RUNNING HEAD: Structural Asymmetry

The Asymmetric Nature of Structural Changes in Command and Control Teams: The Impact of Centralizing and Decentralizing on Group Outcomes

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Abstract

Using 93 teams, we replicated the common cross-sectional structural contingency finding that teams with centralized structures perform more accurately than decentralized structures, whereas decentralized structures perform with more speed than centralized structures. Unlike most tests of contingency theories, however, we directly tested whether teams could actually adapt in the manner directly implied by the theory and found evidence that one type of change is more difficult than another. Teams responded significantly more favorably to centralized-then-decentralized shifts than they did to decentralized-then-centralized shifts. We discuss the need to complement the static logic behind many contingency theories with a dynamic logic that explicitly challenges an assumption of symmetrical adaptation.

The Asymmetric Nature of Structural Changes in Command and Control Teams: The Impact of Centralizing and Decentralizing on Group Outcomes

Within the organizational sciences, the structural contingency theory (SCT) approach to optimal organizational performance proposes that there are different task environments, there are different ways in which to structure organizations, and a proper fit between the structure of an organization and the dictates of the task environment have positive implications for performance (Burns & Stalker, 1961; Lawrence & Lorsch, 1967; Miller, 1988; Pennings, 1992). Simply, SCT advocates an "if this, then that" structure by environment contingency, and support for this proposition and be found in cross-sectional research on both large-scale organizations (Drazen and Van de Ven, 1985) and smaller work teams (Hollenbeck et al., 2002).

Indeed, Townsend, DeMarie and Hendrickson (1998) argue that the application of SCT within the current fast paced technology driven environment has created the need for organizations to be designed around flexible team-based structures. Townsend et al. view the new flexible organization as "a pronounced structural difference from traditional workgroup participation because of their ability to transform quickly according to changing task requirements and responsibilities (p. 23)." Similarly, Levitt, Thomsen, Christiansen, Kunz, Yan, and Nass (1999) extol the virtues of virtual team design, where team structure is adaptively engineered to be aligned with project goals. Allred, Snow and Miles (1996) characterize this emerging model of the organization as "cellular structures" implying both the individual units' ability to function independently and the ability of multiple units to engage in more complex functions through interdependent action. Donaldson (1987) generalizes this adaptive capability as structural adjustment to regain fit.

It is hard to argue with the virtues of flexibility, and the concept of infinitely adaptive people and organizations is certainly alluring. However, the difficulties in maintaining such high levels of adaptation in organizations should not be underestimated. The preponderance of evidence in support of contingency approaches tends to be based on generalizations from static, between group research designs, not within group designs where a team or organization actually changes their structure from Time 1 to Time 2. In fact, little of the empirical research in support of contingency theories in general, and SCT specifically, speaks directly to the issue of change and adaptability across time or different environments. Thus, despite the conceptual attractiveness of this type of reconfigurability, SCT has been under steady attack by those documenting the conditions that make change difficult (Dimaggio & Powell, 1983).

Most of the debate between those who advocate the value of structural adaptation and those who question its feasibility, however, has been framed in all or none terms. To date, there has been no discussion of the *direction of change* that is required by various types of reconfiguration. That is, both sides of this debate have presumed that structural adaptability (or structural inadaptability) is symmetric for all types of changes, and there is no existing theory that proposes that one type of change might be systematically more difficult to accomplish than another, nor any empirical data to test this proposition.

The purpose of this manuscript is to extend the research on the concept "asymmetric adaptability" (Moon et al., 2000) and test the general proposition that adaptability in social systems can only be understood by directly examining both the point of origin and the destination of the adaptation. In general, we argue that certain types of adaptation are more natural than others, and that prior experience working under an earlier system will have marked impact on how people react to the adapted system. That is, although in a Euclidean sense, the distance from Point A to Point B is the same as the distance between Point B to Point A, in a psychological sense, moving a social system from Point A to Point B may be more difficult than moving it from Point B to Point A. Moreover, once a social system has been moved from Point A to Point B, the challenge inherent in reconfiguring the system back in the reverse direction may be greater than the challenge associated with the initial reconfiguration.

In the following sections of this paper we will (a) review the general propositions of Structural Contingency Theory, which imply that teams need to change their structure contingent upon the centrality of speed versus accuracy concerns, (b) describe through illustrative examples two possible points of origin that a team's structure might take on initially (i.e. adapt from) and the two destinations that teams may need to subsequently move their structures in order to stay aligned with their goals (i.e., adapt to), and (c) derive hypotheses regarding why it is more difficult to adapt in one direction versus the other. These ideas are then empirically tested in an experimental study where teams are required to structurally reconfigure in opposing directions.

