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Preface

Asymmetry in structural adaptation: The differential impact of centralizing versus decentralizing team decision-making structures

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ABSTRACT

This study tested predictions derived from Structural Adaptation Theory (SAT) on the longitudinal effects of centralizing and decentralizing decision-making structures in teams. Results from 93 four-person teams working on a command and control simulation generally supported SAT, documenting that it was more difficult for teams to adapt to a centralized decision-making structure after formerly working within a decentralized structure, than it was to adapt in the alternative direction. The negative effects of centralized shifts were mediated by efficiency and adaptability, in the sense that former decentralized teams experienced the negative aspects of centralization (lack of adaptability), but not the positive aspects (efficiency). The dangers of employing structural reconfiguration to solve certain problems in teams are discussed, especially if these changes are based upon expectations generalized from cross-sectional research that did not directly observe teams that experienced true structural change.

Introduction

Teams have been defined as small groups of *interdependent individuals* who share responsibility for specific outcomes (Sundstrom, De Meuse, & Futrell, 1990, p. 120). Team-based structures have played an increasingly important role in contemporary organizations, and longitudinal surveys of Fortune 1000 firms have shown a steady increase in the use of team-based structures moving from less than 20% in 1980, to roughly 50% in 1990, to over 80% in 2000 (Garvey, 2002). This has prompted a great deal of research on teams, much of which has focused on either the impact of various dimensions of team structure or team processes and outcomes (Ilgen, Hollenbeck, Johnson, & Jundt, 2005).

One of the most critical aspects of structure that has to be determined within any work group is where the locus of formal authority for decision-making is going to reside. Members of the group may have different ideas about what they each should be doing based upon variability in their experiences, preferences, knowledge, or information held. In centralized structures, authority is concentrated at the top of the team and a formal team leader has responsibility for making decisions. In contrast, in decentralized structures, authority and decision-making responsibility are dispersed downward and outward through the hierarchy, and individual team members are empowered to make their own decisions (Pugh, Hickson, Hinings, & Turner, 1968).

A great deal of research has been conducted on the virtues and liabilities of alternative team decision-making structures (Bonaccio & Dalal, 2006; Ilgen et al., 2005), and several formal theories have been developed that describe why, when, where, and with whom various structures work well or work poorly (Burns & Stalker, 1961; House, 1971; Pennings, 1992; Vroom & Yetton, 1973). All of these theories emphasize that there is "no one best way" to structure decision-making in teams, and they all describe contingencies associated with why one structure or another is best depending upon the team's goals and strategy. These theories have been supported by empirical research and are routinely incorporated into textbook treatments of this topic, as well as popular press accounts of management teams.

For example, if one were to peruse the popular press, it is clear that when it comes to centralization and decentralization, different organizations are moving in diametrically opposite directions for managing this aspect of structure. Within the United States government, the Department of Homeland Security represented a major centralization of formerly autonomous units (Peters, 2004) whereas the Veterans Administration's new system of publicly supported, but regionally autonomous health centers reflected a move toward decentralization (Rogers, 2005). In the technology sector, IBM has moved in the direction of centralizing operations

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(i.e., creating a small number of super-regional centers that replaced a larger number of smaller and locally managed units; Flynn, 2000), whereas Microsoft has moved toward decentralizing operations (i.e., creating separate business units, such as Home Entertainment, Internet Services, Operating Systems, etc. that generate their own profit and loss statements; Greene, Hamm, & Kerstetter, 2002). In retail, Home Depot centralized purchasing operations that used to take place at nine different regional centers into one single location in Atlanta, while its primary competitor, Lowes, decentralized the same purchasing decisions to regional directors (Foust, 2003).

On the one hand, even though these organizations are moving in opposite directions, all this movement from one structural alternative to another could be rational in the sense that both formal theories and empirical evidence suggest there is "no one best structure" when it comes to centralization versus decentralization (e.g., Burns & Stalker, 1961; Pennings, 1992). At both the organizational level and the team level, one can find conceptual justification and empirical data from cross-sectional studies that suggest that each alternative has its own set of virtues and liabilities (e.g., Drazin & Van de Ven, 1985; Hollenbeck et al., 2002). If it is true that one structure is associated with one desirable outcome, whereas the other structure is associated with a different desirable outcome, then it might be tempting for an organization or work group to *change* their structure if there was a corresponding *change* in goals or strategies.

On the other hand, the cross-sectional and static nature of the current set of theories and data on this topic does not logically support the dynamic generalization that is often inferred in both the popular press and the academic literature. That is, one can accept the static conclusion that one structure is best for one outcome whereas the alternative structure is best for a different outcome, and still challenge the dynamic conclusion that if a group or organization has a *change in goals or strategies* they should *change their structure*. This dynamic generalization implies that "history does not matter" and that the experience of having worked within one structure has no impact on the ability of one to adapt to the alternative structure. However, emerging evidence suggests that in most group contexts, history does matter and past experience has a pronounced impact on future processes and outcomes (McGrath, Arrow, & Berdahl, 2000).

More specifically, when it comes to changes in team structure, research based on Structural Adaptation Theory (SAT) has shown directly that it is more difficult for teams to change their structures in some directions than in others. For example, the major dimensions of team structure work to create teams where the members are either highly tightly coupled or loosely coupled (Orton & Weick, 1990; Weick, 1976), and one of the major propositions of SAT is that is easier for teams to shift into more loosely coupled structures relative to more tightly coupled structures. For example, research on SAT has found that it is more difficult to shift a team's *task allocation structure* from a loosely coupled divisional scheme to a tightly coupled functional scheme than it is to change their structure in the alternative direction (Moon et al., 2004). Similarly, with respect to *reward structures*, the evidence suggests that it is more difficult for teams to change from a loosely coupled individually-based system to a tightly coupled group-based system than it is to make the shift in the opposite direction (Johnson et al., 2006; Beersma et al., 2009).

The purpose of this study is to extend this line of research to the dimension of *decision-making structure*, and we present conceptual arguments and empirical data that challenge the notion of symmetry in structural movement, documenting that it is more difficult for teams to shift from a decentralized to centralized structure than it is to shift in the opposite direction. This has theoretical implications for extending the breadth of Structural Adaptation Theory, but also has practical implications for organizations that might be contemplating changing their structures, hoping to accrue benefits promised by current contingency theories that may never materialize.

