligned within its environment might be more debilitating to some types of individuals than others.

In a study of 320 research participants arrayed into 80 teams (Hollenbeck et al., 2002), we were able to replicate the major findings from SCT regarding the joint effects of structure and task environment on performance. This is a substantive extension of this theory because the smaller size of these teams might have served as a legitimate boundary condition for this theory. Smaller size implies a corresponding opportunity to use mutual adjustment as an alternative coordination mechanism relative to formal structure, but this did not appear to be the case in this study.

This study also found that one of the major dimensions that SCT uses to describe a good external fit (departmentation) also has some implications for what constitutes a good internal fit between the team and team members. The task confronting team members in divisional structures was complex, in the sense that they had to learn how to use four different vehicles that differed substantially on four different dimensions. The data from this study showed that the complexity of the team member's task when structured

divisionally created a positive relationship between general cognitive ability and performance.

The dynamic interplay between internal and external fit was also evident, in the results associated with the misaligned, divisional structure. Although a good internal fit in divisional structures required team members who were high in cognitive ability, the benefits of this type of positive internal fit were eliminated by a poor external fit. Because a divisional structure is set up to promote flexibility, each team member was given one of each different vehicle. In a random environment, where one has no idea from where to expect incoming aircraft, this structure worked well. However, when all incoming aircraft came from similar points of origin, and then predictably and systematically moved in the same direction (NW to SE), divisionally structured teams were highly inefficient. Critical vehicles were too far away from the predictable action--and no amount of intelligence could make up for this structural misalignment.

When confronted with a poor fit between their divisional structure and their task environment, emotional stability turned out to be the most critical personal attribute. Thus, just as a poor external fit could attenuate the otherwise positive effects of cognitive ability, high levels of emotional stability could somewhat offset the negative effects of being in a situation that could be characterized as a poor external fit in SCT.

Although emotional stability partially offset the negative effects of being in a divisional structure in a predictable environment, all else equal, it was still much better for teams facing such an environment to be structured functionally. As expected, performance in functional structures in predictable environments was high, and it was not dependent upon the levels of cognitive ability of the team members. There was also no evidence that

emotional stability played a role in functional structures when the team's structure was out of alignment with the environment. Indeed, taken as a whole, the results from this study suggest that functional structures were simply not conducive to the manifestation of any type of individual difference effects. A functional structure may simply provide such a "strong situation" (Mischel & Shoda, 1998) that there is little latitude in behavior that might be traced to individual differences.

Although this may be an undesirable characteristic of such structures for selection specialists, from a broader organizational view, there may be some benefits from this finding. In particular, structure does provide a means of reducing the negative impact of individual differences for employers that may not be able to select the top people on characteristics like cognitive ability, agreeableness and emotional stability. In personnel selection environments with undesirable selection ratios from an organizational perspective, one might take comfort in finding structural ways of reducing the impact of individual differences on group outcomes. Although more research on the interactions between structure and personnel characteristics is clearly warranted, the results of this study are encouraging and set the stage for further study of the applied psychological impact of various organizational and team structures.

Changing Structure

Hollenbeck et al. (2002) showed clearly the efficiency-flexibility trade-off between the two structural choices, and illustrated why there is no one best way to structure teams. Instead of one best way, SCT argues that groups should be structured functionally in stable and predictable environments, but divisionally in unpredictable and unstable environments. Given this established contingency, many have advocated that in the face of environmental

change, groups need to be able to change their structure so that they are always in alignment. While this inference may logically follow from the existing data, it needs to be noted that this contingency has only been established via between subjects, cross-sectional studies. No one has ever directly documented that teams can actually switch from one structure to another without encountering unforeseen difficulties.

Structural starting points and adaptations. Within the SCT framework, a team that tries to change its structure could start from a number of different points, but for ease of exposition, we will focus on the endpoints of pure functional versus pure divisional schemes. On the one hand, a team may start in a functional structure, and then need to adapt to a divisional structure. For example, the team may have started out in a stable and predictable environment, but because of some change in the competitive landscape may find that it does not have the required flexibility to compete effectively. According to SCT, this team should then adapt and change from its functional structure to a divisional structure (i.e., F-D adaptation).

Alternatively, the team may have started out in a divisional structure, and then needed to adapt to a functional structure. SCT would suggest that this team should adapt and change from the divisional structure to a functional one (i.e., D-F adaptation). Although on paper, it is no more difficult to redraw the organization chart from F-D to D-F, in operational reality it may be much more difficult for actual teams to shift in one direction versus the other. Indeed, there are at least two specific reasons why it might be more difficult for teams to adapt in the D-F direction relative to the F-D direction.

First, in terms of *task scope*, teams that adapt in the F-D direction experience an increase in task scope. That is, their members start out performing relatively narrow roles,

and then switch to a system where they perform a more holistic job. Alternatively, members of teams engaged in D-F adaptation experience a reduction in task scope. The job characteristics theory (Hackman & Oldham, 1976), as well as the empirical literature surrounding this theory makes it clear high task scope is associated with increased intrinsic motivation, which in turn is related to performance (Fried & Ferris, 1987). Thus, one might expect that the increase in intrinsic motivation associated with the F-D adaptation may make this type of shift more viable relative to a D-F adaptation where one experiences a reduction in task scope.

Second, in terms of *group norms*, each of the two different structures place different demands on team members that could affect the group's habits with respect to group processes such as communication. For example, higher levels of interdependence created by structuring a group functionally will result in relatively high levels of communication among group members. In contrast, the broad roles experienced by team members in divisionally structured groups force incumbents to concentrate on their relatively complex, high scope job. This need for concentration, when combined with the relative independence of divisionally structured team members makes communication less critical.

According to Entrainment Theory (Ancona & Chong, 1996), once a set of norms and habitual activities become routine in a social system, these norms become self-reinforcing and entrained so they often persist over time--even after whatever original operational value that might have been attributed to the norms no longer persists. Indeed, there is direct empirical support for the notion that norms established early in a group's existence often continue unabated even after the value of the norms is no longer evident

(Bettenhausen & Murnighan, 1991). Thus, a group that starts out in a functional structure will develop norms for high levels of communication, and when this type of group shifts to a divisional structure, this high level of communication may persist. Although high levels of communication may not necessarily be required by the new structure, this may not necessarily harm the team's effectiveness. In fact, it may even be beneficial in the sense that members can share the expertise they developed as functional specialists with each other as they enact their new expanded roles. On the other hand, a group that starts out divisionally will not develop norms for high levels of communication, but instead, members will be focused on concentrating on their own tasks. When this group shifts to a functional structure, if their initial norms and habits persist, the carryover will be dysfunctional because the functional structure demands high levels of communication. This will result in performance deficiencies that probably would not be experienced by teams that had simply started out in the functional structure in the first place. Hence, this again suggests that it may be more difficult for teams to engage in D-F adaptation relative to F-D adaptation.

Thus, for at least three specific reasons, we felt that SCT is the type of contingency theory that might be fruitful for documenting "asymmetrical adaptability." The theory it implies that there is no single best way to act, and that the appropriate solution (structure) to the organization's problem (promoting performance) may change depending upon external circumstances (stability and predictability of the task environment). Thus, it implies systems need to be adaptive, but as currently stated, makes no allowance for the fact that certain adaptations may be much more difficult than others. That is, it does not recognize the possibility for asymmetrical adaptation and the notion that dynamic team

structures may be one-way streets, where groups can move in one direction, but not another. Based on the theoretical analysis and empirical literature reviewed above, our general hypothesis was that *teams that experience a D-F structural adaptation will perform worse upon realignment than teams that experience an F-D structural adaptation.*

In a study of 264 research participants (Moon et al., 2002) who were arrayed into 66 four-person teams we tested directly to see if teams could actually adapt in the manner implied by the theory and found evidence for "asymmetric adaptability." Whereas both Divisional to Functional (D-F) and Functional to Divisional (F-D) shifts can both be considered "adaptive" under the right circumstances, in fact, one of these adaptations was much easier to negotiate relative to the other. Specifically, structural adaptation seemed to be a one-way street in the sense that it was much more natural for team to shift from Functional to Divisional (F-D adaptability) structure, than to switch in the other direction. We speculated that the F-D adaptation was more natural to make because it reflected an increase in task scope and discretion for the team members over time, and because the norms developed in divisional structures regarding communication were counter-productive in the new functional structure.

Team Process

Backing-up behavior. Given some of the complexities involved in changing and adapting to new team structures, we also performed a study to see how teams may engage in "work around" procedural adaptation that serves as an alternative to structural adaptation. One of the key ways that teams can work around structural misfits is to engage in back-up behavior. Back-up behavior is critical to both the social and task performance of teams and has been generally defined as helping other team members perform their role

(Dickinson & McIntyre, 1997; McIntyre & Salas, 1995; Morgan, Glickman, Woodward, Blaiwes, & Salas, 1986). To effectively engage in backing-up behaviors, team members must have an understanding of other team members' jobs and they, themselves, must be both willing and able to provide and seek assistance when needed. Examples of backing-up behaviors can include filling in for a team member who is unable to fulfill his or her role or helping a fellow team member correct mistakes made in attempting to perform his or her role. It should also be noted that back-up behaviors can come in many different forms, and may reflect either verbal or physical assistance.

