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CUTTHROAT COOPERATION: ASYMMETRICAL ADAPTATION TO CHANGES IN TEAM REWARD STRUCTURES

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To examine social interdependence theory dynamically, we develop a theory of structural adaptation based on "asymmetric adaptability." We suggest that it is more difficult for teams to shift from competitive to cooperative reward structures than from cooperative to competitive structures. We show that teams that switch from competitive to cooperative reward structures demonstrate "cutthroat cooperation." In their performance, marked by lower team decision accuracy and higher speed, they resemble competitive teams more than cooperative teams. Information sharing, also lower for cutthroat cooperation teams than for other cooperative teams, partially mediates the relationship between reward structure and accuracy.

In response to the increased use of team-based structures in organizations, research on work groups has expanded a great deal. Along with the increased attention devoted to work groups has come an emerging conceptual consensus that teams embedded in organizations are best viewed as complex, adaptive, and dynamic systems that perform over time (McGrath, Arrow, & Berdahl, 2000). Unlike past research, which studied groups in static, single-cycle contexts and that emphasized *which* predictor variables related to performance, recent research has focused on *how* teams adapt and change over time and on factors that explain *why* certain variables affect performance and adaptability (Ilgen, Hollenbeck, Johnson, & Jundt, 2005). This new conceptualization stresses the importance of how a group's past history reaches forward to affect its current processes and outcomes, an emphasis that has led to new insights regarding the validity of previously accepted theories and hypotheses (Harrison, Price, Gavin, & Florey, 2002).

Contingency theories are particularly affected by this change in conceptualization. In general, the basic idea in all contingency theories is that there is no one best way to bring about high performance. Instead, contingency theories suggest that certain practices or variables may be positively related to performance for one group of people or set of conditions, but unrelated (or negatively related) to the same outcome for a different group of people or set of conditions. Contingency theories are ubiquitous in the organizational sciences, partly because they seem conceptually commensurate with real-world complexity (Miner, 1984), and partly because they have been supported by empirical research documenting moderator effects in cross-sectional studies in divergent areas such as job design (Hackman & Oldham, 1976), leadership (House, 1971), socialization (Van Maanen & Schein, 1979), conflict management (Ruble & Thomas, 1976), executive compensation (Balkin & Gomez-Mejia, 1987), and organization design (Lawrence & Lorsch, 1967).

Despite the fact that most evidence for contingency theories relies on cross-sectional relationships, it is not uncommon for advocates of contingency theories to suggest that when conditions change, it is necessary for organizations or groups to change as well. They suggest that groups must change in order to maintain the appropriate fit between policies and practices on the one hand, and environmental conditions or goals on the other hand. The contemporary view of organizations and groups as dynamic entities whose current behaviors are shaped by their past history, however, challenges this "adaptive and longitudinal" interpretation of contingency theories. Although it may be true that *initially* one set of practices or policies might be best suited for a particular set of task conditions in a static sense, it may not be true that *sequentially* one should change policies or practices if there is a change in conditions. If a group's past history reaches forward to affect its current perceptions and processes, it may work against the efficacy of the change, and the initial contingency supported with cross-sectional data may not generalize to a longitudinal context.

The purpose of the present experiment was to test the dynamic limits of one contingency theory in particular: social interdependence theory (Deutsch, 1949). This theory addresses and compares competitive and cooperative reward structures and, like all contingency theories, suggests that no one reward allocation practice is best for all goals or task conditions. Rather, the effectiveness of each type of reward allocation rule depends upon a given group's goals or the nature of its task. Numerous studies have widely supported the cross-sectional predictions of social interdependence theory (Johnson, 2003), but the dynamic generalization of this theory, which implies that groups should *change* reward structures if there is a change in their goals or task, has never been tested.

We argue that the benefits associated with cooperative reward structures will be less forthcoming in groups that have a past history of competition. More specifically, we introduce the concept of *cutthroat cooperation*—the idea that the type of cooperation seen among past competitors does not resemble the type of cooperation seen within groups that have only experienced past cooperation. This difference in turn will reduce or negate the benefits one might expect from shifting reward structures in the direction specified by social interdependence theory.