Structural Adaptation Theory

Contingency theories can be found throughout the applied social sciences (Miner, 1984). The underlying theme of every contingency theory is that there is no single correct answer to any complex problem. Whereas a certain approach may be effective in one situation, that same approach may be ineffective in a different situation. The static predictions from these contingency theories are plausible and generally supported by cross-sectional empirical research that takes a "fit versus misfit" approach to structural contingencies. However, in many organizations, the objectives of groups may change over time, and an organization may decide to place a greater emphasis on efficiency or adaptability relative to the past emphasis they placed on these objectives. This may prompt managers of those organizations to consider *changing* their structures, and as we showed in our opening to this manuscript, one can document many real world examples in the popular press of organizations moving toward greater centralization or greater decentralization in the hope of achieving enhanced efficiency or adaptability.

The longitudinal interpretation of these theories presumes, however, that structural movement is a symmetric process that proceeds in either direction with equal ease. That is, it implies that it is as easy to shift from a highly decentralized system that relies on delegation into a highly centralized system that relies on a hierarchical leader, as it is to shift in the opposite direction. Structural Adaptation Theory calls this assumption into question, and suggests that certain forms of structural movement are easier to execute relative to others.

Structural Adaptation Theory specifies three specific aspects of team structure that constitute tight versus loose coupling; task allocation structure (functional versus divisional), reward structure (group-based versus individual-based), and decision-making structure (centralized versus decentralized). As Ilgen et al. (2005) document, these are three independent dimensions of structure that have dominated past theory and research on teams. Many studies have examined the advantages and disadvantages of each of these elements of structure in a cross-sectional sense where each dimension is isolated. In general, tight coupling promotes efficiency (and related outcomes such as depth of knowledge, performance quantity, implicit coordination), whereas loose coupling promotes adaptability (and related outcomes such as breadth of knowledge, performance quality, flexibility, and personal responsibility).

A team is tightly coupled if the task allocation structure is functional (high task interdependence and specialization between members), the reward structure is group-based (all members receive the same reward based on the group's overall outcome), and the decision-making structure is centralized (decisions are made by a team leader). In this configuration, when perceived by either members or outsiders, the team becomes the "figure" and the individual team members essentially become the "ground" in terms of the overall gestalt. In contrast, a team is loosely structured when the task allocation is divisional (members have broader and autonomous responsibility), the reward structure is individual-based (members, rewards are based only on their own performance), and the decision-making structure is decentralized (lower level members make their own decisions). Pushed to an extreme, totally decoupled teams start to resemble just a collection of individuals and cease being perceived as a team.

Although each of these structural alternatives has advantages and disadvantages, as Weick has noted, tightly coupled structures demand the development of norms, processes, and emergent states like implicit coordination, cohesiveness, and trust that are not necessarily required in loosely coupled structures where each person is more autonomous and working largely on their own (Orton & Weick, 1990; Weick, 1976). Conceptual discussions of tightly versus loosely coupled structures did not discuss *shifts* between the types of coupled structures (Orton & Weick, 1990; Weick, 1976); Structural Adaptation Theory (SAT) picks up at this point (Beersma et al., 2009; Johnson et al., 2006; Moon et al., 2004).

SAT holds that although it is possible for teams to develop norms that support tight coupling (e.g., experience working together) this is more complex than just setting individuals out to work on their own. The reason for this is that the requirements to build a social infrastructure in support of interdependence are more complex than the requirements for independent work. That is, the shift toward tighter coupling is more difficult because it requires team members to unlearn old norms associated with autonomous work where each member can do largely what he or she pleases, for new norms that emphasize the development of cooperative processes and emergent states like implicit coordination, cohesiveness, and trust. That is, there is more proactive interference (Bouton, 1993; Jonides et al., 2008) when learning new roles when one shifts from loosely to tightly coupled systems relative to that experienced when one shifts from tightly to loosely coupled systems. This argument forms the conceptual basis for the generic SAT asymmetry proposition and explains why shifts toward tighter coupling are more difficult to execute relative to shifts toward looser coupling.

Prior research on Structural Contingency theory has not directly examined longitudinal structural change in tightly controlled experimental studies; however, a set of recent studies tested this general proposition from SAT for two different specific aspects of structure. Moon et al. (2004), tested this proposition with respect to task allocation structure and found that it was more difficult for individuals to shift from loosely coupled divisional structures to tightly coupled functional structures than it was for teams to shift in the alternative direction. This was shown to be directly attributable to proactive interference of past communication norms and information sharing practices that harmed performance when teams shifted toward tight coupling, but did not harm performance when teams shifted toward loose coupling.

Johnson et al. (2006) and Beersma et al. (2009) tested the general SAT proposition with a different dimension of structure; reward structure. In line with the general proposition of SAT, they found that it was more difficult for teams to shift from individually-based competitive reward structures to group-based cooperative structures than it was for them to shift in the opposite direction. This was shown to be directly attributable to proactive interference of past information sharing practices and unmet expectations for coordination that harmed performance when teams shifted toward tightly coupled reward structures, but did not harm performance when teams shifted toward loosely coupled reward structures.

To date, the propositions from Structural Adaptation Theory have taken place with one dimension isolated at one time. The existing tests focused on task allocation structure (Moon et al., 2004) and reward structure (Beersma et al., 2009; Johnson et al., 2006), however, there has never been any test for decision-making structure. Manipulations of task allocation structure have compared functional versus divisional structures where reward structure and decision-making structure was held constant. Manipulations of reward structure have compared group-based versus individually-based pay schemes and held task allocation structure and decision-making structure constant. In this study, for the first time, we extend the testing of this theory by manipulating decision-making structure while holding task allocation structure and reward structure constant. We also examine mediators (efficiency and adaptability) that differ from previous studies (behavioral coordination, unmet expectations, social loafing, information sharing, helping behavior), but hold the task and the dependent variable constant. We believe this is what a programmatic approach to theory testing requires. That is, one tries to hold everything constant except the specific constructs and variables that are the focus of different studies.