Centralized versus Decentralized Structures

Organizational Design Contingencies. Organizational structure describes how large numbers of persons are differentiated into smaller groups, as well as how the roles of members within these groups are differentiated and coordinated (Pennings, 1992). One of the most critical dimensions of structure is centralization (Wagner, 2002). Centralization deals with the division of labor and refers to the degree to which decision authority rests with a single group leader (centralized) or whether or authority is distributed to group members who can all make autonomous decisions for themselves (decentralized) (Burns & Stalker, 1961).

In centralized structures, the leader tells each team member what actions they should or should not take, or alternatively, waits for team members to make requests for permission to take various actions. These requests are approved, or denied or amended, but in the end, the single person serving as leader has ultimate authority for what actions are taken. In large organizations, there may be several layers of leadership and orders and/or requests may move up and down several layers of hierarchical management. In decentralized organizational structures, the team members can act on their own, without prior orders or having been granted hierarchical permission. Each individual team member has authority to make their own decisions, and the role of the team leader is to help support those individuals. Most organizational structures are neither totally centralized (where all decisions are made by the top leader) nor totally decentralized (where team members are totally autonomous), but instead lie on a continuum where these are the extreme endpoints.

In terms of answering the question "what structure is best?" Structural Contingency Theory (SCT) proposes that there is no "one best way" to structure groups (e.g., Burns & Stalker, 1961; Pennings, 1992). Instead, this theory proposes that the group's structure interacts with the nature of the task environment and the organization's goals

More specifically, according to SCT, centralized structures are superior in task environments that demand error control because the single centralized authority can make sure that members do not take actions are taken that violate the organization's established rules or norms. Centralized structures are also very good at ensuring coordination because the single authority can insure that actions taken by one team member do not counteract or duplicate the actions of another team member, thus creating efficiency. In terms of rule enforcement, organizations that do not embody sufficient centralization are often criticized as tolerating "loose cannons," and in terms of coordination, these same organizations as criticized along the lines that the "right hand does not know what the left hand is doing."

On the other hand, decentralized structures, according to SCT are superior in task environments that demand speed or the learning of new contingencies. Decentralized structures are faster because the team members can initiate action the moment they feel it is necessary, and do not have to waste time waiting for directions or approvals. This is especially the case in large organizations where requests and approvals have to pass through a number of hierarchical levels. Multiple levels of hierarchy can create substantial time delays between the perceived need for action on the part of the team member, and the final approval for action on the part of distal leaders.

In addition to being faster, decentralized structures are also superior in terms of learning new contingencies and developing innovative procedures. Leaders in highly centralized structures often experience information overload, and when this is coupled with an orientation that is focused on the execution of established procedures; this often detracts from their ability to detect new opportunities or the need for new procedures. The more constrained nature of the decision making problem for team members restricts the amount of information that has to be processed and promotes the detection of new relationships. Also, idiosyncrasies in the team member's local environment often point to opportunities to amend or modify the established standardized procedures in a way that makes them more suitable for the specific context experienced by that team member. In general, in terms of speed and innovation, organizations that fail to embody sufficient decentralization are often criticized as being "lumbering" and "unresponsive."

Because structures residing at each end of the centralized—decentralized continuum have their own unique strengths and weaknesses, SCT proposes that no one structure is always superior, and instead, suggests that the most appropriate structure depends on the situation. In situations where error avoidance and tight coordination are required, centralized structures are to be preferred. However, when speed and learning of new contingencies required, then decentralized structures are to be preferred. Therefore, we hypothesize the following:

H1a: In terms of initial performance (Time 1), teams with a centralized structure at Time 1 will perform with more accuracy (i.e., make less errors) relative to teams with a decentralized structure at Time 1.

H1b: In terms of initial performance (Time 1), teams with a centralized structure at Time 1 will perform with less speed relative to teams with a decentralized structure at Time 1.

Asymmetric Adaptability in Structural Movement

Theories of organizational structure imply that there is no one single answer to the question of whether centralized or decentralized structures are best across all conditions. Indeed, both state that under different circumstances, either may be appropriate, and that the degree of centralization needs to "fit" the conditions. Moreover, both sets of theories imply that when conditions change, it may be appropriate to change the decision-making structure in order to maintain this fit. While this inference may logically follow from these theories and the existing data, it needs to be noted that these types of contingencies have only been established via cross-sectional studies, and/or studies that employed between group or organization research designs. Until very recently, researchers have never directly tested whether teams can actually switch back and forth from one structure to another without encountering unforeseen difficulties.

A recent study by Moon et al. (2002), however, questioned the degree to which teams could move easily from one structure to another. Moon et al. developed the construct of asymmetric adaptability, which implied that reconfigurability is directionally dependent, and that it is easier to move social systems in some directions relative to others. In particular, in terms of group norms, different structures place different demands on team members that could affect the group's habits with respect to group coordination processes (Ancona & Chong, 1996; Bettenhausen & Murninghan, 1985). These norms and habits, once established, work forward in time and can either promote or prevent adaptation to alternative structures.