In Porter et al. (in press), we extended the definition of backing-up behaviors provided by McIntyre and his colleagues by suggesting that the central, defining characteristic of backing-up behavior is that it reflects both the recognition that support is needed and the correction of a workload distribution problem that is caused by a structural misfit with the environment. Specifically, backing-up behavior occurs in a team context where the capacity of one team member is being surpassed while the capacity of other team members is being underutilized. When underutilized individuals back up the individual whose capacity is being surpassed, this allows the team to dynamically adjust and perform at a level that could not have been attained had they been working strictly as individuals. The current trend in organizations toward developing team-based structures is predicated on the very hope of just this type of dynamic readjustment, and thus there is clearly a need for research that examines when this does and does not occur in work teams.

Although there is a developing literature on helping behavior in general, there are three aspects of this literature that limit the types of inferences one can draw from it if one is specifically interested in helping in work teams. First, most research on helping has

focused on the frequency of help requests without a corresponding examination of capacity and workload. Unfortunately, such research does not allow one to discriminate between legitimate (i.e., those made when certain team members are experiencing especially high workloads) and illegitimate (i.e., those made when team members are experiencing low to normal workloads) needs for help. That is, the more narrow definition of backing up behavior implies the recognition of a workload-capacity distribution problem in teams that has not been a part of the general helping literature. Indeed, in some instances, a help request may not reflect an objective task need as much as an unwarranted dependency need or social loafing (Williams, Hawkins, & Latane, 1981) on the part of the help seeker in a social context. Therefore, approaches that simply seek to determine the predictors of help requests in general are not nearly as informative as those that seek to determine predictors of legitimate and illegitimate requests for help. Asking for or providing unwarranted back-up behaviors in teams is likely to have counterproductive effects. Moreover, since the types of variables that predict help requests in situations in which there is a legitimate need may differ from the types of variables the predict less legitimate help requests, the approach proposed here is of critical importance for promoting team effectiveness.

Second, by focusing on the frequency of the help requests, the extant literature fails to speak to whether or not help was actually manifested. In other words, in some instances a help request in a team may actually lead to helping but in other instances it may not. In terms of team effectiveness, the critical dependent variable should be whether or not help was actually provided, not just whether it was requested. Backing-up behavior implies the manifestation of help that is not necessarily captured solely by requests for help.

Finally, existing approaches to helping behaviors have focused almost exclusively at the dyadic level rather than the team level. In a team, there is more than one person who can offer assistance, thus dyadic approaches are likely to overlook help that is offered by some other team member not part of focal dyad. That is, one person who might be predicted to help based upon dyadic theories may not do so because there is another individual who is in a better position to provide the needed help. For example, a number of authors have examined helping among supervisor-subordinate dyads from a leader-member exchange (LMX) perspective (e.g., Podsakoff, MacKenzie, Moorman, & Fetter, 1990; Podsakoff, Niehoff, MacKenzie, & Williams, 1993). While such approaches represent a valuable application of the LMX framework to understanding helping behaviors, they fail to recognize that a great deal of help is horizontal, not vertical, and based upon the workload distribution of the entire team--not just a single dyad. In sum, what is currently known about helping in work dyads may have limited utility in terms of both applicability and generalizability understanding back-up behaviors in teams.

Thus, the Porter et al. (in press) study was the first to differentiate help in terms of its legitimacy (in terms of workload capacity distributions), the first to examine this phenomenon at the team level, and the first to provide an objective measure of whether or not help actually ensued. By specifically focusing the theory building effort on backing-up behaviors in teams, rather than helping more generally, we hope to establish some of the key factors that explain team effectiveness in complex and dynamic task environments.

This study employed 248 research participants arrayed into 62 teams and found that when we characterize teams in terms of their back up recipients, the results for conscientiousness indicate from a new and different angle, why high levels of this trait are

so valuable in work contexts. Specifically, recipients who were high in conscientiousness were the most discriminating of all individuals when it came to recognizing whether their need for back up was legitimate or not. Back-up recipients who were high on this trait secured both the most back up (when it was needed) and the least back up (when it was not needed), and were the best at balancing the need for interdependence in teams with the need for self-reliance.

Many have suggested that duty and achievement striving are the two cornerstones of this trait, and it would seem that these two characteristics mesh well together in team contexts. Achievement striving promotes self-reliance and individual level competence, and forces the team member high on conscientiousness and who could potentially receive assistance from others, to personally manage their problems without becoming a burden to the rest of the team. However, this is balanced off nicely by a sense of duty, which implies putting the team's interests above one's own interests. A sense of duty compels the potential back-up recipient in these teams, when high on conscientiousness, to secure help when it is critical to mission effectiveness, even if it places him or her in an otherwise uncomfortable state of dependence.

Although a similar type of interaction was seen with recipient extraversion, it is worth noting that unlike recipient conscientiousness, we also saw a statistically significant main effect for extraversion. This implies that on average, across conditions, back-up recipients who were high on extraversion secured more help than those who were low on this trait. Nevertheless, we found that similar to the potential back-up recipients in teams who were high on conscientiousness, those who were high on extraversion showed some of the same self-reliance when legitimacy was low. This finding is likely the result of these

individuals' tendency to seek excitement and stimulation, as would be the case when they had lots of task demands yet at the same time the capabilities to deal with such demands. Thus, in teams that had back-up recipients who were high on extraversion there was evidence of good discrimination at the high end of the legitimacy continuum (the recipient tended to demand back up when they needed it), and at the low end (the recipient tended to forego back up when it was not needed).

On the other hand, however, teams with recipients who were low on extraversion, failed to show good discrimination at the high end of the legitimacy continuum. In these teams, recipients received similar levels of back up compared to that received by recipients who were high on extraversion when legitimacy was low, but they did not show the same tendency to receive back up when it was needed. That is, when legitimacy was high, recipients who were low on extraversion secured similar levels of back-up behavior as they did when legitimacy was low. This was likely due to the independent, less assertive, and less talkative nature of these individuals. Simply stated, when there was a legitimate need for back up from others, they received no more back up than they did when there was a less legitimate need for back up, probably as a result of not asking for and demanding it.

Turning to when we characterize teams in terms of their back-up providers, we found no support for our hypothesis that provider conscientiousness interacts with the legitimacy of the need for back up in predicting back-up behaviors in teams. We did however, find some evidence for a main effect for provider personality suggesting that teams that have higher levels of conscientiousness among their back-up providers will exhibit higher levels of back-up regardless of whether or not the task situation demands it.

We also found both a main and interaction effect for emotional stability. The main effect revealed that on average, across conditions, teams with back-up providers that were low on emotional stability provided much less back up relative to teams with back-up providers that were high on this characteristic. Although this tendency was most pronounced under conditions of high legitimacy, one can see a difference between high and low emotional stability providers even at low levels of legitimacy. The effects for emotional stability were the strongest in terms of effects size, in that the main and interactive effects for this variable explained 16% of the variance in back-up behaviors. Clearly, if one is hoping to see the type of dynamic readjustment of workload that one hopes to see in teams, then the level of emotional stability among team members becomes a critical composition issue. Back-up providers who are low on emotional stability, perhaps because they are fixated on their own problems, tend to be unwilling or unable to concentrate on the problems of others. In this study, we found strong evidence that the self-focused nature of those providers who are low on emotional stability may manifest itself as a tendency to fail to provide assistance to others even when working interdependently with them on team tasks.

Although the effects for emotional stability among back-up providers were strong, surprisingly, we saw no effects whatsoever for provider agreeableness. Given the definition of agreeableness, this was, in our a priori opinion, the strongest candidate in this context. In fact, to a large extent, we expected to see the type of indiscriminate backing up among teams with highly agreeable potential back-up providers that might lead to main effects such us those seen among providers who were low in emotional stability. While one potential explanation for this could be that the indiscriminate nature of backing up among

agreeable team members was so high, that it was not even focused on the right person (i.e., the a priori specified potential back-up recipient), our posthoc analyses failed to support this explanation.

Another potential explanation for our inability to find any effects for back up provider agreeableness may be the level at which we examined this particular personality construct. Agreeableness, as with the other personality factors examined in our study is composed of six distinct facets, or subfactors. However, unlike the other personality constructs we examined, only one of the subfactors of agreeableness would seem to be theoretically related to backing-up behaviors, namely altruism. Altruism represents an active concern for others and a willingness to assist others in need of help (Costa & McCrae, 1992). Therefore, a more specific altruism measure may have exhibited more predictability than our more broad agreeableness measure that also purports to measure trust, straightforwardness, compliance, modesty and tender-mindedness, none of which we would expect to be theoretically related to backing-up behaviors in teams.