Contingency theories and decision-making structure: achieving cross-sectional fit

In the area of team decision-making structure, there are several formal theories that lay out many of the contingencies associated with centralized versus decentralized structures. In fact, one can identify at least three specific theories that formally describe the conditions that are conducive to centralized decision-making versus decentralized decision-making, including Structural Contingency Theory, Path Goal Theory, and the Vroom–Yetton Model.

For example, at the group level, Vroom and Yetton (1973) outlined four decision-making styles (i.e., autocratic, consultative, group-based, and delegation), as well as a set of rules for determining which style is most appropriate for different situations. Similarly, at the group level, the Path Goal Theory of leadership identifies four parallel decision-making styles (directive, supportive, participative, and achievement-oriented) and argues that leaders should choose the style that best reflects the demands of the current situation as defined by a specific set of rules (House, 1971). Each of these theories describes specific conditions where a centralized strategy (such as autocratic or directive) is more appropriate, as well as alternative conditions conducive to a decentralized strategy (delegation or achievement-oriented). However, all of these predictions are based on theories that do not formally recognize the role of the group's history in their conceptual argumentation and data sets that are cross-sectional in nature. Thus, whereas one can directly draw from the existing knowledge base when making predictions about the virtues of *centralized structures* or *decentralized structures* in a static, cross-sectional sense, the current knowledge base is insufficient for making predictions about the virtues of *centralizing structures* or *decentralizing structures* in a dynamic and longitudinal sense. That is, what we know about centralization and decentralization as nouns may not generalize to what they mean as verbs.

Centralized structures and efficiency

Most contingency theories involving decision-making structures propose that centralized structures relying on a central hierarchical leader are generally more *efficient* relative to decentralized structures that distribute authority to separate independent team members. For example, Structural Contingency Theory (SCT; Burns & Stalker, 1961) argues that relative to lower level team members, a formal hierarchical leader often has a better "big picture" understanding of the entire task environment. From that position, he or she can often recognize and remedy problems with imbalanced workloads that might not be possible in decentralized structures where each team member is focused solely on their own goals and workload. A formal leader can also coordinate efforts to avoid redundancies in actions, and avoid potential cannibalization of efforts where the decisions made by one independent team member counter or nullify the decisions made by a different team member.

Centralized decision-making structures are also more efficient because a formal leader can often serve as a vehicle for ensuring that best practices are diffused throughout the entire team. Individual team members in decentralized structures, on the other hand, tend to focus on their own work and fail to benefit from the team-wide variability in experiences that might point to efficiency gains. Centralized structures are also more efficient because they tend to reduce decision-making errors because lower level decisions have to be approved, and hence, every decision gets a "second look" prior to execution. This process is especially valuable if the formal leader has more experience, knowledge or information relative to the lower level team members, which decreases the probability that team members will mishandle routine matters.

Decentralized structures and adaptability

According to SCT, these advantages of centralized decision-making structures are offset by certain disadvantages that play to the strengths of decentralized structures. In general, the efficiency of centralized structures often results in a lack of adaptability, which is instead, generally associated with decentralized structures. For example, although the "second look" aspect of centralized structures may prevent some routine errors, if it is applied to all decisions, this greatly slows the speed of decision-making processes. A formal leader that has to make or approve too many decisions can get overloaded and delays at this level might preclude the ability of lower level team members to flexibly exploit time sensitive opportunities that may not have been anticipated a priori.

In a similar fashion, because formal leaders are often one step removed from the task environment, they may not be able to recognize and take advantage of local idiosyncratic elements of the task experienced by different team members working in different areas. Thus, decision-making in centralized structures can become overly standardized by cognitive processing limitations of the formal leader. This person may be insensitive to local variations that may be exploited by lower level decision-makers if they had the authority to act unilaterally. In addition, the very process of making their own decisions and getting feedback on them promotes enhanced trial and error learning on the part of lower level team members who are more empowered in decentralized structures (Kirkman & Rosen, 1999; Spreitzer, 1995). The potential to learn more directly (as opposed to vicariously) from this more intensive decision-feedback experience, in turn, promotes the personal development of lower level team members, expanding the adaptability of the team to respond to future novel or non-routine conditions.

Structural Adaptation Theory: executing longitudinal change

In line with previous tests of Structural Adaptation Theory, we predict that it is more difficult for teams to shift in the direction of tighter coupling (from decentralized to centralized) relative to looser coupling (centralized to decentralized). Although centralized structures should be more efficient than decentralized structures, when team members have had a history of being empowered to make their own decisions, the requirements for efficiency gains (i.e., the development of information sharing norms, trust, shared mental models, and effective behavioral coordination) will be difficult to achieve. Thus, teams that shift into a centralized structure from a previous decentralized structure are less likely to obtain the efficiency benefits of that structure for psychological reasons, even though for structural reasons, they are likely to experience the negative effects related to lack of adaptability. That is, there is likely to be much more proactive interference (Bouton, 1993; Jonides et al., 2008) when learning new roles that force one to surrender decision-making authority and autonomy relative to learning new roles that grant individuals more decision-making authority and autonomy.

Based upon the theories and literature described above, we propose and test three specific formal hypotheses. First, based upon SAT, we propose a moderator hypothesis:

Hypothesis 1. Performance at Time 2 will be an interactive function of Time 1 and Time 2 Structure, such that the performance difference between teams that *transition into centralized* structures and teams that *only experience centralized* structures will be greater than the difference between teams that *transitioned into decentralized* structures and teams that *only experience decentralized* structures.

Second, because the primary positive feature of centralized structures relative to decentralized structures is their increased efficiency and their primary liability is lack of adaptability, we propose a mediator hypothesis:

Hypothesis 2. The structural asymmetry effect will be mediated by efficiency and adaptability, such that if one controls for efficiency and adaptability, the deleterious effects associated with decentralized to centralized structural shifts will be eliminated.

Finally, we contend that the specific reason for this mediation effect is that teams that shift into a centralized structure will experience the negative aspects of that structure (lack of adaptability), but not the positive aspects of that structure (efficiency). Thus,

Hypothesis 3. Centralization will be positively related to efficiency and negatively related to adaptability for teams that do not shift structure, but for teams that shift structure, centralization will be negatively related to both efficiency and adaptability.