For example, in a study of eighty teams working on a command and control simulator, Moon et al. (2002) showed that the norms and habits that developed in teams that initially employed functional structures (high frequency of communication and teamwork) supported their transition to a subsequent divisional structure. On the other hand, the norms that developed within teams that were structured divisionally (concentration and independence) hindered the ability of these teams to adapt to a subsequent functional structure. Thus, adaptation was asymmetrical, in the sense that functional teams could adapt to a new divisional structure, but divisional teams were unable to adapt to a new functional structure.

A similar type of asymmetry could be found when teams are asked to move from centralized to decentralized structures or from decentralized to centralized structures. In particular, in terms of autonomy, the transition from centralized to decentralized structures represents a situation where the majority of group members see an increase in their own personal discretion and power. Alternatively, asking the group to move from a decentralized structure to a centralized structure results in the majority of people having to surrender autonomy.

Asking the majority of people to surrender autonomy and control runs counter to most theories of human development, which sketches out personal development as a sequence of adopting roles of increasing responsibility and complexity (e.g., Erikson, 1992). Also, several theories of work motivation suggest that people respond better to changes in their work that increase discretion and the scope of their task relative to changes that decrease discretion and task scope (Hackman & Oldham, 1976; Hertzberg, Mausner, & Snyderman, 1970).

Based upon the developing literature on asymmetry in structural movement, as well as theories of human development and work motivation, we expect that it will be more difficult for teams to transition in the decentralized to centralized (D-C) direction relative to the centralized to decentralized (C-D) direction. This difficulty for D-C teams could manifest itself in three different ways.

First, the effects of centralization and on accuracy detected at the team's initial stage may not replicate to the subsequent stage when they have switched into the focal structure, whereas the effects for decentralization on speed would replicate. That is, at Time 2, newly centralized teams may not show the same type of accuracy advantage seen in teams that had this structure at Time 1, but still show some of liabilities of centralized structures in terms of speed. More formally:

H2a: In terms of subsequent performance (Time 2), teams with centralized structures at Time 2 will not perform with more accuracy (i.e., make less errors) relative to teams with decentralized structures.

H2b: In terms of subsequent performance (Time 2), teams with centralized structures at Time 2 will perform with less speed relative to decentralized teams.

In addition to failing to replicate effects from Time 1 to Time 2, it could also be the case that performance at Time 2 could be directly affected by the Time 1 structure. This could manifest itself in two different ways. First, the effects of the Time 1 structure could reach forward and affect performance at Time 2 -- positively for teams that are making the C-D transition but negatively for teams making the D-C transition.

H3a: In terms of subsequent performance (Time 2), teams with centralized structures at Time 1 will not perform with more accuracy at Time 2 (i.e., make less errors) relative to teams that had decentralized structures at Time 1.

H3b: In terms of subsequent performance (Time 2), teams with centralized structures at Time 1 will perform with less speed relative to teams that had decentralized structures at Time 1.

Finally, the rather than directly affecting Time 2 performance, Time 1 structure could moderate the effects of Time 2 structure on Time 2 performance, weakening or strengthening the effect of the Time 2 structure. Specifically:

H4a: In terms of subsequent performance (Time 2), the effect of Time 2 structure on Time 2 accuracy will be moderated by Time 1 structure, in the sense that the positive effects of centralized structures on accuracy will be greater for C-C teams relative to D-C teams.

H4b: In terms of subsequent performance (Time 2), the effect of Time 2 structure on Time 2 speed will be moderated by Time 1 structure, in the sense that the negative effects of centralization on speed will be greater for D-C teams relative to C-C teams.

Methods

Research Participants

Participants included 372 students from an introductory management course at a large Midwestern University who were arrayed into 93 four-person teams. In exchange for their participation, each earned class credit and all were eligible for cash prizes (up to $400 per session) based upon the team's performance. Around 40 % of the teams received cash, and they were informed of this opportunity before signing up for the research.

Task

Participants engaged in a modified version of the Distributed Dynamic Decision-making (DDD) Simulation (see Miller, Young, Kleinman, & Serfaty, 1998). The DDD is a dynamic command and control simulation requiring team members to monitor activity in a geographic region and defend it against invasion from unfriendly air or ground tracks or tracks that enter the region. In this version, participants were seated in close proximity to one another at four networked computer terminals. Verbal communication was the only method of communication allowed during the task. Team members were free to talk as much or a little as they wanted.