Our arguments supporting these conjectures arise from our entropy-based theory of structural adaptation. This theory elucidates why some types of structural changes are more difficult for social systems to execute than are others and how such greater difficulty can be traced to the past history of the people residing in these systems. Drawing on a variety of literatures, we first outline an expansion of contingency theories in static contexts and examine information sharing as a possible mediator between reward structure and team performance. Then, expanding contingency theory to dynamic contexts, we show that structures that initially foster independent behaviors are not conducive to structural changes that are designed to promote interdependent action. In fact, contradicting dynamic generalizations of extant contingency theories, many supposed "adaptations" could even be maladaptive, depending upon the nature of the change that is being elicited.

DIMENSIONS OF TEAM STRUCTURE

Drawing on Burns and Stalker's (1961) theory of mechanistic and organic organizations, Wagner (2000) outlined two structural dimensions that are important in making contingency predictions in static contexts. First, centralization reflects the vertical aspect of structure (i.e., the degree to which decision-making authority is distributed among organization members). In a highly centralized team, the team leader retains control of most (or all) decisions regarding the team and its work. In a highly decentralized team, team members have extensive autonomy in making decisions affecting their individual work, and they often must reach consensus decisions on issues affecting the team as a whole. Second, departmentation reflects the horizontal aspect of structure (i.e., the degree to which the organization members' formal roles are specialized). In highly functional team structures, each team member is a specialist or has expertise that the other team members do not share. In highly divisional team structures, team members are undifferentiated generalists, and they share expertise.

These two dimensions form the basis of structural contingency theory, according to which these structures fit different task environments and promote different aspects of performance. Specifically, centralized and functional structures promote *accuracy* and are best suited to *predictable* environments, whereas decentralized and divisional structures promote *speed* and are best suited to *unpredictable* environments. These predictions have been empirically supported in numerous studies (Drazin & van de Ven, 1985; Ellis, Hollenbeck, Ilgen, & Humphrey, 2003; Hambrick, 1983; Hollenbeck et al., 2002).

Although these two dimensions clearly are important in determining a team's structural fit with its environment, they do not capture the entire conceptual space in which teams may be structured. Drawing on social interdependence theory, we suggest that *rewards* represent a third dimension along which team structure may vary and that structural contingency theory and social interdependence theory can be combined into a more integrative theory on the contingent impact of structure on performance. Following the structural contingency suggestion that there is no one best way to enhance performance, we propose that the three dimensions of structure—centralization, departmentation, and rewards—represent three parallel methods that impact performance in similar ways. Centralized, functional, and cooperative structures promote performance accuracy but decrease performance speed. Decentralized, divisional, and competitive structures, on the other hand, promote speed but decrease accuracy. Figure 1 shows these relationships as well as our model of a new integrative theory, structural adaptation theory. Because both centralization and departmentation have been the subject of extensive research, in this study we focused our efforts on the contingent effects of team reward structures as outlined by social interdependence theory.

SOCIAL INTERDEPENDENCE THEORY

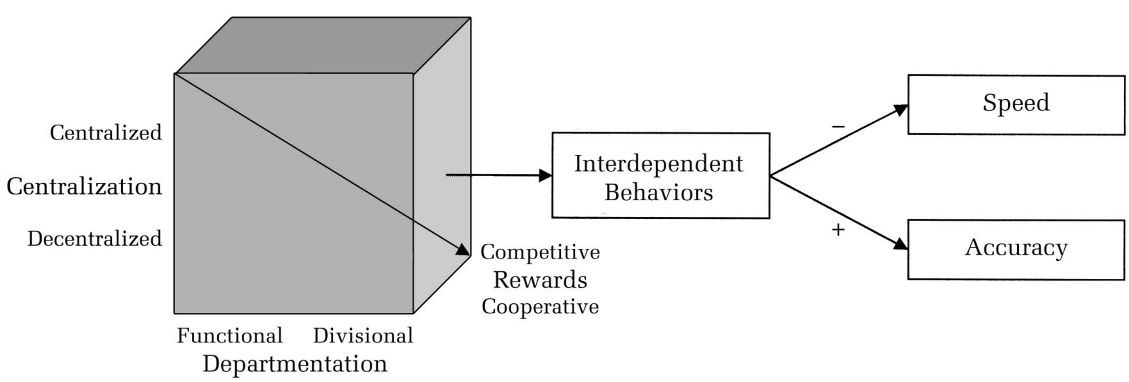
Social interdependence theory suggests that people's beliefs about how their goals are related determine the way in which these people interact, which in turn affects their performance (Deutsch, 1949). Central to this theory is the categorization of situations that create cooperative or competitive orientations. When a situation is structured cooperatively, individuals perceive that their goals are positively related to those of the other individuals in the situation. When a situation is structured competitively, individuals perceive that their goals are negatively related.