Methods

Participants and task

Participants were 372 students from a management course at a large 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 based upon the team's performance. 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 forces that enter the region (see Hollenbeck et al. (2002) for a detailed description of the task).

The DDD grid

Each team member's computer screen contained a geographic region partitioned into four quadrants of equal size. Each team member is assigned responsibility for one of the four quadrants. 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."

The objective of the simulation was 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 lost points. Points were also lost if friendly tracks are engaged or if unfriendly tracks are engaged in the neutral space.

Bases and vehicles

Assigned to each team member's base of operations 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. Assets vary on four capabilities, vision, speed, fuel capacity, and power, which are distributed among the assets so that each has both strengths and weaknesses.

For example, the AWACs had the greatest range of vision but no power to engage unfriendly tracks. The fighter jets were fastest, but only had enough power to engage a small percentage of tracks. The tanks had enough power to successfully engage all tracks, but were the slowest in terms of movement around the grid. The helicopters had moderate levels of power (they could successfully engage roughly two-thirds of the tracks) and moderate speed, but were limited in range (how long they could stay out on patrol). The diverse and specialized nature of the assets placed a premium on the team's ability to use the right asset for the right task at the right time, and this typically required a great deal of real time communication and coordination.

Tracks

Tracks were radar representations of friendly and enemy forces, and generally entered the screen from the sides of the grid. Initially, when a track enters someone's detection ring (the radar range supporting detection at a "presence or absence" level), they showed up as unidentified. Once the track entered someone's identification ring (the radar range supporting a definitive classification) it can be identified. Identified tracks have power levels of 0 (friendly), 1, 3, or 5. If a team member disables a friendly track, this was a major decision-making error and points are deducted from their score. If the track is unfriendly, a team member should engage the track. If the asset used for engagement has enough power, the track can be disabled.

Some successful engagements, however, are more efficient than others. The most efficient engagement occurs when the power of the asset matched the power required of the track exactly. For example, if the track had a power of 1, the perfect asset to engage that track is one of the jets because they too had a power of 1. Similarly, if the track required a power of 3, then the perfect asset to engage that track is one of the helicopters because they had a power of 3. Finally, if the track requires a power of 5, the tanks are the *only* asset that had sufficient power (5).

Finally, there were several tracks that were novel and did not appear in the training session. The nature of these novel tracks could only be learned by collective trial and error experience. So for example, the track designated as U+ was friendly, but the team could only learn this when a player engaged it and was then informed they hit a friendly track (and thus made an error). Teams had to adapt to these because they were not covered by their training session. Adaptable teams shared this information with everyone to make sure that this only happened once, but teams that failed to learn and adapt from their experience often repeated this error. Similarly, if a track such as U# was engaged by a jet and then by a helicopter but neither had enough power to destroy the track, this meant that this track had a power of 5 and could only be engaged by a tank. Adaptive teams learned this quickly and adjusted so that the slow moving tanks could be put in position to engage such tracks in the future.

Note that the tanks, because they could destroy *all* tracks, were not an effective diagnostic tool for learning the nature of the novel tracks. All tracks were destroyed when engaged by tanks, and hence the team could never learn from this engagement whether the unidentified track was a 1, 3, or 5. Thus, teams that failed to learn from their collective experience tended to overuse this one asset because it allowed them to destroy tracks even though they never learned the true nature of the novel tracks. This resulted in long-term problems because the tanks were the only asset that could engage certain tracks and teams that were efficient and adaptive "saved" this asset for just the right occasion. They did not over-utilize it engaging tracks that could be engaged by other faster assets such as jets or helicopters.

Procedures

When participants arrived for their scheduled 3 hour experimental session, they indicated their agreement to participate by signing a consent form and were told the general purpose of the study. Each team member was then randomly assigned to a four-person team and to a specific base of operations. Because we were primarily focused on the role of structure (centralized versus decentralized), we randomly assigned team members' positions to ensure that any differences between teams utilizing centralized versus decentralized structures could not be attributed to certain characteristics of the central team member, such as higher skills or ability.

Training took approximately 90 min. The first 30 min were devoted to declarative knowledge regarding all the various details relevant to playing the DDD. The second 60 min 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 min of hands-on practice, each team member had 1 AWACS plane, 1 jet, 1 helicopter, and 1 tank at his or her base of operations. Although they were free to make decisions on their own, each team member also practiced transferring vehicles to his or her teammates and practiced launching transferred vehicles from his or her base of operations. As a result, each team received the same training regardless of experimental condition (centralized versus decentralized).

Following the break, teams completed two 30 min experimental sessions. Teams were randomly assigned to either a centralized or decentralized structure during the first session and to either a centralized or decentralized structure during the second session, creating a 2 (Time 1 Structure) by 2 (Time 2 Structure) factorial design. Prior to beginning each session, teams encountering a centralized structure were informed that a central team member would be responsible for launching and transferring all 16 vehicles to his or her teammates for the duration of the task. Each team member was also told that they needed to work with the central team member in order to keep their forbidden zones free from enemy targets. Teams encountering a decentralized structure were informed that they each had responsibility for 1 AWACS plane, 1 jet, 1 helicopter, and 1 tank. They were also told that they would be unable to transfer vehicles to one another during the task, but that they could assist each other in executing tasks. After finishing both experimental sessions, participants were thanked and debriefed.

Manipulations

Team structure

A centralized team structure was created by giving decision-making authority to a single team member, who was responsible for all 16 vehicles during the task. He or she had to launch the vehicles from his or her base and transfer them to the appropriate team member. When team members engaged tracks on the screen, the vehicles were returned to the central team member's base of operations, giving him or her control over who engaged what track when and with what type of vehicle. Because it took time to reload and refuel each asset, it was critical that teams deployed their assets efficiently, using the right asset for the right task, even though some assets could execute all or most of the tracks.

The central team member could also ensure that his or her teammates did not take actions that violated the established rules of the task because in order for team members to engage enemy tracks on the screen, the central team member had to approve their actions. Although the central team member was given primary decision-making power, he or she was only able to monitor approximately 25% of the screen with his or her base of operations. The other three team members were responsible for monitoring and protecting the majority of the screen to ensure that the team lost the fewest amount of points. As a result, in order for the team to succeed, all four team members had to remain actively involved in the task.