The DDD Grid. Figure 1 is a display of the geographic region, which is partitioned into four quadrants of equal size. Each team member in a four-person team is assigned responsibility for one of the four quadrants and operates from a workstation labeled DM-1 through DM-4 in the figure. Team members are referred to as "Decision Makers," thus the DMi notation, with DM1 the southeast (SE) quadrant, DM2 in the northwest (NW), DM3 in the southwest (SW), and DM4 in the northeast (NE) quadrant. In the center of the screen is a 4 by 4 square designated as the "highly restricted zone" which is nested within a larger 12 by 12 square called the "restricted zone." Outside the restricted zone is a neutral space. Each team member in the configuration illustrated in Figure 1 is responsible for an equal portion of highly restricted, restricted and neutral space.

The objective of the simulation is to identify any tracks that enter the space, determine whether they are friendly or unfriendly, and, if unfriendly, keep them out of the restricted zones. If an unfriendly track enters one of the restricted zones, the team will begin to lose points. Twice as many points per second are lost for unfriendly tracks located in the highly restricted zone than the restricted zone. Points are also lost if friendly tracks are mistakenly engaged or if unfriendly tracks are engaged in the neutral space (see below for methods of engagement). Cash prizes are awarded to teams that lose the fewest points.

Bases and Vehicles. On the screen, DM1-DM4 represent the physical location of each team member's home base of operation. Assigned to each base are four assets, or vehicles, that may be used to defend the space (i.e., keep unfriendly tracks out of restricted areas). The four assets consist of a combination of surveillance aircraft (AWACs), fighter jets, helicopters, and tanks. Each, when active, is represented by an icon on the screen (e.g., the tank in the lower right hand quadrant of Figure 1 and the helicopter in the upper right). Assets vary on four capabilities: vision, speed, fuel capacity, and power. Vision is represented by the rings surrounding each asset. The outermost ring is referred to as the detection ring, which allows each team member to see tracks on the screen. The inner ring, which is called the identification ring, allows team members to identify whether the track is friendly or enemy. Fuel capacity refers to the amount of time each asset is allowed to remain on the screen after being launched from someone's home base. Power lets team members know which tracks can be engaged with which assets. If the asset has any power (i.e., greater than zero), it will have a third ring between the detection and identification rings representing the area in which the approaching track can be engaged in. Note in Figure 1 there are three rings around the tank (lower right), helicopter (upper right), and jet (lower left) but only two rings around the AWACs (upper left).

Capabilities are distributed among the assets so that each has both strengths and weaknesses. For example, the AWACs has the greatest range of vision but no power to engage unfriendly tracks. Tanks, on the other hand, have the highest level of power but their range of vision is small and their speed is slow. Table 1 provides capability values for each asset. The only capability possessed by the base of operations is vision. For example, Figure 1 presents the visual capabilities of DM1. The detection ring around DM1 is labeled "Base DR", while the identification ring around the base is labeled "Base IR."

Tracks. Tracks enter the screen from the sides of the grid with a line (i.e., a vector) attached to them indicating the direction they are proceeding through the space. Initially, when tracks enter someone's detection ring, they show up as unidentified, which is represented by a small diamond with a question mark in the middle. For example, in Figure 1, the track in the southeast quadrant labeled A?-215 has not been identified. Once the track enters someone's identification ring, it can be identified. When tracks are identified, the diamond turns into a box with a letter and a number inside of it, as shown by track Aa0-230 in DM4's highly restricted zone in Figure 1. Inside the box it says A0, which, according to Table 1, means that it is a quick moving friendly track.

Actions Taken Towards Tracks. Once a track is identified as unfriendly, a team member can engage the track by moving an asset near enough so that the track is within the attack ring. If the asset has enough power (see Table 1), the track can be disabled. When team members are able to quickly disable unfriendly tracks inside the restricted zones, the team will avoid losing large amounts of points. However, to maximize their score, team members also have to make sure that they are not disabling a friendly track or disabling an unfriendly outside the restricted zones.

Procedures

When participants arrived for their scheduled three-hour experimental session, they indicated their agreement to participate by signing a consent form and they were told the general purpose of the study.

Each team member was randomly assigned to a four-person team and to a specific base of operations. Team members remained at their specific base of operations (i.e., DM1, DM2, DM3, or DM4) during the duration of the experiment. Training took approximately 90 minutes. The first 30 minutes were devoted to declarative knowledge regarding all the various details relevant to playing the DDD. The second 60 minutes focused on the simulation, with the trainer instructing the team members on the details of the task, the operation of the mouse, etc. During the 60 minutes of hands-on practice, team members were free to ask questions.

At the completion of the 90-minute practice session, the team members filled out a short questionnaire designed to assess their level of declarative and procedural knowledge of the DDD task. They were then given a five-minute break while the trainer scored the questionnaires. Any incorrect answers were retrained after the five-minute break, prior to beginning the 2 experimental sessions. The experimental sessions lasted a total of one hour, with 100 tracks presented during the first 30 minutes and 100 tracks presented during the second 30 minutes. At Time 1, teams were centralized or decentralized. At Time 2, their structure either switched or stayed the same. During the experimental sessions, teams encountered 25 of each of the eight types of ground and air tracks. After finishing both tasks, research participants were thanked and debriefed.