The lack of effects may also be attributed to the nature of this simulated military task. Research participants in this simulation may perceive disabling an enemy track as an aggressive act. Since aggressiveness is the opposite of agreeableness, an agreeable person might manifest this trait by showing a great deal of restraint when it comes to disabling enemy tracks. If the person directs his or her agreeableness at enemy tracks rather than at teammates, this would create the appearance of the person as being unhelpful from the team member's perspective. This may have implications for any type of task, however, where there is competition between teams. In "win-lose" types of situations, if an agreeable person cannot behave aggressively toward a competitor, then their value to the

team may be less than in a situation where there is no direct win-lose competitor whose interests have to be directly harmed for the team to be successful.

Team learning. Although most of our research has focused on how team structure and structural changes relate to performance in general, in Ellis et al. (in press), we also examined the role that team structure plays in the more specific criterion of team learning. We define team learning as *a relatively permanent change in the team's collective level of knowledge and skill produced by the shared experience of the team members.* This definition expands upon traditional conceptualizations of the learning process at the individual level (e.g., Weiss, 1990) by recognizing that, in team contexts, people can learn not just from their own direct experience, but also from the experience of other team members. Clearly project teams can process information not only within, but also between the minds of the team members (Ickes & Gonzalez, 1994). The purpose of Ellis et al. (in press) was to utilize information processing theory at the individual and team level to better understand how teams learn and how this is affected by structure. Based on the literature regarding attentional capacity, constructive controversy, and truth-supported wins, all of which have links to information processing theory, we examined the effects of certain personal and situational variables on project team learning. Specifically, the literature on attentional capacity suggests that the level of cognitive ability and the workload distribution within the team can affect project team learning. Constructive controversy, on the other hand, suggests that the level of agreeableness and openness to experience within the team can impact knowledge and skill acquisition. Finally, research on truth-supported wins indicates that specific team structures may influence the learning process within project teams.

The idea that there are limits on attentional resources and immediate memory capacity is one of the basic tenets of information-processing theory (e.g., Dempster, 1981; Mandler, 1975; Shiffrin, 1976). Researchers have long suggested that individuals possess a

certain attentional span, which determines the maximum number of mental elements that they can attend to at one time (e.g., Baldwin, 1984). Working memory, which is used to process incoming information and store the resulting products, is led by the central executive, a flexible workspace with severe restrictions on its capacity to handle large amounts of information (e.g., Baddeley, 1986; Baddeley & Hitch, 1974). The processing and storage of information must compete for the limited capacity in working memory (e.g., Daneman & Carpenter, 1980; 1983).

Although much of the research on information processing capacity resides in the cognitive and developmental psychology literatures, similar ideas have been introduced by organizational psychologists. Kanfer and Ackerman (1989) note that attentional resources are an "undifferentiated pool representing the limited capacity of the human information-processing system" (p. 663). In their resource allocation model, Kanfer and Ackerman propose that competing task demands, such as goal attainment and task performance, will dip into the pool of attentional resources. The initial stages of skill acquisition, where individuals are confronted with a novel task and must deal with unfamiliar information, require large amounts of attentional resources. During these stages, general cognitive ability accounts for much of the variance in individual performance (Ackerman, 1986).

General cognitive ability deals with "acquiring, storing in memory, retrieving, combining, comparing, and using in new contexts information and conceptual skills" (Humphreys, 1979, p. 115). Individuals with high levels of cognitive ability have a greater attentional-cognitive capacity (Ackerman, 1986). For these individuals, the demands of the learning process will have less of an effect, as their pool of attentional resources may be deeper than individuals with low levels of cognitive ability. As a result, during the initial stages of the learning process when attentional demands are high, an individual's cognitive ability level has been shown to correlate with performance (Kanfer & Ackerman, 1989). This relationship between cognitive ability and performance, based on task's attentional requirements, has been supported by a number of researchers (e.g., Ackerman, 1986;

Sternberg, 1977), indicating that cognitive ability predicts an individual's learning ability (Jensen, 1986).

From a resource perspective, cognitive ability represents an undifferentiated resource that team members bring to team settings requiring information processing. Yet, to our knowledge, no one has examined the relationship between cognitive ability and knowledge and skill acquisition at the team level. This may be due, in part, because the focus is normally on team performance rather than team learning (e.g., LePine, Hollenbeck, Ilgen, & Hedlund, 1997). In the research conducted here, we predict that teams composed of individuals high in cognitive ability will possess a larger pool of attentional resources. This will be especially useful to project teams, who must progress through the initial phases of the learning process.

Attentional resources residing within team members are clearly important in the learning process, but externally-mediated situational characteristics can also impact the information processing capabilities of the team members. At the declarative stage, most of an individual's attention will be devoted to learning the task at hand. When additional tasks are introduced, individuals cannot devote attention to all the tasks at once due to the limited capacities of their information processing systems. The first task will likely receive the majority of the individual's attention, while additional tasks will end up receiving only cursory attention (Kanfer & Ackerman, 1989). If the individual attempts to evenly distribute resources among all tasks, performance on each will likely suffer. Research has shown that the addition of a concurrent task impairs performance on the primary task, particularly when the tasks are novel (e.g., Kahneman, 1975).

This study proposes that a similar situation will arise at the team level when team members are overloaded with information. More specifically, overloading project teams should lead to slower learning. However, unlike individuals, the cognitive limits of teams exist within subunits. Even if overall workload remains constant, overloading one or more individual team members could interfere with learning. We suggest that simply

overloading the capacity of <u>one</u> team member by unevenly distributing the workload within the team will be detrimental to the learning process.

Because teams must process information both individually and collectively during the learning process, any information or insight gathered by individual team members must be shared within the team. However, effective information sharing may not always proceed without conflict. To the extent that different team members bring different types of information and expertise to the problem, some degree of conflict will be both inevitable and desirable. In fact, bringing in multiple perspectives can lead information to be processed in diverse ways within teams (e.g., Hinsz, Tindale, & Vollrath, 1997; Hinsz, Vollrath, Nagao, & Davis, 1988). This could have implications for the collective acquisition of knowledge and skill within teams.

The literature on "groupthink" supports this assertion by documenting that facile and uncritical agreement within the team can have a negative impact on problem solving (Janis, 1982). Although many tenets of the groupthink phenomenon have been questioned, the notion that premature consensus has a negative effect on group problem solving and decision making accuracy has been well-supported (Aldag & Fuller, 1993). When teams attempt to learn or solve problems, a full and critical discussion of the available data and ideas is required (Tjosvold & Deemer, 1980). Often team members have divergent solutions to problems that the team faces. Discussing these opposing perspectives is crucial in the area of group problem solving (Hall & Williams, 1970; Janis, 1982; Maier, 1970; Maier & Hoffman, 1964), and Tjosvold and his colleagues (Tjosvold, Wedley, & Field, 1986) have labeled this phenomena "constructive controversy."

The current study suggests that the level and quality of constructive controversy within project teams may be influenced by two specific personal variables: agreeableness and openness to experience. Agreeableness is one of the big-five factors of personality and reflects the degree to which a person is friendly, trusting, tolerant, compliant and modest (e.g., Goldberg, 1993). At the individual level, there has been quite a bit of research

investigating the effects of agreeableness on a variety of outcomes. Unfortunately, results have been less than encouraging (e.g., Barrick & Mount, 1991). In many ways, the characteristics that describe agreeable people make them ideally suited if the goal is to develop team cohesiveness. Indeed, although there is not a great deal of literature linking agreeableness to team level outcomes, one study has documented a positive relationship between agreeableness and social cohesion (Barrick et al., 1998). However, the goal of this study is not to examine what makes teams more cohesive, but rather to examine what makes teams better learners. Under such conditions, behaviors manifested by individuals high in agreeableness (e.g., compliance, self-effacing, modesty, conforming, nonconfrontational) may be dysfunctional. Agreeable team members, who by definition are compliant and deferent, may more readily accept the opinion of their team members uncritically in order to avoid argument. Without the benefits of critical discussion, teams may not be able to effectively share and critique information and ideas (e.g., Hall & Williams, 1970; Maier & Hoffman, 1964).

While agreeableness may not positively affect the introduction and critical discussion of new ideas within project teams, openness to experience could potentially be more beneficial. Individuals high in openness to experience are much more willing to consider novel ideas, try new things, readily question authority, and display unconventional tendencies (e.g., Costa & McCrae, 1992). Like agreeableness, there is little evidence that openness to experience predicts performance at work (e.g., Barrick & Mount, 1991). However, researchers have suggested that openness to experience is positively related to particular aspects of intelligence, such as divergent thinking (McCrae, 1987). When faced with a novel task, such qualities help open individuals learn (Blickle, 1996; Busato, Prins, Elshout, & Hamaker, 1999). Perhaps that is why openness to experience is positively related to training proficiency (Barrick & Mount, 1991).

We suggest that, because open individuals have a strong intellectual curiosity and seek out unconventional ideas (e.g., LePine, Colquitt, & Erez, 2000), they will be more

willing to participate in a full and critical discussion of the available data and ideas. Open individuals will search for different perspectives that may oppose one another. If there is controversy regarding the final solution to the problem, open individuals will accept it as constructive controversy, not as something to be avoided in the future.