A decentralized team structure was created by dividing responsibility for all 16 vehicles equally between the four members of the team. Each team member had the authority to launch 1 AWACS plane, 1 jet, 1 helicopter, and 1 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 act on their own without prior orders or having been granted hierarchical permission. Team members could initiate action the moment they felt it was necessary without wasting time waiting for directions or approvals and could amend or modify the established standardized procedures in order to deal with idiosyncrasies in their local environments. Thus, there was no designated central team member in this condition. All team members were empowered to make their own decisions.

Although the team members' roles in the decentralized structure allowed for more discretion, they still had to coordinate and work together. Both structures created task interdependence within the teams, although clearly, the members of centralized teams were more tightly coupled and more interdependent relative to decentralized teams. Still, even in the decentralized teams, there was task interdependence because the tracks moved from one quadrant to another. Thus, team members needed to warn each other of unfriendly tracks headed their way, and had to "hand-off" friendly tracks that moved from one quadrant to another. There were also instances of workload distribution inequalities, where one team member would get more traffic than he or she could handle while at the same time, his or her teammates were experiencing little or no traffic. This meant that in order to be effective, all the teams had to balance workload in real time, shifting tasks from one person to another.

Measures

Team performance

The two main objectives of every DDD team are to (1) engage enemy tracks as quickly as possible once they enter one of the restricted zones and (2) avoid engaging friendly tracks. These two objectives are reflected in the team's offensive and defensive scores during the game. The team's offensive score starts at 1000 points and goes up 5 points every time an enemy target is cleared from one of the forbidden zones. If a team member clears an enemy target outside the forbidden zones or clears a friendly target anywhere on the screen, the team's offensive score drops by 25 points. The team's defensive score starts at 50,000 and decreases 1 point for every second an enemy resides within the restricted zone. If an enemy enters the highly restricted zone, the team's defensive score begins to drop by 2 points per second. Team performance was measured by standardizing and combining each team's offensive and defensive scores. Thus, conceptually, team performance required the team to make both fast and accurate decisions, and then execute those decisions in a flexible and efficient manner.

Because we were primarily interested in how well teams were able to shift from one structure to another, we also standardized overall performance scores within each structure. Thus, when we compare teams that *switched into a centralized structure* with teams that had *only experienced centralized structures* in the past, these comparisons were based on the exact same metric and the exact same task conditions. Similarly, when we compare teams that *switched into a decentralized structure* with teams that had *only experienced decentralized structures* in the past, these comparisons were based on the exact same metric and the exact same task conditions.

Efficiency

As we noted earlier, one key aspect of this task is that teams needed to make efficient use of their resources. That means that each known or routine track is engaged with the one asset that has the exact same power, and that the team avoid using high power assets such as the tanks (and to a lesser extent, the helicopters) to engage low power tracks. The simulation captured this by calculating the difference between the power required and the power employed for each successful engagement. This number was zero only if the team used the perfect asset for each and every engagement. This number departed from zero each time a high power asset was over-utilized. We reversed coded this variable so that a high score reflects high levels of efficiency. In addition, as we did with performance, we standardized this variable within structural conditions, focusing mainly on differences within structures among teams that shifted versus stayed the same, not on differences between structures.

There were several underlying causes of this type of "wasting of resources," all of which reflected inefficiencies in the team's operations. In some cases, this resulted from the team member's failure to understand the "big picture" and balance a workload distribution problem. This generally meant that the team member with the highest workload was not receiving help from those with lower workloads, and hence had to use whatever he or she had available at the moment to engage a track, regardless of its efficiency. In other cases, this resulted from redundancy in actions, in the sense that one team member was in the process of setting up an efficient engagement, but another team member, unaware of this, felt the need to quickly dispatch a track, even if he or she could only do this inefficiently.

Adaptability

As we noted earlier, there were many non-routine or novel tracks that were not part of the formal training, but that the team had to adapt to during the simulation. The simulation recorded how well teams did in adapting to these novel tracks by counting the frequency with which the team engaged novel tracks with the exact asset that was required. Thus, this measure is similar to the efficiency measure, only it just focuses on the non-routine tracks that the team had to adapt to in real time. Teams that failed to learn and adapt from their trial and error experience often made decision-making errors with respect to these novel tracks, failed to engage them altogether, or engaged them with the wrong asset. For example, some teams that were low in adaptability destroyed all of the unidentified tracks with the one asset they knew would work each time (the tanks), which as we noted earlier, had negative long-term implications for performance. The correlation between efficiency and adaptability measures was .02, supporting the notion that these are unique and independent criteria.

Results

Hypothesis 1 stated our central proposition regarding the asymmetrical nature of adapting team decision-making structures in alternative directions. Specifically, we predicted that Team Performance at Time 2 will be an interactive function of Time 1 and Time 2 Structure, such that the performance difference between teams that *transition into centralized* structures and teams that *only experience centralized* structures will be greater than the difference between teams that *transition into decentralized* structures and teams that *only experience decentralized* structures.

Table 1a shows the results of regressing Team Performance at Time 2 on Time 1 Structure, Time 2 Structure, and their interaction. There were no main effects for Time 1 Structure or Time 2 Structure on Time 2 Performance. However, the interaction of Time 1 and Time 2 Structure explained a statistically significant 5% of the

Table la
Results of hierarchical regression analysis.

Step	Independent variable	Time performance (Time 2)		
		β	R^2	ΔR^2
1	Time 1 Structure	.10	.01	.01
	Time 2 Structure	.00		
2	Time 1 Structure × Time 2 Structure	.38*	.06*	.05*

Note. $N = 93$ (decentralized condition: $n = 47$, centralized condition: $n = 46$).
* $p < .05$.

Table 1b
Mediation of structure by efficiency and adaptability.