Deutsch proposed that reward structure was the primary determinant of within-group interaction patterns, leading to distinct effects on two dimensions of group performance. More than 100 years ago, Woodworth (1899) suggested that performance often reflects a trade-off between speed of performance and the accuracy of that performance. Regarding accuracy, *cooperative* reward structures encourage "promotive interaction" (Deutsch, 1949): group members engage in teamwork and mutually supportive behavior, whereby each group member looks out for the interests of the others in the group. In addition, insights and lessons learned by one member are often shared with others so that all benefit vicariously from one member's experiences. As team members share what they have learned, the number of team errors tends to decrease. Thus, according to social interdependence theory, cooperative structures promote accuracy of group performance.

On the other hand, rather than share information and experience, people placed in *competitive* structures tend to keep any valuable information proprietary. Even worse, people placed in competitive reward structures may engage in "contrient interaction" (Deutsch, 1949): group members actually impair the progress of others in an effort to gain some parochial advantage for themselves at the expense of the larger group or collective. Thus, competitive reward structures tend to reduce the accuracy of group performance.

The higher accuracy that arises out of cooperative reward structures, however, comes at a price. In an experiment that manipulated reward structure, Beersma, Hollenbeck, Humphrey, Moon, Conlon, and Ilgen (2003) showed that although cooperative rewards improved accuracy, they reduced speed. This finding has also been observed in the field with naturally occurring variability in reward structures (Jenkins, Mitra, Gupta, & Shaw, 1998). The mechanisms responsible for the differing effects of reward structure on these performance dimensions, however, have not been determined empirically. Steiner's classic work on group process (1972) discussed how both coordination loss and motivation loss can cause group productivity to be lower than the sum of what the individuals could accomplish independently. Although a great deal of research has examined motivation loss (in the form of social loafing or free-riding behavior [Latane, Williams, & Harkins, 1979]), relatively little

FIGURE 1
Model of Structural Adaptation Theory



research has examined coordination loss (Levine & Moreland, 1998).

Social interdependence theory suggests that one such coordination behavior that may act as a mediator between reward structure and performance is information sharing; the degree to which team members share information with each other may explain the differences in the accuracy and speed achieved with cooperative and competitive reward structures. Avoiding errors often depends on the sharing of information within a team; as team members learn through experience, they can help their teammates avoid errors by sharing the lessons they have learned. Thus, the more teams share information, the fewer errors they should make. Often, however, information cannot be shared while team members are engaging in productive work; they will sometimes temporarily halt production activities in order to communicate what they have learned to each other. Thus, the more teams share information, the more they will slow down their production.

Hypothesis 1a. When teams have no prior experience working under different reward structures, information sharing mediates the relationship between accuracy and reward structure (competitive or cooperative).

Hypothesis 1b. When teams have no prior experience working under different reward structures, information sharing mediates the relationship between speed and reward structure (competitive or cooperative).

STRUCTURAL ADAPTATION THEORY

Although the cross-sectional predictions that emerge from structural contingency theory and social interdependence theory are clear and well supported, the goals of work groups or organizations may change over time. The dynamic interpretation of these theories implies that structural movement is a symmetric process that can proceed in any direction with equal ease. According to our integrative theory of structural adaptation, however, certain forms of structural movement are easier for some groups than others. Specifically, and as depicted in Figure 1, our view is that movement that flows from functional, centralized, and cooperative systems to divisional, decentralized, and competitive systems is more natural than changes that flow in the opposite direction.