Although staffing project teams with agreeable and open individuals will likely influence team learning, information will be collectively processed more efficiently if there is a balance between the commonality and uniqueness of information within the team (Hinsz et al., 1997). Commonality refers to the number of team members that have access to a piece of information. If access is limited to one team member, the team will be less likely to attend to the information (Stasser, & Titus, 1985), the information will remain unshared (Stasser, Taylor, & Hanna, 1989), and the team will have difficulty recalling the information in the future (Hinsz, 1990). Even if the information is shared, team members will have different frames of reference or mental representations of the knowledge domain, only allowing them to encode, store, and retrieve a certain set of information regarding the task. In order to properly interpret all of the information that they are receiving, the team needs to have a common or shared frame of reference (Levine, Resnick, & Higgins, 1993; Tindale, Sheffey, & Scott, 1993). This can be accomplished by internally aligning the environment through the structure of the team.

Defining roles more narrowly within the team, as in functional structures, provided the team with unique sets of information. So instead of having access to all 16 pieces of information, each team member had access to four unique pieces of information. Teams utilizing functional structures were expected to be more likely to come up with a variety of solutions to a given problem, which may be especially beneficial when the correct solution is unclear.

Clearly neither functional nor divisional structures offered the optimal balance between commonly and uniquely distributed information within the team. Therefore, some type of compromise structure needed to be created, and the literature on collective

induction is highly relevant in terms of stipulating the exact nature of that structure. Specifically, "truth supported wins" models suggest that it is enough for two team members to share access to the same set or information in order for the group to attend to and acquire the information collectively (Hinsz et al., 1997). Researchers have shown that two people need to arrive at the correct solution in order for the group as a whole to correctly solve the problem (e.g., Laughlin, 1980; Laughlin & Ellis, 1986). Given these findings, structures that create "role partners" (two individuals who share expertise and information processing responsibilities) may allow for the best mix of common and unique information within the team. We refer to these structures as pair-based structures because they use matched dyads to control the amount of access each team member has to various pieces of information.

We tested many of these ideas regarding team learning in a study of 436 research participants who were arrayed into 109 four-person teams. Our study indicated that cognitive ability positively affects team learning. This is consistent with the work of Ackerman (1986) and Kanfer and Ackerman (1989) who have utilized information processing theory to empirically examine knowledge and skill acquisition at the individual level. They suggest that an individual's level of cognitive ability affects their attentional capacity, which can be beneficial during initial stages of the learning process. Although Kanfer and Ackerman's research was conducted at the individual level, their results appear to remain true at the team level. When team members exhibit deep attentional capacities, the collective attentional capacity of the team becomes more expansive. The project teams examined in this study were faced with the initial stages of the learning process, and teams high in cognitive ability managed to build a much stronger foundation of knowledge and skill during the task.

Team composition also includes the personalities of the team members. Most studies find that conscientiousness is the strongest predictor of team effectiveness (e.g., Barrick et al., 1998). However, other factors may be of import when the task requires a

high degree of interaction (Bell & Kozlowski, 2002). Project team learning depends on the collective encoding, storing, and retrieving of information, which can only occur through interaction between team members. In these situations, agreeableness and openness to experience may be the most important personality factors. Although we failed to find significant results for openness to experience, teams composed of members who were high in agreeableness exhibited lower levels of knowledge and skill acquisition. This rather interesting effect of team agreeableness on team learning supports the idea that constructive controversy may help groups solve problems by bringing in multiple perspectives through a full and critical discussion of different data and ideas (Tjosvold & Deemer, 1980). Agreeable team members may be more cohesive (Barrick et al., 1998), but when new information is shared, there must be some level of conflict if the team is to avoid premature consensus. Teams composed of members who are high in agreeableness tend to exhibit compliant and deferent behaviors (e.g., Goldberg, 1993), which may prevent them from critically evaluating different opinions or conflicting pieces of information. Our results suggest that this can be detrimental to the learning process within project teams.

McGrath (1964) suggests that, although team composition is important, other input variables such as the workload distribution within the team and the team's structure has the potential to influence aspects of team effectiveness. Regarding workload distribution, we found that teams encountering an uneven workload distribution learned less than teams encountering an even workload distribution. Kanfer and Ackerman (1989) proposed that individuals possess a limited amount of information processing resources. When additional tasks are presented, their information processing capabilities may be overloaded and, if so, performance suffers. Our results indicate that overloading individual team members can also disrupt the collective information processing system of encoding, storage, and retrieval that is needed in order for the team to acquire necessary knowledges and skills.

Regarding team structure, we found that certain structures were beneficial for the acquisition of knowledge and skill, while others are more detrimental. Several decades ago, Bion (1961) noted that there are unconscious forces that impinge on team processes. Team members have an inherent need to feel "paired" with other individuals within the team. In other words, team members want to feel unified with, not isolated from, others. This unconscious force may have impacted the relationship between structure and team learning in this study. In particular, we found that project teams working within a paired structure learned more than those that were structured divisionally or functionally. This offers support for a "truth supported wins" model for teams confronted with induction tasks (Laughlin & Ellis, 1986). That is, at least two team members need to have access to the same information in order for the team to learn. Researchers have suggested that pairing team members together can positively affect the team's collective information processing capabilities (Hinsz et al., 1997). This is likely due to the fact that team members more readily share information, and are better able to interpret shared information, when it is commonly held within the team (e.g., Stasser & Titus, 1985). At the same time, there is enough unique information to allow team members to develop multiple solutions to the problem when learning through trial and error.

Conclusion

The work in the last three years has centered on structural issues in teams. It began by looking at structural conditions and asking how those conditions impacted team performance from a structural contingency perspective. The contingency perspective looked to the typical contingency between structure and situational demands defined capacity in terms of team resources and time. To those initial conditions, later work began to add the fit not only to the task demands but to the personal characteristics of team members. Later work looked at structure as it related to critical processes of team behavior, those of teamwork and learning. It also moved from static conditions to dynamic ones where teams needed to adjust their structure to changing demands. This work led to the

discovery of asymmetries in adaptability. Current work continues to address interactional effects between structure, time, nature of change demands and characteristics of team members as we seek to better understand those factors affecting the effectiveness command and control team performance on dynamic decision making tasks.

References

Ackerman, P. L. (1986). Individual differences in information processing: An investigation of intellectual abilities and task performance during practice. Intelligence, 10, 109-139.

Aldag, R. J., & Fuller, S. R. (1993). Beyond fiasco: A reappraisal of the groupthink phenomenon and a new model of group decision processes. Psychological Bulletin, 113, 533-552.

Ancona, D., & Chong, C. L. (1996). Entrainment: Place, cycle, and rhythm in organizational behavior. In B. M. Staw & L. L. Cummings (Eds.), Research in organizational behavior (pp. 251-284). Greenwich, CT: JAI Press.

Anderson, S. E., & Williams L. J. (1996). Interpersonal, job, and individual factors related to helping processes at work. Journal of Applied Psychology, 81, 282-296.

Baddeley, A. D. (1986). (Ed.). Working memory. Oxford: Oxford University Press.

Baddeley, A. D., & Hitch, G. (1974). Working memory. In G. Bower (Ed.), Advances in learning and motivation (Vol. 8). New York: Academic Press.

Baldwin, J. M. (1984). Mental development in the child and the race. New York: MacMillan.

Barrick, M. R., & Mount, M. K. (1991). The Big Five personality dimensions and job performance: A meta-analysis. Personnel Psychology, 44, 1-26.

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

Bell, B. S., & Kozlowski, S. W. J. (2002). Adaptive guidance: Enhancing serl-regulation, knowledge, and performance in technology-based training. Personnel Psychology, 55, 267-306.

Bettenhausen, K. L., & Murnighan, J. K. (1991). The impact of purpose, participant preconceptions, and rating level on the acceptance of peer evaluations. Group and Organizational Studies, 14, 182-197.

Bion, W. R. (1961). Experiences in groups. New York: Basic Books.

Blickle, G. (1996). Personality traits, learning strategies, and performance. European Journal of Personality, 10, 337-352.

Burns, T., & Stalker, G. M. (1961). The management of innovation. London: Tavistock.

Busato, V. V., Prins, F. J., Elshout, J. J., & Hamaker, C. (1999). The relationship between learning styles, the Big-Five personality traits, and achievement motivation in higher education. Personality and Individual Differences, 26, 129-140.

Costa, P. T., & McCrae, R. R. (1992). Revised NEO personality inventory. Odessa, FL: Psychological Assessment Resources.

Daneman, M., & Carpenter, P. A. (1980). Individual differences in working memory and reacting. Journal of Verbal Learning and Verbal Behavior, 19, 450-466.

Daneman, M., & Carpenter, P. A. (1983). Individual differences in integrating information between and within sentences. Journal of Experimental Psychology: Learning Memory and Cognition, 9, 561-583.

Dempster, F. N. (1981). Memory span: Sources of individual and developmental differences. Psychological Bulletin, 89, 63-100.

Dickinson, T. L., & McIntyre, R. M. (1997) A conceptual framework for teamwork measurement. In M. T. Brannick, E. Salas, & C. Prince (Eds.), Team performance assessment and measurement (pp. 19-43). Mahwah, NJ: Erlbaum.