Manipulations

Centralization. In centralized structures, decision authority rests with a single team leader who has the authority to tell team members what actions they should or should not take. These requests are approved, or denied or amended, but in the end, the single person serving as leader has ultimate authority for what actions are taken. In this study, centralization was manipulated by shifting the responsibility for all 16 vehicles to DM2. DM2 was responsible for launching vehicles from his or her base and transferring those vehicles to the appropriate team member. When team members engaged tracks on the screen, the vehicles were returned to DM2's base of operations, giving him or her complete control over who engaged what track when and with what type of vehicle. In essence, DM2 was assigned a leadership role by being given authority over team members' actions. In order for team members to engage enemy tracks on the screen, DM2 had to approve their actions. DM2 had the authority to make sure that members did not take actions that violated the established rules or norms of the task. This aided coordination within centralized teams because the leader insured that actions taken by one team member did not counteract or duplicate the actions of another team member.

In decentralized structures, team members can act on their own without prior orders or having been granted hierarchical permission. Each individual team member has authority to make their own decisions, and the role of the team leader is to help support those individuals. In this study, decentralization was manipulated by dividing the responsibility for all 16 vehicles between the four team members. Each team member had the authority to launch an AWACS plane, a jet, a helicopter, and a tank. After engaging a track, vehicles returned to each team member's base of operations, giving each team member complete control over what track should be engaged with what type of vehicle and when. Team members could initiate action the moment they felt it was necessary without wasting time waiting for directions or approvals. Team members could also amend or modify the established standardized procedures in order to deal with idiosyncrasies in their local environments.

Measures

Speed. Speed was measured by calculating the speed at which team members engaged enemy tracks once they entered the restricted area. Each team started the simulation with 50,000 defensive points and lost one point for every second that an unfriendly track was in the restricted zone and two points for every second that an unfriendly track was in the highly restricted zone. The faster team members engaged enemy tracks in the restricted areas, the higher their defensive score.

Accuracy. Accuracy was measures by calculating the number of friendly fire kills during the task. A friendly fire kill consisted of (1) an attack on a friendly track anywhere on the screen, or (2) and attack on a track outside of the restricted areas. Both of these actions violate the established rules or norms of the task. In fact, each team starts with 200 offensive points and loses 25 points for each friendly fire kill. The more teams engage in friendly fire kills, the less accurate they are on the task.

Results

This study employed a 2x2 (structure at Time 1 and Structure at Time 2) completely crossed design. Table 2 provides the means, standard deviations, and intercorrelations among the variable included in the analyses.

Tests of Hypotheses

Hypothesis 1a. Hypothesis 1a proposed that, at Time 1, centralized teams would be more accurate than decentralized teams. As shown in Table 3, regression analyses indicated that structure explained a significant 11% of the variance in accuracy at Time 1. Because structure was negatively related to accuracy ($\underline{\beta} = -.33$, $p < .01$), this indicated that centralized teams engaged in less friendly fire kills, and thus were more accurate, than decentralized teams. Hypothesis 1a was supported.

Hypothesis 1b. Hypothesis 1b concerned the speed at which team members engaged enemy tracks in the restricted areas, proposing that decentralized teams would be faster than centralized teams. Table 3 indicates that structure explained a significant 30% of the variance in speed at Time 1. Because structure was negatively related to speed ($\underline{\beta} = -.55$, $p < .01$), this indicated that decentralized were faster than centralized teams. Thus, Hypothesis 1b was supported.

Hypothesis 2a. Hypothesis 2a proposed that, at Time 2, centralized teams would not reap the benefits of increased accuracy over decentralized teams. As shown in Table 3, at Time 2, structure explained an insignificant 3% of the variance in accuracy. Centralized and decentralized teams did not significantly differ in terms of accuracy ($\underline{\beta} = -.16$, ns). These results support Hypothesis 2a.

Hypothesis 2b. Hypothesis 2b proposed that, at Time 2, decentralized teams would continue to outperform centralized teams when it came to the speed at which they engaged tracks in the restricted zones. Table 3 indicates that structure explained a significant 27% of the variance in speed at Time 2. Decentralized teams were faster than centralized teams ($\underline{\beta} = -.52$, $p < .01$), supporting Hypothesis 2b.

Hypothesis 3a. Hypothesis 3a examined the effects of structure at Time 1 on accuracy at Time 2. We proposed centralization at Time 1 would have no impact on accuracy at Time 2. As shown in Table 3, Time 1 structure explained no variance in accuracy at Time 2 ($\underline{\beta} = -.04$, ns). So, regarding accuracy at Time 2, it did not matter whether teams were centralized or decentralized, supporting Hypothesis 3a.