What is the causal mechanism that links these three dimensions of structure and explains why structural movement is a directionally dependent process that depends on a team's history? We suggest that, like physical systems, social systems can be differentiated by their degree of complexity and that more energy is required to maintain the structure of complex systems than that of simple ones. Moreover, according to the second law of thermodynamics, complex and organized systems have a natural tendency to break down over time into structures that are increasingly simple and chaotic:

> In a closed system, entropy does not decrease. That is, if the system is initially in a low-entropy (ordered) state, its condition will tend to slide spontaneously toward a state of maximum entropy (disorder). For example, if two blocks of metal at different temperatures are brought into thermal contact, the unbalanced temperature distribution (which represents a partial ordering of the energy) rapidly decays to a state of uniform temperature as energy flows from the hotter to the colder block. Having achieved this state, the system is in equilibrium. (*Encyclopedia Britannica,* 2004)

This approach to equilibrium is an irreversible process in closed systems, and the tendency toward equilibrium is so fundamental to physics that the second law is probably the most universal regulator of natural activity known in science.

Of course, social systems are inherently open (Katz & Kahn, 1978), and many forms of external energy can be employed to prop up and revitalize such systems over time, including incentives, charismatic leadership, cultural values, and so on. However, all else being equal, one might expect that a social system version of the second law of thermodynamics might nevertheless hold in some basic form. If this is the case, in the absence of any formal, external intervention, complex, highly ordered systems—those that are hierarchical, specialized, and marked by members' self-sacrifice—may inherently drift toward being disordered and chaotic systems that are decentralized, undifferentiated, and marked by members' self-serving behavior.

Thus, one can conceive of the change from centralized to decentralized, functional to divisional, and cooperative to competitive structures as being downhill shifts, in the direction of increased entropy, whereas changes in the opposite direction are uphill shifts, attempts to counter entropy. The arrow in Figure 1, which shows the ultimate downhill shift from a centralized, functional, and cooperative structure to a decentralized, divisional, and competitive structure, graphically represents this. Although it is possible to shift a social system from an unordered state to an ordered state, it requires more time, effort, and energy to carry off this type of structural movement than it takes to carry off a shift from an ordered state to an unordered state.

Empirical Evidence for Asymmetric Adaptability

Turning first to departmentation, we note that Moon and his colleagues (2004) provided a direct test of directional differences in structural adaptation, showing that when a task environment changed from one level of predictability to another, changes in departmentation did not result in outcomes consistent with structural contingency theory. Instead, in keeping with with entrainment theory (Ancona & Chong, 1996), past routines established early in a group's history reached forward and negated the supposed benefits of structural change. Thus, whereas teams found it natural to adapt in one direction (functional to divisional), they struggled to adapt in the opposite direction (divisional to functional). Moon and coauthors' explanation for this phenomenon centered on the degree to which teams engaged in *coordination behaviors*. Teams that started in a functional structure developed routines in which they coordinated their actions with other team members, and this coordination carried over when they switched to a divisional structure, but teams that started in a divisional structure found it difficult to develop these routines because of their history.

Regarding changes in centralization, Ellis and colleagues (2003) found that teams adapted much more effectively when they shifted from a centralized to a decentralized structure, rather than the other way around. In a centralized structure, decision-making authority rests primarily with a team leader, and team members are expected to collectively defer to this person, regardless of their own preferences. In decentralized structures, individual group members are free agents who can make their own decisions without waiting for approval or a top-down set of orders. Ellis et al. (2003) showed that giving team members more decision-making authority by shifting from centralized to decentralized structures was adaptive, but removing this authority by making the opposite shift was maladaptive.

Asymmetrical Adaptation: The Case for Reward Structures

In this study, we focused on reward structures (i.e., the third axis depicted in Figure 1). We expected that the relationship between reward structure and performance dimension found under an initial reward structure would not be found when the reward structure changed, because the nature of teams' past experiences changes their group dynamics in ways that make the teams incomparable to what they were when they had no history. This shift would demonstrate that the cross-sectional prediction of social interdependence theory does not generalize to dynamic contexts. Specifically, we argue that making the transition from a cooperative to a competitive reward structure is much less disruptive for teams than is making the opposite transition.