Ellis, A. P. J., Hollenbeck, J. R., Ilgen, D. R., Porter, C. O. L. H., West, B. J., & Moon, H. (in press). Team learning: Collectively connecting the dots. Journal of Applied Psychology.

Fried, Y., & Ferris, G. R. (1987). The dimensionality of job characteristics: Some neglected issues. Journal of Applied Psychology, 40, 287-322.

Galunic, D.C., & Eisenhardt, K. M. (1994). Renewing the strategy-structure-performance paradigm. In B. M. Staw & L. L. Cummings (Eds.), Research in organizational behavior (pp. 215-255). Greenwich, CT: JAI Press.

Goldberg, L. R. (1993). The structure of phenotype personality traits. American Psychologist, 48, 26-34.

Gutenberg, R. L., Arvey, R. D., Osburn, H. G., & Jeanneret, R. (1983). Moderating effects of decision-making information-processing job dimensions on test validities. Journal of Applied Psychology, 68, 602-608.

Hackman, J. R., & Oldham, G. (1976). Motivation through job design: A test of a theory. Organizational Behavior and Human Performance, 16, 250-279.

Hall, J., & Williams, M. (1970). Group dynamics training and improved decision-making. Journal of Applied Behavioral Science, 6, 39-68.

Hinsz, V. B. (1990). Cognitive and consensus processes in group recognition memory performance. Journal of Personality and Social Psychology, 59, 705-718.

Hinsz, V. B., Tindale, R. S., & Vollrath, D. A. (1997). The emerging conceptualization of groups as information processors. Psychological Bulletin, 121(1), 43-64.

Hinsz, V. B., Vollrath, D. A., Nagao, D. H., & Davis, J. H. (1988). Comparing the structure of individual and small group perceptions. International Journal of Small Group Research, 4, 159-168.

Hollenbeck, J. R. (2000). A structural approach to external and internal person-team fit. Applied Psychology: An International Review, 49, 534-549.

Hollenbeck, J. R., Moon, H., Ellis, A. P. J., West, B. J., Ilgen, D. R., Sheppard, L., Porter, C. O. L. H., & Wagner, J. A., III. (2002). Structural contingency theory and individual differences: examination of external and internal person-fit. Journal of Applied Psychology, 87, 599-606.

Humphreys, L. G. (1979). The construct of general intelligence. Intelligence, 3, 105-120.

Ickes, W., & Gonzalez, R. (1994). "Social" cognition and social cognition: From the subjective to the intersubjective. Small Group Research, 25, 294-315.

Janis, I. L. (1982). Victims of Groupthink (2nd ed.). Boston: Houghton-Mifflin

Jensen, A. R. (1986). g: Artifact or reality? Journal of Vocational Behavior, 29, 301-331.

Kahneman, D. (1975). Effort recognition and recall in auditory attention. Attention and Performance, 6, 65-80.

Kanfer, R., & Ackerman, P. L (1989). Motivation and cognitive abilities: An integrative / aptitude-treatment interaction approach to skill acquisition. Journal of Applied Psychology, 74, 657-690.

Laughlin, P. R. (1980). Social combination processes in cooperative problem-solving groups on verbal intellective tasks. In M. Fishbein (Ed.), Progress in social psychology (pp. 127-155). Hillsdale, NJ: Erlbaum.

Laughlin, P. R., & Ellis, A. L. (1986).Demonstrability and social combination processes on mathematical intellective tasks. Journal of Experimental Social Psychology, 22, 177-189.

LePine, J. A., Colquitt, J. A., & Erez, A. (2000). Adaptability to changing task contexts: Effects of general cognitive ability, conscientiousness, and openness to experience. Personnel Psychology, 53, 563-593.

LePine, J. A., Hollenbeck, J. R., Ilgen, D. R., & Hedlund, J. (1997). The effects of individual differences on the performance of hierarchical decision making teams: Much more than G. Journal of Applied Psychology, 82, 803-811.

Levine, J. M., Resnick, L. B., & Higgins, E. T. (1993). Social foundations of cognition. Annual Review of Psychology, 44, 585-612.

Maier, N. R. (1970). Problem solving and creativity in individuals and groups. Monterey, CA: Brooks-Cole.

Maier, N. R., & Hoffman, L. (1964). Financial incentives and group decision in motivation change. Journal of Social Psychology, 64, 369-378.

Mandler, G. (1975). Memory storage and retrieval: Some limits on the reach of attention and consciousness. In P. M. A. Rabbitt & S. Dornic (Eds.), Attention and performance. London: Academic Press.

McCrae, R. R. (1987). Creativity, divergent thinking, and openness to experience. Journal of Personality and Social Psychology, 52, 1258-1265.

McGrath, J. E. (1964). Social psychology: A brief introduction. New York: Holt, Rinehart, & Winston.

McIntyre, R. M., & Salas, E. (1995). Measuring and managing for team performance: Lessons from complex environments. In R. A. Guzzo & E. Salas (Eds.), Team effectiveness and decision-making in organizations (pp. 9-45). San Francisco: Jossey-Bass.

Miller, D. L., Young, P., Kleinman, D., & Serfaty, D. (1998). Distributed dynamic decision-making simulation phase I: Release notes and user's manual. Woburn, MA: Aptima, Inc.

Mischel, W., & Shoda, Y. (1998). Reconciling processing dynamics and personality dispositions. Annual review of psychology, 49, 229-258.

Moon, H., Hollenbeck, J. R., West, B., Humphrey, S. E., Ilgen, D. R., Ellis, A., & Porter, C.O.L.H. (2002). Asymmetrical adaptability: Lack of parallelism in dynamic team structures. Unpublished manuscript.

Morgan, B. B., Jr., Glickman, A. S., Woodward, E. A., Blaiwes, A., & Salas, E. (1986). Measurement of team behaviors in a Navy environment (NTSC Rep. No. 86-014). Orlando, FL: Naval Training System Center.

Nunnally, J. (1978). Psychometric theory. New York: McGraw Hill.

Pennings, J. M. (1992). Structural contingency theory: A reappraisal. In B. M. Staw & L. L. Cummings (Eds.), Research in organizational behavior (pp. 267-309). Greenwich, CT: JAI Press.

Podsakoff, P. M., MacKenzie, S. B., Moorman, R. H., & Fetter, R. (1990).

Transformational leader behaviors and their effects on followers' trust in leader,

satisfaction, and organizational citizenship behaviors. Leadership Quarterly, 1, 107-

142.

Podsakoff, P. M., Niehoff, B. P., McKenszie, 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 and Human

Decision Processes, 54, 1-44.

Portor, C. O. L. H., Hollenbeck, J. R., Ilgen, D. R, Ellis, A. P. J., West, B. J., & Moon, H.

(in press). Backing-up behaviors in teams: The role of personality and legitimacy of

need. Journal of Applied Psychology.

Shiffrin, R. M. (1976). Capacity limitations in information processing, attention, and

memory. In W. K. Estes (Ed.), Handbook of learning and cognitive processes (Vol. 4).

Hillsdale, NJ: Erlbaum.

Stasser, G., Taylor, L. A., & Hanna, C. (1989). Information sampling in structured and

unstructured discussion of three and six person groups. Journal of Personality and

Social Psychology, 57, 67-78.

Stasser, G., & Titus, W. (1985). Pooling of unshared information in group decision

making: Biased information sampling during discussion. Journal of Personality and

Social Psychology, 48, 1467-1478.

Sternberg, R. J. (1977). Intelligence, information processing and analogical reasoning: The

computational analysis of human abilities. Hillsdale, NJ: Erlbaum.

Tindale, R. S., Sheffey, S., & Scott, L.A. (1993). Framing and group decision making: Do cognitive changes parallel preference changes? Organizational Behavior and Human Decision Processes, 55, 470-485.

Tjosvold, D., & Deemer, D. K. (1980). Effects of controversy within a cooperative or competitive context on organizational decision-making. Journal of Applied Psychology, 65, 590-595.

Tjosvold, D., Wedley, W. C., & Field, R. H. G. (1986). Constructive controversy, the Vroom-Yetton model, and managerial decision-making. Journal of Occupational Behavior, 7, 125-138.

Wagner, J. A. (in press). Organizations. In A. E. Kazdin (Ed.), Encyclopedia of Psychology.

Weiss, H. M. (1990). Learning theory and industrial and organizational psychology. In M. D. Dunnette & L. M. Hough (Eds.), Handbook of industrial and organizational psychology (2nd ed., Vol. 2, pp. 171-221). Palo Alto, CA: Consulting Psychologists Press.

Williams, K. D., Hawkins, S., & Latane, B. (1981). Identifiability as a deterrent to social loafing: Two cheering experiments. Journal of Personality and Social Psychology, 40, 303-311.

APPENDIX

Scholarly Outputs on ONR Sponsored Team Research

Team Effectiveness Research Laboratory (TERL:MSU)

Michigan State University

John R. Hollenbeck & Daniel R. Ilgen

Background: In the spring of 1990 John R. Hollenbeck and Daniel R. Ilgen along with their students, began a program of research on team performance. It was initiated by funding from the Office of Naval Research and has been funded by that office since that time. Below are publications and presentations from that research effort. The items in bold are the ones added as a result of the funding for award number N00014-00-1-0398 for the period 01-April-2000 through 31-October-2002.