Hypothesis 3b. Hypothesis 3b suggested that, regarding speed at Time 2, it did matter how the team was structured at Time 1. In particular, decentralized teams at Time 1 were proposed to be faster at Time 2 than centralized teams at Time 1. Table 3 shows that Time 1 structure explained no variance in speed at Time 2 ($\Delta R^2 = .00$, $\underline{\beta} = -.04$, ns). So, regarding speed at Time 2, it did not matter whether teams were centralized or decentralized, which does not support Hypothesis 3a.

Hypothesis 4a. Hypothesis 4a proposed that Time 1 structure would moderate the relationship between Time 2 structure and Time 2 accuracy, such that teams remaining in a centralized structure would be more accurate than teams switching to a centralized structure. From the hierarchical regression analyses shown in Table 3, the interaction between Time 1 and Time 2 structure had no impact on accuracy at Time 2 ($\Delta R^2 = .00$, $\underline{\beta} = .00$, ns), thus Hypothesis 4a was not supported.

Hypothesis 4b. Hypothesis 4b proposed that Time 1 structure would moderate the relationship between Time 2 structure and Time 2 speed, such that teams remaining in a decentralized structure would be faster than teams switching to a decentralized structure. As shown in Table 3, the interaction between Time 1 and Time 2 structure had a significant impact on speed at Time 2 ($\underline{\beta} = .34$, $p < .01$). The interaction explained 4% of the variance in speed at Time 2. The nature of this interaction was such that the effects of centralization on speed at Time 2 were much more pronounced for the D-C teams relative to the stable C-C teams.

Discussion

This study examined the implication of centralizing and decentralizing structure across time on accuracy and speed within team contexts. Results indicated that, at Time 1, centralized structures were more accurate than decentralized structures, but decentralized structures were faster than centralized structures. At Time 2, decentralized structures continued to be faster than centralized structures, but centralized structures were not more accurate than decentralized structures. We found that there was little direct carryover from Time 1. That is, Time 1 structure did not influence either speed or accuracy at Time 2. However, regarding speed, there was an interaction between structure at Time 1 and structure at Time 2, such that the negative effects of centralization on speed were much great for C-D teams. Thus, whereas teams switching in the C-D direction seemed to benefit from the best of both worlds (enhanced accuracy but no loss of speed), the teams that switched from decentralized to centralized structures seemed to experience the worst of both worlds (no gain in accuracy, but a loss of speed).

Theoretical Implications

According to Structural Contingency Theory (SCT), there is no "one best way" to structure groups. Centralized structures are superior in task environments that demand accuracy because the single centralized authority can make sure that members do not take actions are taken that violate the organization’s established rules or norms. Decentralized structures, on the other hand, are superior in task environments that demand speed or the learning of new contingencies because the team members can initiate action the moment they feel it is necessary. Our results replicated this general finding of Structural Contingency Theory at Time 1.

However, if teams or organizations want to sustain excellence over time and changing environmental conditions, they need to be adaptive (Pulakos, Arad, Donovan, & Plamondon, 2000) and able to switch back and forth from one set of routines to another. The dynamic implication of this finding is that if a team’s task environment changes from Time 1 to Time 2, leading to a different emphasis on speed versus accuracy, then, in order to stay in a fit with its environment, the team should change structures. Although at a conceptual level, it is hard to argue with the virtues of adaptability, to date there has been little recognition of dynamic influences on behavior that may make some types of adaptation more or less natural relative to others. Utilizing the concept of "asymmetric adaptability" (Hollenbeck et al., 2002), we found that it was much more natural for team to shift from centralized to decentralized, than to switch in the other direction. We speculated that the centralized to decentralized adaptation was easier to make because of an increase in team members' own personal discretion and power. Alternatively, the shift from decentralized to centralized is more difficult because team members have to give up a significant amount of autonomy. Our results support theories of human development that suggest personal development consists of a sequence of roles of increasing responsibility and complexity (e.g., Erikson, 1992). Our results also support theories of work motivation that suggest employees perform better when they have more discretion and the scope of their task is increased (e.g., Hackman & Oldham, 1976).

Although it was beyond the scope of this one study to test all existing contingency theories in this same manner, we think is interesting to speculate on how various contingency theories might stand up to the same kind of test that was applied here to SCT. For example, the Vroom-Yetton model of leadership is a contingency theory that states that the decision making process that the leader engages in should depend upon characteristics of the followers and the situation (Vroom and Yetton, 1973). Within one set of circumstances, the model might recommend that the leader use a process labeled GII. In this instance, the leader is supposed to share the problem with subordinates, and together they should generate and evaluate alternatives. The goal would be to work slowly and attempt to reach consensus on a solution. The leader serves in the role of the chairperson, coordinating the discussion, and keeping it focused on the problem. The leader makes sure the critical issues are discussed but does not try to influence the group to adopt his or her solution. In the end, the leader needs to be willing to accept and implement any solution that has support from the group.