Empirical research suggests that team members operating under a cooperative reward structure establish positive relationships with each other that allow them subsequently to shift to a competitive reward structure with little carryover. Tjosvold, Johnson, Johnson, and Sun (2003) tested predictions based on social interdependence theory while examining the prior relationship of the team members, hypothesizing that "friends with a history of working together cooperatively may behave quite differently in a competition than would participants who dislike each other and have engaged in negative behavior toward each other in the past" (Tjosvold et al., 2003: 68). In a study of static groups, they found that when the relationship between current competitors had once been strong, they had positive feelings during the competition, perceived that the competition was improving their relationship and enhancing task effectiveness, had more motivation to take on new projects and collaborate with competitors in the future, and were less likely to quit their jobs than competitors without a strong prior relationship. We propose dynamic teams making a shift from cooperative to competitive reward structures experience similar feelings and perceptions, creating a state we will refer to as *friendly competition.* The past cooperative experiences of these teams create a strong foundation that allows them to engage in competition with each other, increasing their speed, but decreasing their accuracy, just as would be described by social interdependence theory.

On the other hand, we expect that the shift from competitive to cooperative reward structures will be much more disruptive for team performance. Teams that start out experiencing within-team competition develop a win-lose mind-set that fosters independent—or even contentious—behavior. Trust is low within such a group owing to a perceived discrepancy in the values of the team members (Sitkin & Roth, 1993), creating habits of independence. Trust builds up slowly over time (Jones & George, 1998), and a simple change in reward structure from competitive to cooperative is not likely to be enough to trigger changes in these habits and immediately foster interdependent behavior. Such a team, then, will be in a state that we refer to as *cutthroat cooperation,* and will be likely to engage in behaviors more consistent with its past competitive reward structure than with its current cooperative reward structure.

This phenomenon may at least partially account for problems associated with organizations that have recently merged with former competitors. Although many of these mergers (or acquisitions) look compelling on paper, they often fail to live up to expectations in reality. For example, combining government agencies such as the Central Intelligence Agency (CIA) and the Federal Bureau of Investigation (FBI) into a single new department like the Department of Homeland Security is likely to be difficult, because the past history of these units may negate the supposed benefits of structural realignment. The fact that these two agencies have a somewhat competitive past means that the problem of cutthroat cooperation may inhibit information sharing between the agencies and diminish the decision accuracy of the new department. Thus, although it has been suggested that the Department of Homeland Security provides additional incentive for the CIA and the FBI to communicate and integrate information, some have questioned the degree to which this will take place in practice. In fact, with respect to the new FBI-CIA cooperative structure, one analyst noted the following: "It hardly would be decisive in producing easier communication between the two agencies—*there is too much history,* not to mention constitutional concern" (Treverton, 2002: 68; emphasis added).

Because trust develops asymmetrically—that is, it is hard won but easily lost—we expect cutthroat cooperation to lead to conditions that will not conform to predictions drawn from social interdependence theory after a team changes reward structures. That is, instead of displaying the pattern social interdependence theory would suggest, high accuracy and low speed after shifting to a cooperative reward structure, teams in which cutthroat cooperation exists (henceforth, "cutthroat cooperation" teams) will carry over their past performance pattern and be higher in speed than in accuracy. Teams in which friendly competition exists ("friendly competition" teams), on the other hand, will *not* carry over their past performance pattern, but instead will have high speed and low accuracy, like other competitive teams.

Hypothesis 2. After experiencing a change in reward structure, friendly competition teams display a performance pattern similar to that of other competitive teams: fast but inaccurate.

Hypothesis 3. After experiencing a change in reward structure, cutthroat cooperation teams do not display a performance pattern similar to that of other cooperative teams (slow but accurate), but instead display a performance pattern similar to that of competitive teams: fast but inaccurate.

Finally, we expect that information sharing will be a highly important mediating influence because it lies at the core of why cooperative systems are more accurate (more information is brought to bear on tasks), but slower (information sharing takes time and detracts from ongoing task activities). Cutthroat cooperation teams share less information than teams that have only known cooperation, and this at least partially explains differences in performance.