Journal Articles:

Hollenbeck, J. R., Ilgen, D. R., Phillips, J., & Hedlund, J. (1994). Decision risk in dynamic two-stage contexts: Beyond the status quo. Journal of Applied Psychology, 79, 592-598.

Hollenbeck, J. R., Ilgen, D. R., & Sego, D. J. (1994). Repeated measures regression: Enhancing the power of leadership research. Leadership Quarterly, 5, 3-23.

Hollenbeck, J. R., Ilgen, D. R., Sego, D. J., Hedlund, J., Major, D. A., & Phillips, J. (1995). The multi-level theory of team decision making: Decision performance in teams incorporating distributed expertise. Journal of Applied Psychology, 80, 292-316.

Quiñones, M. A. (1995). Pretraining context effects: Training assignment as feedback. Journal of Applied Psychology, 80, 226-238.

Hollenbeck, J. R., Ilgen, D. R., Tuttle, D., & Sego, D. J. (1995). Team performance on monitoring tasks: An examination of decision errors in contexts requiring sustained attention. Journal of Applied Psychology, 80, 685-696.

Phillips, J., Hollenbeck, J. R., & Ilgen, D. R. (1996). The prevalence and prediction of positive discrepancy creation: Examining a discrepancy between two self regulation theories. Journal of Applied Psychology, 81, 498-511.

LePine, J. A., Hollenbeck, J. R., Ilgen, D. R., & Hedlund, J. (1997). The effects of individual differences on the performance of hierarchical decision making teams: Much more than G. Journal of Applied Psychology, 82, 803-811.

Hattrup, K. (1998). The role of self-perception in reactions to preferential and merit-based hiring. Journal of Applied Social Psychology, 28, 225-234.

Hedlund, J., Ilgen, D. R., & Hollenbeck, J. R. (1998). The effect of computer-mediated versus face to face communication on decision making in hierarchical teams. Organizational Behavior and Human Decision Processes, 76, 30-47.

Hollenbeck, J. R., Colquitt, J. A., Ilgen, D. R., LePine, J. A., & Hedlund, J. (1998). Accuracy decomposition and team decision making: Testing theoretical boundary conditions. Journal of Applied Psychology, 83, 494-501.

Hollenbeck, J. R., Ilgen, D. R., LePine, J. A., Colquitt, J. A., & Hedlund, J. (1998). The multilevel theory of team decision making: Explaining and controlling the decision accuracy of leaders and staff. Academy of Management Journal, 21, 269-282.

Ilgen, D. R. (1999). Teams in organizations: Some implications. American Psychologist, 54, 129-139.

Phillips, J. M. (1999). Antecedents of leader utilization of staff input in decision-making teams. Organizational Behavior and Human Decision Processes, 77, 215-242.

Klein, H. J., Wesson, M. J., Hollenbeck, J. R., & Alge, B. J. (1999). Goal commitment and the goal setting process: Conceptual clarification and empirical synthesis. Journal of Applied Psychology, 64, 885-896.

Fried, Y., Hollenbeck, J. R., Slowik, L. H., Tiegs, R. B., & Ben-David, H. A. (1999). Changes in job decision latitude over time: The influence of personality and interpersonal satisfaction. Journal of Vocational Behavior, 54, 233-243.

LePine, J. A., Colquitt, J. A., & Erez, A. (2000). Adaptability to changing task contexts: Effects of general cognitive ability, conscientiousness, and openness. Personnel Psychology, 53, 563-594.

Phillips, J. M. (2001). The role of decision influence and team performance in member self-efficacy, withdrawal, satisfaction with the leader, and willingness to return. Organizational Behavior and Human Decision Processes, 84, 122-147.

Hollenbeck, J. R. (2000). A structural approach to external and internal person-team fit. Applied Psychology: An International Review, 49, 534-549.

Ilgen, D. R., & Davis, C. A. (2000). Bearing bad news: Reactions to negative performance feedback. Applied Psychology: An international review, 49, 511-526.

Klein, H. J., Wesson, M. J., Hollenbeck, J. R., Wright. P. M., & DeShon, R. P. (2001). The assessment of goal commitment: A measurement model meta-analysis. Organizational Behavior and Human Decision Processes, 85, 32-55.

Moon, H. (2001). The two faces of conscientiousness: Duty and achievement striving in escalation of commitment dilemmas. Journal of Applied Psychology, 86, 533-540.

Moon, H. (2001). Looking forward and looking back: Integrating completion and sunk-cost effects within an escalation-of-commitment process decision. Journal of Applied Psychology, 86, 104-113.

Colquitt, J. A., Hollenbeck, J. R., Ilgen, D. R., LePine, J. A., & Sheppard, L. (2002). Computer-assisted communication and team decision making performance: The moderating role of openness to experience. Journal of Applied Psychology, 87, 402-410.

LePine, J. A., & Van Dyne, L. (2001). Voice and cooperative behavior as contrasting forms of contextual performance: Evidence of differential effects of Big-Five personality characteristics and general cognitive ability. Journal of Applied Psychology, 86, 326-336.

Phillips, J. M. (2002). Antecedents and consequences of procedural justice perceptions in hierarchical decision-making teams. Small Group Research, 33, 32-64.

LePine, J. A., Hollenbeck, J. R., Ilgen, D. R., Colquitt, J. A., & Ellis, A. (2002). Sex composition, situational strength and team decision accuracy. Organizational Behavior and Human Decision Processes, 88, 445-475.

Porter, C. O. L. H., Hollenbeck, J. R., Ilgen, D. R., Ellis, A. P. J., West, B. J., Moon, H. K. (2002). Backing up behavior in teams: The role of personality and

legitimacy of need. Proceedings: Seventh Annual International Command and Control Research Technology Symposium, Monterey, CA.

Hollenbeck, J. R., Moon, H., Ellis, A. P. J., West, B. J., Ilgen, D. R., Sheppard, L., Porter, C. O. L. H., & Wagner, J. A., III. (2002). Structural contingency theory and individual differences: examination of external and internal person-fit. Journal of Applied Psychology, 87, 599-606.

Conlon, D. E., Moon, H., & Ng, K. Y. (2002). Putting the cart before the horse: The unexpected benefits of arbitrating before mediating. Journal of Applied Psychology, 87, 978-984.

Moon, H., & Conlon, D. E. (2002). From acclaim to blame: Evidence of a person sensitivity decision bias. Journal of Applied Psychology, 87, 33-42.

Book Chapters

Ilgen, D. R., Major, D. A., Hollenbeck, J. R., & Sego, D. J. (1993). Team research in the 1990s. In M. M. Chemers & R. Ayman (Eds.), Leadership theory and research: Perspectives and directions (pp. 245-270). New York: Academic Press.

Hollenbeck, J. R., Sego, D. J., Ilgen, D. R., Major, D. A., Hedlund, J., & Phillips, J. (1994). Team decision making accuracy under difficult conditions: Construct validation of potential manipulations and measures using the TIDE^2 simulation. In M. Brannick, E. Salas, & C. Prince (Eds.), New directions in team measurement. San Francisco: Jossey-Bass.

Ilgen, D. R., Major, D. A., Hollenbeck, J. R., & Sego, D. J. (1995). Raising an individual decision-making model to the team level: A new research model and paradigm. In R.

Guzzo & E. Salas (Eds.), Team decision making in organizations (pp. 113-148). San Francisco: Jossey-Bass.

Hollenbeck, J. R., LePine, J., & Ilgen, D. R. (1996). Individual differences in adapting to roles in decision making teams. In K. R. Murphy (Ed.), Individual differences in behavior and organizations (pp. 300-333). San Francisco: Jossey-Bass.

Ilgen, D. R., LePine, J. A., & Hollenbeck, J. R. (1997). Effective decision making in multinational teams. In P. C. Earley & M. Erez (Eds.), New perspectives in international industrial and organizational psychology (pp. 377-409). San Francisco: Jossey-Bass.

Ilgen, D. R., & Sheppard, L. (2001). Motivation in teams. In M. Erez, H. Thierry, & U. Kleinbeck (Eds.), Motivational issues in multinational teams. New York: Erlbaum.

Humphrey, S. E., Hollenbeck, J. R., Meyer, C. J., & Ilgen, D. R. (2002). Hierarchical team decision making. In G. R. Ferris & J. J. Martocchio (Eds.), Research in personnel and human resources management (pp. 175-214). Greenwich, CT: JAI Press.

Books

Ilgen, D. R., & Hulin, C. L. (Eds.). (2000). Computational modeling of behavior in organizations: The third scientific discipline. Washington, DC: The American Psychological Association.

Technical Reports

Hollenbeck, J. R., Sego, D. J., Ilgen, D. R., & Major, D. A. (1991). Team interactive decision exercise for teams incorporating distributed expertise (TIDE^2): A program and paradigm for team research (Tech. Rep. 91-1). East Lansing: Michigan State University.