Step	Independent variable	Team performance (Time 2)		
		β	R^2	ΔR^2
1	Efficiency	.33**	.51*	.51*
	Adaptability	.63**		
2	Time 1 Structure	−.04	.52	.00
	Time 2 Structure	.02		
3	Time 1 Structure × Time 2 Structure	−.01	.52	.00

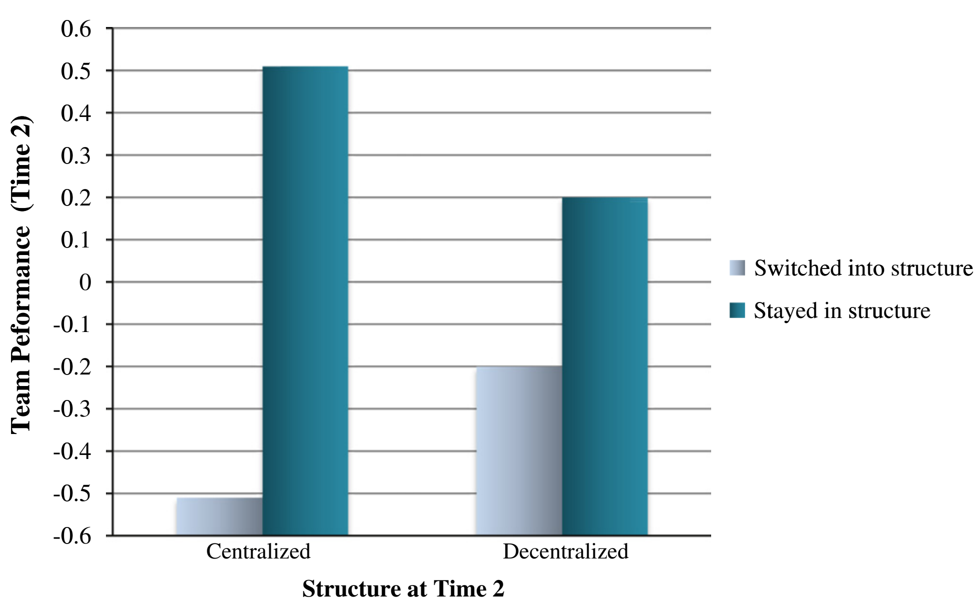
Note. $N = 93$ (decentralized condition: $n = 47$, centralized condition: $n = 46$).
* $p < .05$.
** $p < .01$.

variance. The nature of this interaction is plotted in Fig. 1 and shows that relative to teams that had only experienced centralized structures, teams that *transitioned into* centralized structures performed very poorly. In contrast, the difference in performance between teams that shifted into decentralized structures and those that had only experienced decentralized structures was much less pronounced. A set of planned comparison tests of means also supported this inference in the sense that the mean difference between the centralized–centralized teams at Time 2 was significantly greater than the decentralized–centralized teams ($p < .05$); however, the difference between the decentralized–decentralized teams and the centralized–decentralized teams at Time 2 was not significant (decentralized–centralized = −.51; centralized–centralized = .51; centralized–decentralized = −.20; decentralized–decentralized = .19). Thus, the team's history mattered, and teams found it more difficult to make the decentralized to centralized transition.

Hypothesis 2 stated that this asymmetry effect documented in the test of Hypothesis 1 will be mediated by efficiency and adaptability, such that if one controls for efficiency and adaptability, the deleterious effects associated with decentralized to centralized structural shifts will be eliminated. Table 1b shows the results of repeating the regression run to test Hypothesis 1, only after controlling for the effects of efficiency and adaptability in a prior hierarchical step. This table shows that efficiency and adaptability were both valuable, and that together they explained a statistically significant 51% of the variance in Team Performance at Time 2. In addition, consistent with Hypothesis 2, once these variables are entered into the equation, the interaction between Time 1 and Time 2 Structure on performance is no longer significant.

Hypothesis 3 suggested the moderated mediation hypothesis that centralization will be positively related to efficiency and negatively related to adaptability for teams that do not shift structure, but for teams that shift structure, centralization will be negatively related to both efficiency and adaptability. Consistent with this hypothesis, we found that the correlation between Time 2 Structure (where Decentralized was coded 0 and Centralized was coded 1) and efficiency to be +.32 ($p < .05$) for former centralized teams, but −.29 ($p < .05$) for former decentralized teams. The difference between those two correlations was also statistically significant ($z = 2.94$, $p < .001$), and shows directly that teams that shifted into centralized structures did not experience the supposed benefit of their new structure. In contrast, regardless of their past history, both sets of centralized teams experienced the negative effect of that structure, in the sense that the correlation between structure and adaptability was −.68 ($p < .05$) and −.51 ($p < .05$) respectively for teams that had a past history of centralization or decentralization. The difference between those two correlations was not statistically significant.

In addition to testing for history effects via the comparison of correlations, we also plotted the moderated mediation models for teams with alternative histories via unstandardized path coeffi-



Note. Switched into structure signifies that the team structure changed from Time 1 to Time 2. Stayed in structure signifies that the team remained in the same team structure for both Time 1 and Time 2. Team Performance at Time 2 was standardized within Time 2 condition.

Fig. 1. Team performance at Time 2 as a function of Time 1 and Time 2 Structure.

cients. The top portion of Fig. 2 shows that for teams that had a centralized history, having a centralized structure at Time 2 was positively related to efficiency and negatively related to adaptability, and efficiency and adaptability were in turn both related to performance. According to the Sobel (1982) test, the mediation effect of efficiency was statistically significant ($z = 1.76$, $p < .05$), as was the mediation effect for adaptability ($z = -3.18$, $p < .05$). Thus, for teams with a centralized history, there were *positive and negative* aspects associated with their centralized structure at Time 2. In contrast, the bottom portion of this figure shows that for teams with a decentralized history, having a centralized structure at Time 2 had *negative effects on both* adaptability and efficiency, which were again, both related positively to performance. According to the Sobel test, the mediation effect for adaptability was statistically significant ($z = -3.80$, $p < .05$), but this was not the case for efficiency ($z = -.86$). These tests also support the overall conclusion that teams that shifted from decentralized structures into centralized structures experienced the liability of this structure (the negative path through adaptability), but not the virtue of this structure (the lack of a positive path through efficiency).

Discussion

Organizations are increasingly relying on team-based structures, and in team contexts, one has to formally specify where the locus of decision-making authority is going to reside in a structural sense. One option is to place authority in the hands of a single team member who assumes a centralized leadership role, whereas another option is to distribute decision-making authority to lower level team members who are empowered to make their own decisions. As we showed in our introduction, at any one point in time, different organizations can be found to be moving in different directions on this dimension in pursuit of alternative means of achieving a competitive advantage. Past research on team structure, however has tended to be cross-sectional, and the research reported challenges the dynamic generalization of past structural contingency research to conditions where teams actually change their structure.