Hypothesis 4a. Information sharing mediates the relationship between reward structure (cutthroat cooperation or consistent cooperation over time) and accuracy.

Hypothesis 4b. Information sharing mediates the relationship between reward structure (cutthroat cooperation or consistent cooperation over time) and speed.

METHODS

Research Participants and Task

Three hundred twenty undergraduate students in an upper-level management course at a large midwestern university were arrayed into 80 four-person teams. Individuals signed up for a research session at their discretion and were randomly assigned to teams within their session. Teams were randomly assigned to the experimental conditions under which they would participate in two 30-minute simulations, which we refer to as time 1 and time 2. The simulations were identical for both times and all conditions. Students received course credit for participation.

Participants engaged in a dynamic and networked computer simulation, which was a modified version of a simulation, Distributed Dynamic Decision-Making (DDD), developed for the Department of Defense for research and training (Miller, Young, Kleinman, & Serfaty, 1998). The version of the simulation used here, the MSU-DDD, was developed for teams of four members with little or no military experience. Because this simulation has been described in detail elsewhere (see Beersma et al., 2003), we provide only a brief description below.

Teams played a command-and-control simulation in which each team member sat at a networked computer. The individual team members were located in the same room but were unable to see the screens of their teammates. The teams' mission was to monitor a hypothetical geographic region, keeping unfriendly forces from moving into the restricted areas and allowing friendly forces to move about freely. Radar representations of these forces moving through the geographic space monitored by the team were known as "tracks." In monitoring the geographic space, each team member's base had radar capacities that covered only a portion of the area that needed to be monitored. Any track outside the radar range was invisible to the team members from their base. If the team members wanted to determine the nature of a track outside this ring, they could ask their teammates to provide that information to them, or they could launch a vehicle, move it near the track, and identify the track themselves.

Each team member had control of four vehicles that could be launched and moved to different areas of the screen. The vehicles had the ability to engage the various tracks as they moved through the geographic region. In total, the team had four AWACS planes, four tanks, four helicopters, and four jets. Each of these vehicles varied in its capacities on four different dimensions: (1) range of vision, (2) speed of movement, (3) duration of operability, and (4) weapons capacity. Each team member controlled one of each of the four types of vehicle, a distribution creating a divisional resource allocation structure whereby each team member could engage and disable any enemy track that encroached on his/her geographical region.

There were eight types of "standard tracks" that were known a priori to have specific characteristics, and these were taught in the training session prior to the start of the simulation. There were also four types of novel tracks, or "unknown tracks" that were not encountered during training. Thus, team members did not know whether the novel tracks were air or ground or friendly or unfriendly, and they did not know what power it took to disable them if they were unfriendly. The team members could only learn the nature of these tracks via deductive trial-and-error experience. The teams' overall objective, then, was to disable enemy tracks as quickly as possible if they entered the restricted airspace, while avoiding the errors of disabling friendly tracks or wasting resources by attempting to engage tracks with less power than was required.

Manipulations and Measures

Reward structure. Teams were randomly assigned to four experimental conditions. "Cutthroat cooperation" teams participated under a competitive reward structure at time 1 and a cooperative reward structure at time 2. "Friendly competition" teams participated under a cooperative reward structure at time 1 and a competitive reward structure at time 2. "Cooperative" teams operated under a cooperative reward structure both times, and "competitive" teams operated under a competitive reward structure both times.

The members of each team that operated under a cooperative reward structure both times were told that their opportunity to win a cash prize would require their team to be one of the top-performing teams in the experiment and that all team members would share equally in the reward. The members of each team that operated under a competitive reward structure both times were told that their opportunity to win a cash prize would require them to be one of the top-performing individuals in the experiment. Because the number of tracks was fixed at a relatively low number (19 tracks per quadrant), in order to obtain a score that was high enough to warrant winning the individual bonus in the competitive condition, an individual had to venture outside of his or her quadrant during the simulation. That is, he or she had to detect, identify, and attack tracks in teammates' quadrants, thus limiting the potential score of the other team members. Thus, it was nearly impossible for two members of one team to both qualify for the bonus in the competitive condition—if one team member gained the bonus, the others necessarily lost it.