Ilgen, D. R., Major, D. A., Hollenbeck, J. R., Sego, D. J. (1991). Decision making in teams: Raising an individual decision making model to the team level (Tech. Rep. 91-2). East Lansing: Michigan State University.

Sego, D. J., Hollenbeck, J. R., Ilgen, D. R., & Major, D. A., (1992). Team decision making accuracy within three different base rate conditions. Paper presented at the annual meetings of the American Psychological Association, Washington, DC.

Barrett, L. E. (1992). Decision making teams: Their study in the U. S. military (Tech. Rep. 93-1). East Lansing: Michigan State University.

Ilgen, D. R., & Hollenbeck, J. R. (1993). Effective team performance under stress and normal conditions: An experimental paradigm, theory and data for studying team decision making in hierarchical teams with distributed expertise (Final Rep. NR. 93-2). East Lansing: Michigan State University.

Hollenbeck, J. R., Ilgen, D. R., LePine, J. A., & Hedlund, J. (1995). Sex composition and decision making accuracy in groups and teams (Tech. Rep.). Armstrong Laboratory, Brooks Air Force Base, San Antonio, TX.

Hollenbeck, J. R., & Ilgen, D. R. (1996). Team decision making in hierarchical teams: A Final Report (Tech. Rep. No. 96-01). East Lansing: Michigan State University.

Conference Presentations

Hollenbeck, J. R., Sego, D. J., Ilgen, D. R., & Major, D. A. (1992). Team decision making under stressful conditions: Construct validation of potential manipulations and measures from the TIDE^2 simulation. Paper presented at team conference at the University of South Florida.

Ilgen, D. R. (1992). Team decision making research and theory. Symposium organized by the author. Annual meeting of the Society for Industrial and Organizational Psychology, Montreal.

Ilgen, D. R., Hollenbeck, J. R., Sego, D. J., Major, D. A., Phillips, J., & Hedlund, J. (1992). Team member abilities and problem solving strategy effects on team decision making outcomes and processes in teams with distributed expertise. BRG Symposium, Monterey, CA.

Major, D. A., Sego, D. J., Hollenbeck, J. R., & Ilgen, D. R. (1992). Decision making in teams with distributed expertise. Presented at the annual meeting of the Society for Industrial and Organizational Psychology, Montreal.

Ilgen, D. R. (1993). Team decision making: Theory, method, and results. Presented at the annual Nags Head Conference on Groups and Organizational Effectiveness, Boca Raton, FL.

Ilgen, D. R. (1993). Team-level constructs of team decision making: Informity, staff validity, and hierarchical sensitivity. Presented at the annual meetings of the Society for Organizational Behavior, Virginia Beach, VA.

Hattrup, K. (1994). The role of the self-concept and fairness perceptions in reactions to preferential hiring. In M. A. McDaniel (Chair), Research in affirmative action. Symposium presented at the Night Annual conference of the Society for Industrial and Organizational Psychology, Nashville, TN.

Hedlund, J., Ilgen, D. R., & Hollenbeck, J. R. (1994). Computer mediated versus face-to-face communication in hierarchical team decision making. Paper presented at the annual meetings of the Society of Industrial and Organizational Psychology, Nashville, TN.

Hollenbeck, J. R. (1994). Decision making in heirarchical teams with distributed expertise: A theory and data. Presented at the 23rd annual International Congress of the International Association of Applied Psychogy, Madrid, Spain.

Ilgen, D. R. (1994). Work teams: Some critical issues. Presented at the 23rd annual International Conference of the International Association of Applied Psychology, Madrid.

Ilgen, D. R., Major, D. A., Hollenbeck, J. R., & Sego, D. J. (1994). Decision making in teams: entitled, "Team decision-making in organizations: New frontiers" at the annual meeting of the Society for Industrial and Organizational Psychology, Nashville, TN.

Ilgen, D. R., & Hollenbeck, J. R. (1994). Decision making accuracy in four person teams with distributed expertise: Testing the predictive utility of three team-level constructs. Presented at the 1994 Symposium on Command and Control Research and Decision Aids, Naval Postgraduate School, Monterey, CA.

Ilgen, D. R. (1995). Teams in work organizations: Facts and infatuations. The Keynote

Address for the First Annual Conference of the Australian Psychology Association.

Sydney.

Ilgen, D. R., & Hollenbeck, J. R. (1995). Decision making in hierarchical teams.

Symposium presentation at the First Annual Conference of the Australian

Organizational Psychology Association, Sydney.

Hollenbeck, J. R., Ilgen, D. R., LePine, J. A., & Hedlund, J. (1995). The multilevel theory

of team decision making: Extensions and interventions. Paper presented at the First

Annual International Conference on Command and Control Research. Washington,

DC: National Defense University.

Hollenbeck, J. R., Ilgen, D. R., Tuttle, D., & Sego, D. J. (1995). Team performance on

monitoring tasks: An examination of decision errors in contexts requiring sustained

attention. Paper presented at the 1995 annual Meeting of the Academy of Management,

Vancouver, Canada

Hollenbeck, J. R., Ilgen, D. R., & Weissbein, D. (1996). Information management and

decision making following unusual events: Analysis at the team and individual level.

Paper presented at the 1996 Command and Control Research and Technology

Symposium, Monteray, CA.

Hollenbeck, J. R., Ilgen, D. R., & Weissbein, D. (1996). Improving decision making in

contexts requiring sustained attention. Paper presented at the annual meeting of the

Society of Industrial and Organizational Psychology, San Diego, CA.

Hollenbeck, J. R. (1996). Improving team decision making: Lessons from the team effectiveness research laboratory. Paper presented at the Annual Meeting of the Michigan Association of Industrial/ Organizational Psychologists, Detroit, MI.

Hollenbeck, J. R. (1996). Repeated measures regression in cross-cultural research: Finding where the action is in cross-level variance structures. Paper presented at Hong Kong University of Science and Technology.

Ilgen, D. R. (1996). Cross-fertilization: A two way street. Presented as part of a symposium on the interaction between basic and applied psychology organized by M. Frese, International Congress of Applied Psychology, Montreal.

Hollenbeck, J. R., Ilgen, D. R., Hedlund, J., Colquitt, J. A., & LePine, J. (1996). The multilevel theory of team decision making: Replication and extension. Paper presented at the annual meting of the Society of Industrial and Organizational Psychology, San Diego, CA.

Phillips, J. M., Hollenbeck, J. R., & Ilgen, D. R. (1996). The prevalence and prediction of positive discrepancy creation: An application of episodic and non-episodic theories of motivation. Paper presented at the annual meeting of the Society of Industrial and Organizational Psychology, San Diego, CA.

LePine, J. A., Hollenbeck, J. A., Ilgen, D. R., & Hedlund, J. (1997). Individual differences and performance in hierarchical decision making teams. Paper presented at the annual meetings of the Society of Industrial and Organizational Psychology, St. Louis, MO.

Hollenbeck, J. R., Ilgen, D. R., & Colquitt, J. A. (1997). Accuracy decomposition and group architecture: Testing theoretical boundary conditions. Paper presented at the 1997 Command and Control Research and Technology Symposium, Washington, DC.

Ilgen, D. R. (1998). Computational modeling: Time to give it a chance. Presented at the annual meetings of the Society for Organizational Behavior, Washington, DC.

Ilgen, D. R. (1998). Fifteen years of team research: What have we learned and where are we going? Presented at the annual meetings of the Human Factors Society, Chicago, IL.

Hollenbeck, J. R., Colquitt, J. A., & Gully, S. (1998). Repeated measures regression: Decomposing variance in multilevel research. Paper presented at the 1998 annual meeting of the Society of Industrial and Organizational Psychology, Dallas.

Hollenbeck, J. R., & Ilgen, D. R. (1998). The multilevel theory: Modeling the factors that influence decision making accuracy in hierarchical teams. Paper presented at the 42nd annual meeting of the Human Factors and Ergonomics Society, Chicago.

Hollenbeck, J. R., & Ilgen, D. R. (1998). Team performance under conditions of shifting structural demands. Presented at the annual meetings of the Society of Organizational Behavior, Washington, DC.

LePine, J., Hollenbeck, J. R., & Ilgen, D. R. (1998). Adaptability in hierarchical decision making teams. Paper presented at the Command and Control Research and Technology Symposium, Monterey, CA

Hollenbeck, J. R, Ilgen, D. R., Sheppard, L., & Ellis, A. (1999). Person-in-team fit: A structural approach. Paper presented at the annual meetings of the Society of Industrial and Organizational Psychology, Atlanta.

Ilgen, D. R., & Hollenbeck, J. R. (1999). Team decision making under conditions of

changing situational demands: A paradigm for research. Presented at the Command

and Control Research and Technology annual meeting held at the Naval War Collage,

Newport, RI.

Ilgen, D. R., Hollenbeck, J. R., LePine, J. A., Sheppard, L., Ellis, A., & Moon, H. (1999).

Team decision making under conditions of changing situational demands: A paradigm

for team research. Presented at the 3rd Australian Industrial and Organisational

Psychology Conference, Brisbane.