Alternatively, within a different set of circumstances, the model might recommend that the same leader use a process labeled AI, where the leader solves the problem himself or herself, using personal information, and not involving the subordinates in any way. While accepting the *static logic* that might lead this theory to recommend such different styles under different circumstance, the concept of asymmetrical adaptability makes one question the *dynamic logic* involved when, in a real operational setting, the social system tries to move from one state to the other.

Specifically, if the original circumstances dictate a series of initial decisions where the AI style is appropriate and executed, but then circumstances change, it may be quite natural for the group to adapt from a an AI to GII style because the group members' roles and influence are expanded in the new adapted situation. However, if the original circumstances allow for a long series of GII style decisions, but then circumstances change – demanding the leader adopt a new AI style, will this shift be as easy to execute as the other? In this instance, group members are being asked to sacrifice influence and discretion, and their reaction to the AI style may not be the same as those who only experience the AI style at Stage 1. There may very well be asymmetrical adaptability in this situation, such that it easier for a team to evolve from a series of AI to GII decision rules, than it would be for the same team to adapt from a series of GII to AI decision rules.

Practical Implications

There are a number of practical implications of our results, including implications regarding the Homeland Security program that has been put in place in the United States. Recently Tom Ridge was faced with the expensive and daunting task of combining 22 separate autonomous governmental agencies that employed more than 170,000 employees. The merger was designed to ensure that there was a centralized structure in place with all 22 of the former independent agencies now reporting to Ridge. The goal of this restructuring was to promote inter-unit coordination and enhance error control (in the form of minimizing terrorist infiltration and operation). However, Senator Joseph Lieberman reported that there are still problems with intelligence sharing within and among governmental agencies (Kulish, 2003). The results of our study imply that such problems may be occurring because a shift from decentralization to centralization does not really increase accuracy and, in fact, slows operations down.

Our results also have implications for organizations interested in engaging in acquisitions-related activity. From 1990 to 1993, acquisitions accounted for $222 billion in corporate activity. Many organizations view acquisitions as an opportunity to effectively invest corporate resources. However, the majority of evidence suggests that the intended benefits of acquisitions are rarely realized (e.g., Datta, Pinches, & Narayan, 1992; Schmidt & Fowler, 1990). Research has found it difficult to explain why acquisitions fail (Pablo, 1994). Perhaps acquisitions are ineffective because former companies who got to make their own decisions now have to report to the acquirer, reducing the autonomy of formerly autonomous units. Our results suggest that organizations would benefit from a shift from centralized to decentralized structures, but not the other way around. Since most acquisitions involve a D-C transition, this may explain why acquisitions that look great on paper, fail to live up to expectations when put in operation.

Limitations and Directions for Future Research

In this study, we discussed how shifting from decentralized to centralized structures would benefit the team by providing team members with increased autonomy. However, the same shift decreases his or her autonomy. Certain leaders may be very reluctant to give up power within the team. This could potentially results in counterproductive team behaviors by the former leader designed to sabotage group performance. The team leaders in this study had little to gain from their position of power, so these types of counterproductive behaviors likely did not present themselves. However, in teams where status and power hold meaning to team members, there could be a number of negative effects of the shift from centralized to decentralized structures that are caused by leaders who do not want to share authority.

In addition, this study concentrated on the influence of structure shifts on speed and accuracy within teams. However, there are a number of individual differences that may affect this relationship. For instance, not all group members may be willing to assume more responsibility. There may be groups who members would resist C-D transitioning because they lack the motivation or ability to assume a larger role with more discretion and responsibility. Regarding personality, those individuals who are higher in achievement orientation may be more willing to accept the added autonomy and discretion inherent in the shift from centralized to decentralized.

Finally, because this study was conducted in a laboratory context, there are the traditional concerns one might have regarding the external validity of these findings. On the one hand, there are certain features of this task and our research participants that do achieve what Berkowitz and Donnerstein (1982) refer to as mundane realism. Most weapons directors or those operating consoles in command and control situations are lieutenants, and thus our research participants are about the right age and education level. In addition, the command and control task is one where people sit at computer monitors and collect information exactly as is done in this simulation (which was developed for the Department of Defense). Also, these people tend to be assembled into crews based upon rotations that preclude their working together for long periods of time (i.e., many of these crew have limited histories and futures).

On the other hand, it is also clear that we could not ever simulate the psychological processes involved in real warfare in this laboratory context. While the consequences of decisions for our research participants were not as dramatic as they would be in a real situation, however, this was a psychologically engaging task and research participants were visibly upset when they performed poorly or made errors. The research participants were also aware of the financial bonuses that were available to the top performing teams, and the valence and probability of such rewards motivated them to perform well. Thus, there were consequences associated with performance that mattered to these people, so we believe that "psychological realism" (Berkowitz and Donnerstein, 1982) was quite high.