Performance: Speed and accuracy. Both performance dimensions were objective and captured by the computer simulation. Speed of performance was a combination of attack speed and identification speed. Attack speed was the time elapsed between an enemy track's entering the restricted area and a team member's engaging it. Identification speed was the time elapsed between a track's entering the screen and a team member's identifying it. We standardized and averaged the two variables to create the speed composite, which was obtained at both times 1 and 2.

Accuracy of performance was a combination of friendly fire errors and missed opportunities. Friendly fire errors was a count of the number of times a friendly track was disabled. Missed opportunities was a count of the number of times an enemy track was engaged, but the vehicle used to engage the track did not have enough power to disable it. Both of these variables represented errors made by a team, and we standardized and averaged them to create the accuracy composite, which was obtained at both times 1 and 2.

Information sharing. Like the performance dimensions, the computer simulation captured the frequency of information-sharing behavior. In the simulation, when a team member identified tracks, that information appeared only on his or her own screen. Team members had the opportunity to transfer the identity of tracks so that when the tracks appeared in their teammates' detection rings, the full identity of the track would also appear. Thus, information sharing was a count of the total number of times a team member transferred the identity of tracks to teammates.

Data Analysis

The research design in this experiment incorporated both within-teams and between-teams components. Reward structure was a between-teams component, and performance measure (speed or accuracy) was a within-teams component. Because of this mixed design, we utilized repeated-measures regression to analyze the data. Repeated-measures regression partitions the variance in the dependent variable into two orthogonal sources: variability between teams due to differences in overall performance, and variability within teams due to differences in speed or accuracy (Cohen & Cohen, 1983). Performance is then regressed onto the predictors, and the variance explained by the predictors is compared to the appropriate variance partition (either the between-teams or within-teams variance). This procedure allows one to see how much of the appropriate variance component the predictors explain.

For example, reward structure was a between-teams manipulation (i.e., each team experienced only one sequence of rewards), and thus any variance explained by reward structure should be compared to the between-teams variance, rather than to the total variance in performance. The performance criteria constituted a within-teams variable (i.e., each team provided a measure of both speed and accuracy). This analytical method also allows one to test interactions of within-teams components (in our case, the performance dimensions of speed or accuracy) with between-teams components (i.e., reward structure). Significant interactions would indicate support for contingencies, like the ones predicted under social interdependence theory.

RESULTS

Table 1 shows the means, standard deviations, and intercorrelations for all of the variables in the experiment. Before testing our hypotheses, we first examined the predictions based on social interdependence theory at time 1 to see if previous findings would be replicated. Specifically, we tested whether at time 1, when teams had no prior experience working under different reward structures, reward structure and performance dimension would interact in such a way that competitively rewarded teams would be fast but inaccurate and cooperatively rewarded teams would be slow but accurate. We conducted this test because our hypotheses rested on the assumption that the cross-sectional predictions of social interdependence theory would be confirmed.

To test this assumption, we used a moderated repeated-measures regression analysis based on 160 observations: 80 teams observed on both speed and accuracy. There was no main effect for performance dimension ($\beta = .00$, n.s.; this finding was a natural result of standardizing the variables), and no statistically significant effect of reward structure

TABLE 1
Means, Standard Deviations, and Correlations[a]

Variable	Mean	s.d.	1	2	3	4	5	6	7
1. Time 1 reward structure[b]	0.01	0.50							
2. Time 2 reward structure[b]	0.01	0.50	.00						
3. Time 1 speed	0.00	0.88	−.25*	.03					
4. Time 2 speed	0.00	0.83	−.05	−.12	.59**				
5. Time 1 accuracy	0.00	0.79	.33**	.07	.15	.12			
6. Time 2 accuracy	0.00	0.85	.11	.09	.03	.12	.55**		
7. Time 1 information sharing	15.91	12.30	.61**	.06	−.17	−.11	.39**	.14	
8. Time 2 information sharing	16.98	14.06	.15	.62**	−.10	−.21*	.20*	.20*	.48**

[a] $n = 80$ teams.
[b] Dummy coded: −.5 = competitive; .5 = cooperative.
* $p < .05$
** $p < .01$

on overall performance ($\beta = .03$, n.s.). The interaction of these two variables, however, was highly significant ($\beta = .91$, $p < .01$, $\Delta R^2 = .08$), and it indicated that competitive teams were faster but less accurate, while cooperative teams were slower but more accurate. This pattern directly replicates the findings of Beersma and her colleagues (2003) and supports the contingency notion that no one reward structure is best for all dimensions of performance.