LePine, J. A., Hollenbeck, J. R., Ilgen, D. R., Colquitt, J. A., & Ellis, A. (1999). Using

criterion decomposition to enhance decision making team performance. Paper

presented at the annual meetings of the Society of Industrial and Organizational

Psychology, Atlanta, GA.

Sheppard, L., Ellis, A., Moon, H., Hollenbeck, J. R., & Ilgen, D. R. (1999). Differences in

team structure: A look at team performance on a modification of the DDD. Paper

presented at the annual meetings of the Society of Industrial and Organizational

Psychology, Atlanta, GA.

LePine, J. A., Colquitt, J. A., & Purdy, C. (1999). Adaptation to changing task contexts:

Effects of general cognitive ability, openness, and conscientiousness. Presented at the

58th annual meeting of the National Academy of Management, Chicago, IL.

Hollenbeck, J. R., & Ilgen, D. R. (2000, April). A look at team performance on

modifications of the DDD. Paper presented at the annual meetings of the Society

for Industrial and Organizational Psychology, New Orleans, LA

Hollenbeck, J. R., Ilgen, D. R., Sheppard, L., & Ellis, A. (2000, April). <u>Person-in-team</u>

<u>fit: A structural approach</u>. Paper presented at the annual meetings of the Society

for Industrial and Organizational Psychology, New Orleans, LA.

Ilgen, D. R., & Hollenbeck, J. R. (2000, April). Symposium: <u>Simulations for the study</u>

<u>of teams</u>. Paper presented at the annual meetings of the Society for Industrial and

Organizational Psychology, New Orleans, LA.

LePine, J. A., Hollenbeck, J. R., Ilgen, D. R., Colquitt, J. A. & Ellis, A. (2000, April).

<u>Using criterion decomposition to enhance decision making team performance.</u>

Paper presented at the annual meetings of the Society for Industrial and

Organizational Psychology, New Orleans, LA.

Ellis, A., Bell, B. S., & Ployhart, R. E. (2000, April). <u>Team training: An application of</u>

<u>Stevens and Campion's Teamwork KSAs</u>. Paper presented at the 15th annual

conference for the Society for Industrial and Organizational Psychology, New

Orleans, LA.

Ellis, A., & Ilgen, D. R. (2000, April). <u>Race and ratings in a team situation: An</u>

<u>attributional perspective</u>. Paper presented at the 15th annual conference of the

Society for Industrial and Organizational Psychology, New Orleans, LA.

Hollenbeck, J. R., Ilgen, D. R., Moon, H., Ellis, A., Sheppard, L., West, B. J., &

Porter, C. O. L. H. (2000, April). <u>Human performance in teams with adaptive</u>

<u>structures: A structural contingency theory approach</u>. Paper presented at the 15th

annual conference of the Society for Industrial and Organizational Psychology,

New Orleans, LA.

Moon, H., Hollenbeck, J. R., Ilgen, D. R., West, B., Ellis, A., Humphrey, S., & Porter, C. O. L. H. (2000, June). Asymmetry in structural movement: Challenges on the road to adaptive organizational structures. Presented at the Command and Control Research and Technology Symposium 2000, Naval Postgraduate School, Monterey, CA.

Beersma, B., Humphrey, S. E., Moon, H., Conlon, D. E., Hollenbeck, J. R., & Ilgen, D. R. (2001). The benefits of participation prior to structural change in groups. Presented at the International Association for Conflict Management Conference, Cergy (Paris), France.

Moon, H., Conlon, D. E., & Humphrey, S. E. (2001, April). Baby steps: Incremental escalation in individual and group decision making. Presented at the 16th annual meeting of the Society for Industrial and Organizational Psychology, San Diego, CA.

Moon, H., Humphrey, S. E., & Maue, B. (2001, April). The mutual suppression of anxiety and depression within escalation decision-making dilemmas. Presented at the 16th annual meeting of the Society for Industrial and Organizational Psychology, San Diego, CA.

Moon, H. (2001). The tripartite model of personality: The integration of internal and external aspects of personality within the Five-Factor model framework. Presented at the annual Academy of Management meeting, Washington, DC.

Conlon, D. E., Moon, H., & Ng, K. Y. (2001, April). Comparing outcomes to hybrid forms of dispute resolution procedures. Presented at the 16th annual meeting of the Society for Industrial and Organizational Psychology, San Diego, CA.

Porter, C.O.L.H., Hollenbeck, J. R., Ilgen, D. R., Ellis, A.P.J., Moon, H. K., & West, B. J. (2001, April). Towards understanding backing up behaviors in work teams: The role of personality and the legitimacy of need for backing up others. Paper presented at the 16th annual conference for the Society for Industrial and Organizational Psychology, San Diego, CA.

Conlon, D. E., Moon, H., & Ng, K. Y. (2001). Putting the cart before the horse: The unexpected benefits of arbitrating before mediating. Presented at the annual Academy of Management meeting, Washington, DC.

Ellis, A. P. J., Ilgen, D. R., Hollenbeck, J. R., & Porter, C.O.L.H. (2001). Capacity collaboration, and commonality: A framework for understanding team learning. Paper presented at the annual conference of the Academy of Management, Washington, DC.

Ellis, A.P.J., Ilgen, D. R., Hollenbeck, J. R., Porter, C.O.L.H., West, B. J., & Moon, H. (2001). Capacity, collaboration, and commonality: A framework for understanding team learning. Paper presented at the 6th International Command and Control Research and Technology Symposium, Annapolis, MD. [Recipient of the Best Paper Award for the conference.]

Beersma, B., Hollenbeck, J. R., Humphrey, S. E., Moon, H., Conlon, D. E., & Ilgen, D. R. (2002). Cooperation, competition, and team performance: Towards a contingency approach. Presented at the annual meetings of the Academy of Management, Denver, CO.

Porter, C. O. L. H., Humphrey, S. E., Hollenbeck, J. R., & Ilgen, D. R., Ellis, A. J. P., West, B. J., & Moon, H. (2002). External and internal misfit in teams: The role of backing up behaviors as structural workarounds. Presented at the Command and Control Research and Technology Symposium, Naval Postgraduate School, Monterey, CA.

Ellis, A.P.J., Ilgen, D. R., Hollenbeck, J. R., Porter, C.O.L.H., West, B. J., & Moon, H. (2002, Sept.). Capacity, collaboration, and commonality: A framework for understanding team learning. Paper presented at the 7th International Command and Control Research and Technology Symposium, Quebec City, Canada.

Theses and Dissertations

Landis, R. S. (1992). The effects of team composition and incentives on team performance on an interdependent task. Unpublished masters thesis. East Lansing: Michigan State University.

Major, D. A. (1992). Decision making at the individual and team levels: Moderators of the effects of cognitive frames and risk taking. Unpublished dissertation. East Lansing: Michigan State University.

Quiñones, M. A. (1993). Pre-training context effect: Training assignment as feedback. Unpublished dissertation. East Lansing: Michigan State University.

Hedlund, J. (1993). Computer-mediated versus face-to-face communications in hierarchical team decision making. Unpublished masters thesis. East Lansing: Michigan State University.

Sego, D. J. (1994). <u>Role formation within hierarchical decision making teams with distributed expertise: A role expansion model</u>. Unpublished dissertation. East Lansing: Michigan State University.

Hattrup, K. (1995). Affirmative action in organizational hiring: Self-regulation and fairness processes in beneficiary reactions. Unpublished dissertation. East Lansing: Michigan State University.

Elliott, L. (1997). Unpublished dissertation, East Lansing: Michigan State University.

Phillips, J. M. (1997). <u>Antecedents and consequences of leader utilization of staff information in decision making teams: Addressing a leader dilemma</u>. Unpublished dissertation. East Lansing: Michigan State University.

Hedlund, J. (1997). <u>The influence of sex composition and task sex-linkage on decision making in hierarchical teams</u>. Unpublished dissertation. East Lansing: Michigan State University.

LePine, J. A. (1998). <u>An integrative model of team adaptation</u>. Unpublished dissertation. East Lansing: Michigan State University.

Sheppard, L. (1998). <u>Communication in teams: How patterns of communications influence team effectiveness</u>. Unpublished masters thesis. East Lansing: Michigan State University.

Colquitt, J. A. (1999). <u>The impact of procedural justice in teams: Analysis of task, team and member moderators</u>. Unpublished dissertation. East Lansing: Michigan State University.

Ellis, A. (2000). Race effect on performance evaluation in a team situation: An attributional perspective. Unpublished masters thesis. East Lansing: Michigan State University.

Porter, C. O. L. H. (2001). Singled out: Task and social implications of providing individual-level feedback in teams. Unpublished dissertation. East Lansing: Michigan State University.

Moon, H. (2002). The tripartite model of personality: Integrating the Five Factor model and intrinsic motivation. Unpublished dissertation. East Lansing: Michigan State University.

Ellis, A. P. J. (2003). The effects of acute stressors on transactive memory and shared mental models in temporary project teams: An information processing approach. Unpublished dissertation. East Lansing: Michigan State University.