Theoretical contributions

The problem of what decision-making structure to employ is certainly not a new problem in the applied social and behavioral sciences, and there is an extensive set of theories (including but not limited to Structural Contingency Theory, Path Goal Theory, and the Vroom–Yetton Model) that have examined the virtues and liabilities of these two different structural approaches to team decision-making. Based upon these theories and findings, prescriptions in the form of contingency statements have been derived that specify the why, when, where, and with whom alternative structures should be used. The consensus in the current literature suggests that centralized structures are best when one is operating in contexts where the goal is to achieve efficiency, but that decentralized structures are superior if one is trying to achieve adaptability. Thus, one should choose the structure that is the best fit for one's current goal. In addition, these same theories and literature are used to make prescriptions about what to do if one's goals or priorities *change*. However, we have shown in this study that one has to take care in generalizing from the current literature, based largely upon a static logic and cross-sectional data, to contexts where teams are considering *changes* in structure. Although it is almost a throwaway line in most discussion sections to say, "We need more longitudinal research on this topic," the current study shows dramatically why this can make a difference for substantive theoretical reasons.

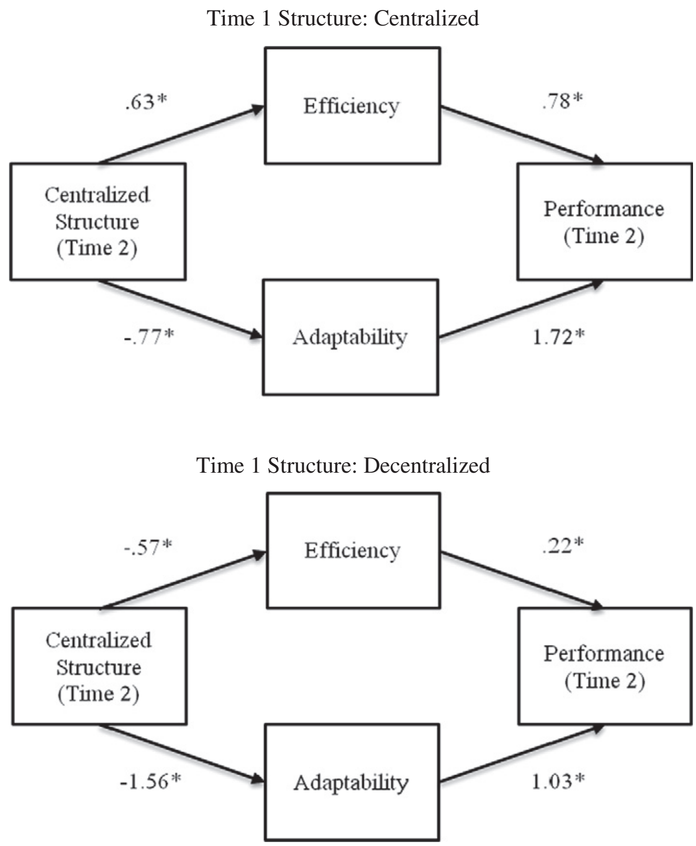
Unlike most previous research on decision-making structures, this study actually observed teams trying to *change* from one kind of structure to another, and we found that "history matters" when it comes to structural transitioning. Teams that were asked to shift from tightly coupled centralized structures to loosely coupled decentralized structures seem to have little difficulty making this transition, but teams that were asked to shift in the other direction struggled a great deal. These teams experience the liability of their new centralized structure in terms of lower adaptability, and they did not seem to display the efficiency advantages that are traditionally associated with centralized decision-making structures. Hence, the benefits promised by current contingency theories did not materialize for these groups.

Instead, both the presence and the direction of the asymmetry effect that we documented here were consistent with Structural Adaptation Theory (SAT). This theory proposes that transitions from simple, loosely coupled systems into more complex, tightly coupled systems require more time and effort to execute relative to changes that move a team from a tightly coupled system to a loosely coupled system. That is, if one converts the adjectives centralized and decentralized into the verbs *centralizing and decentralizing*, one sees that centralizing is a much more difficult process relative to decentralizing when one is talking about change. Thus, team adaptation has to be understood *not as a generic process* that phrases the problem in terms of "can this team adapt," but instead as *a directional process* that phrases the problem in terms of "can this team adapt *to this, from that*?" Many teams that might be able to adapt from centralized to decentralized decision-making structures may not be able to adapt in the alternative direction.

This study on *decision-making structure* (vertical differentiation) extends previous research on SAT that has found parallel effects for other dimensions of structure. For example, in terms of *task allocation structures* (horizontal differentiation), Moon et al. (2004) found that it was more difficult for teams to shift from loosely structured divisional structures to tightly coupled functional structures than it was for them to switch from functional to divisional structures. In the terms of SAT, functional structures represent more tightly coupled systems because the high degree of task specialization means that interdependence requirements are high. Individual team members in functional structures can accomplish very little on their own, and they need to build efficient communication networks with other team members to perform effectively, and this often takes more time and energy. In contrast, divisional structures create broad roles and capacities, thus reducing interdependency requirements, and decreasing the need for communication between team members. Teams seem to be able to shift into this type of divisional structure seamlessly, but they struggle to shift out of it.

Similarly, both Johnson et al. (2006) and Beersma et al. (2009) supported predictions derived from SAT with respect to *team reward structures*. Both of these studies documented that teams responded much more in line with existing theories when asked to adapt from group-based cooperative to individual-based competitive reward structures than when they were asked to transition in the opposite direction. In terms of SAT, cooperative structures that reward individual team members equally based on the overall performance level of the team are tightly coupled systems. Cooperative reward systems require the team to develop trust and collaborations skills, and this seems to take time and energy. In contrast, competitive reward structures, where each member's outcomes are based strictly on their own behaviors, are simple and loosely coupled systems with lower levels of interdependence. People seem to be able to transition into this type of reward structure much more readily than they are able to transition out of it.