Beyond the issues of mundane and psychological realism, however, one needs to keep the nature of the research question in mind when assessing the relevance of external validity. We are less concerned with actual command and control situations than we are in testing the dynamic application of SCT in a team context. Since there is no formal aspect of this theory that would imply it would *not work* in this specific context, this context provides a legitimate venue within which to test the theory. As Ilgen (1986) noted, this is precisely the type of question that is well suited to laboratory contexts.

In addition, it should be noted that this study simply could never have been conducted in the field. That is, one of the major problems with trying to scientifically study real command and control situations is that the number of teams is small, their tasks geographically and politically idiosyncratic, and their availability limited. There are no cases where one has multiple teams that experience the exact same tasks, in the exact same order, in the exact same context with everything but structure controlled.

Finally, the whole issue of external validity needs to be considered in the light of the fact that to technically achieve external validity within one study, one has to randomly select research participants, tasks and times from some meaningful population. Clearly, this was impossible in this context, as well as most others. Indeed, one virtually never sees a study where the tasks chosen for the research were randomly selected from some meaningful population of tasks, and therefore, it is virtually impossible to meet the technical requirements for generalizing across tasks. Certainly, as Flanagan & Dipboye (1981) note, it would be foolish to conclude that simply because a study was conducted in one specific field context, that its findings would be generalizable to all other field contexts.

Fortunately, as Cook and Campbell (1979) have noted, “a strong case can be made that external validity is enhanced more by many heterogeneous small experiments than by one large experiment employing random selection of subjects, tasks and times” (p. 80). Moreover, as directly shown by Anderson, Lindsay and Bushman (1999), the correlation between effect sizes obtained in laboratory settings and field settings generally exceed .70. Thus, there is the hope that the generalizability of the findings reported here will become evident as other researchers, perhaps interested in these findings, replicate this study with other small experiments with different samples and tasks conducted at different times.

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Table 1

Summary of Assets and Tracks

	Assets				Tracks			
	Duration (in min.)	Speed	Vision	Power	Speed	Power	Nature	Need to Disable
Assets								
Tank	8:00	slow	very limited	high (5)				
Helicopter	4:00	medium	limited	med. (3)				
Jet	2:00	very fast	far	low (1)				
AWACs	6:00	fast	very far	none				
Tracks								
A0					Fast	none	Friendly	TK, HE, JT
A1					Fast	low (1)	Enemy	TK, HE, JT
A3					Fast	med. (3)	Enemy	TK, HE
A5					Fast	high (5)	Enemy	TK
G0					Slow	none	Friendly	TK, HE, JT
G1					Slow	low (1)	Enemy	TK, HE, JT
G3					Slow	med. (3)	Enemy	TK, HE
G5					Slow	high (5)	Enemy	TK

Notes: For vehicles: *duration* = amount of time a vehicle may stay away from the base before needing to refuel, *speed* = how fast the vehicle travels across the game screen, *vision* = refers to the range of vision the vehicle has to both see and identify tracks, *power* = the ability of the vehicle to engage enemy tracks. For tracks: *nature* = whether the track is an enemy or friend, *speed* = how fast the track travels across the game screen, *need to disable* = which of the vehicles can successfully engage the track.

Table 2

Means, Standard Deviations, and Intercorrelations Among Variables Included in Analyses

Variable	Mean	SD	1	2	3	4
1. Time 1 Structure	.49	.50	--			
2. Time 2 Structure	.49	.50	.01	--		
3. Speed	41428.12	4366.91	-.27**	-.19*	--	
4. Accuracy	4.33	2.18	-.20**	-.01	.02	--

Note: N = 93. Structure was coded 0 for decentralized and 1 for centralized.
* *p* < .05. ** *p* < .01

Table 3

The Results of Regressing Speed and Accuracy on Time 1 and Time 2 Structure

		Time 1 Speed			Time 1 Accuracy		
Step	Independent Variable	β	R^2	ΔR^2	β	R^2	ΔR^2
1	Time 1 Structure	-.55**	.30**	.30**	-.33**	.11**	.11**
		Time 2 Speed			Time 2 Accuracy		
1	Time 2 Structure	-.52**	.27**	.27**	-.16	.03	.03
2	Time 1 Structure	.05	.27**	.00	-.04	.03	.00
3	Time 2 Structure x Time 1 Structure	.34*	.31**	.04*	.00	.03	.00

Note: N = 93. Increments for variables entered at the R^2 significance levels are based on F tests for that step. Structure was coded 0 for decentralized and 1 for centralized.
* $p < .05$. ** $p < .01$

Figure 1

The DDD Grid, Including Bases, Vehicles, and Tracks