In this study, for the first time, we extend the testing of this theory by manipulating decision-making structure while holding task allocation structure and reward structure constant. We also examine mediators (efficiency and adaptability) that differ from previ-



Note. All paths are unstandarized coefficients. $N = 46$ for the centralized condition; $N = 47$ for the decentralized condition. * $p < .05$.

Fig. 2. Mediated models for Time 1 and Time 2 Structure.

ous studies (behavioral coordination, unmet expectations, social loafing, information sharing, helping behavior), but hold the task and the dependent variable constant. Thus, when the results of all of these studies are taken as a whole, they suggest that tightly coupled systems characterized by centralized decision-making, functional task allocation, and cooperative rewards are easy to transition *from*, but difficult to transition *to*. In contrast, loosely coupled systems characterized by decentralized decision-making systems, divisional task allocation, and competitive rewards seem to be easy to transition *to*, but difficult to transition *from*. This seems to be attributable to the fact that the virtues associated with tightly coupled systems require efficient coordination, effective communication networks, and trust – all of which take more time and effort to develop. In contrast, the virtues of decentralized, divisional, and competitive structures such as increased adaptability, speed, and accountability – seem to manifest themselves more quickly.

Practical implications

In terms of the specific findings of this test of SAT, the results of this study caution organizations with respect to making certain types of shifts in the decision-making structures of their teams. For example, a manager confronted by a large number of poorly performing teams that happen to be structured in a centralized fashion might consider shaking things up by changing the team's decision-making structure toward greater decentralization. This could indeed be a sound decision if the former problems of these teams could be attributed to the traditional liabilities associated with centralized structures such as lack of adaptability. Changing the decision-making structure might alleviate these problems. On the other hand, if a manager is confronted by a large number of poorly performing teams that happen to be structured in a decentralized fashion, the strong temptation to go in and centralize the team's decision-making structure may need to be resisted. The evidence from this study suggests that the traditional virtues associated with centralized structures such as efficiency, may not manifest themselves due to the team's prior history. In general, SAT cautions against structural changes that create tightly structured teams, implying that the bar should be set higher prior to instantiating structural changes in this direction relative to making changes toward looser coupling.

The results of this and other studies testing SAT do not imply that organizations should abandon tightly coupled team structures or take them off the table when considering changes. As we have noted, there are clear and well documented limitations to decentralized decision-making structures, divisional task allocation structures, and competitive reward structures. Given the right circumstances and contingencies, shifting into a more complex and tightly structured system may be an absolute requirement for some teams. The results of this study merely imply that one has to have more patience and lower expectations when one is shifting teams in directions toward tighter coupling, than when one is shifting teams toward looser coupling. The need for this would not be apparent from current contingency theories that assume that the adaptation process is generic and symmetric, as opposed to directional and asymmetric.

Finally, although we studied the extremes of decision-making structures (totally centralized versus totally decentralized) for ease of conceptual exposition and to enhance the power of our research design, real world organizations are not confronted with just these two alternatives. Team decision-making structure is best considered as a continuum anchored by these extremes and organizations may wish to avoid the kinds of drastic shifts in team structure we investigated here. Organizations could develop hybrid structures that lie in between these extremes and use these as either transition points on the way to the opposite structure or structural end points in and of themselves. Research has shown that organizations can benefit from compromising and placing teams in structures that offer a balance between the two extremes (Ellis et al., 2003).

Limitations and directions for future research

Although our results were generally supportive of SAT, a few limitations of the empirical study have to be noted. First, although the longitudinal nature of our data represented one of the unique aspects of this study, we were only able to observe teams during a short period of time. Thus, the short term, single-cycle nature of the task has to be considered as a potential boundary condition. On the one hand, this may imply that the results we observed here are actually under-estimates of what one might see in a longer, real-world context, where the history has developed over a much *longer* period of time. Future research needs to follow teams for longer time periods and more adaptation cycles to fully appreciate the role of the group's history in terms of influencing the group's future (Marks, Mathieu, & Zaccaro, 2001). Hopefully, our findings associated with just a single cycle played out over a short time period may motivate such future research, but research employing tasks other than this one is clearly needed.

Second, many real world instantiations of structural change are also accompanied by rationales for why the group is changing in one direction or another. The impact of this on reactions to change was not examined in this study. For example, the relative level of the team's past performance and the attributions for this may have implications for transitioning in and out of different structures. For example, if a loosely coupled team was performing poorly and the team members attributed this to lack of ability and teamwork, they might respond better to a shift toward tighter coupling than if the poor level of performance had been attributed to bad luck. Research on action and transition cycles in team (Marks et al., 2001) suggests that the type of information processing that occurs between performance episodes has important implications for future action episodes. Hence, leaders need to help teams come to a common understanding of how to interpret their own history during transition cycles, and this view of leaders as history teachers is a unique insight that SAT brings to this phenomenon.

Third, given the nature of our research questions, we felt that a laboratory context represented the best venue to cleanly test our hypotheses without interference from external confounds. Real organizations that are making structural shifts are usually so different on so many dimensions from organizations that are standing pat with their structures that making meaningful comparisons between the two is virtually impossible. The ability to untangle what part of the overall difference is due to structural change and what is due to all the myriad of confounding influences motivated us to examine this in a context where the level of experimental control allows for a more rigorous inference regarding directional effects of structural change. Nevertheless, one needs to keep all the limitations associated with this type of venue in mind when drawing inferences.

Conclusion

There is no ''one best way'' to design a group's or organizations decision-making structure. There are virtues and liabilities associated with both centralized and decentralized systems, and several different contingency theories that spell these out in some detail. For this reason, as in the examples that we cited at the beginning of this article, it is natural for organizations to consider changing their structure from one system to another if they change their goals or strategies. However, our results suggest that, in line with Structural Adaptation Theory, some changes are more natural relative to others. Groups that move from a more highly ordered state to a less highly ordered state (centralized to decentralized) seem to derive the benefits of the new structure but not its traditional liabilities. In contrast, groups that move from a less ordered state to a more highly ordered state are attempting to reverse entropy, and struggle with this specific type of adaptation. As a result, the static predictions made by many contingency theories such as the Vroom–Yetton Model, Path Goal Theory, and Structural Contingency Theory, fail to hold up as teams dynamically shift from one structure to another.

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