Hypotheses 1a and 1b propose that information sharing mediates the effects of reward structure on accuracy and speed at time 1. We tested the mediation hypotheses following the Baron and Kenny (1986) procedure requiring three conditions to be met if mediation effects are to be inferred: (1) the independent variable must be significantly related to the proposed mediator, (2) the independent variable must be significantly related to the dependent variable, and (3) the relationship between the independent and dependent variables is decreased when the mediation effects are controlled for.

Turning to the first of these conditions, we found that the relationship between information sharing and the reward structure at time 1 was statistically significant ($r = .61$, $p < .01$). Cooperatively rewarded teams shared significantly more information than competitively rewarded teams. With respect to the second condition for mediation, there were also significant relationships between reward structure and accuracy ($r = .33$, $p < .01$) and between reward structure and speed ($r = -.25$, $p < .05$). Regarding the third condition for mediation, when the relationship between information sharing and accuracy was controlled, the effect of reward structure on accuracy dropped significantly ($\beta = .15$, n.s.). This drop indicated that information sharing at least partially mediated the relationship between reward structure and accuracy, supporting Hypothesis 1a. When the relationship between information sharing and speed was controlled, however, the relationship between reward structure and speed did not drop significantly ($\beta = -.23$, $p = .05$), and thus Hypothesis 1b was not supported.

Our second and third hypotheses predict that friendly competition teams would exhibit a performance pattern similar that of to the other competitive teams, but that the cutthroat cooperation teams would exhibit a performance pattern dissimilar to that of the other cooperative teams. To test these hypotheses, we compared the performance patterns of these two conditions at time 2 with the results found at time 1, allowing us to see if findings differed significantly from the static predictions based on social interdependence theory. Specifically, we compared the time 2 performance pattern of the friendly competition teams with the time 1 performance pattern of teams operating under a competitive reward structure and compared the time 2 performance pattern of the cutthroat cooperation teams with the time 1 performance pattern of teams operating under a cooperative reward structure. To remove any time-related effects, we standardized all of the variables within time. To support the results of these tests, and to help rule out the possibility that remaining under a given reward structure for two consecutive time periods changes performance patterns, we conducted similar tests comparing the time 2 performance patterns of friendly competition and cutthroat cooperation teams with the time 2 performance of teams remaining under a competitive or cooperative reward structure.

Table 2 shows the results of a moderated repeated-measures regression analysis in which the time 2 performance of the friendly competition teams was compared to the time 1 performance of teams who were under a competitive reward structure. The main effect for performance dimension was significant ($\beta = -.24$, $p < .01$, $\Delta R^2 = .06$), indicat-

TABLE 2
Results of Repeated-Measures Regression Analysis of Performance of Competitive Teams on Performance Dimension and Reward Structure[a]

Step	Independent Variable[b]	β	ΔR^2	Incremental Variance within Teams[c]
1	Performance dimension	−.24**	.06	.13
2	Reward structure	.03	.00	
3	Performance dimension × reward structure	.26	.01	.01

[a] $n = 59$ teams (39 time 1 competitive, 20 time 2 friendly competition).
[b] Codings were as follows: speed = 1; accuracy = 2. Time 1 competitive = 0; time 2 friendly competition = 1.
[c] Within-teams factors accounted for 48 percent of the variance in performance.
** $p < .01$

ing that both types of teams performed better on speed than on accuracy. More importantly, however, the interaction term was not significant (β = .26, n.s.), indicating that the friendly competition teams did not differ significantly from the time 1 competitive teams in their pattern of performance. Results were similar when we conducted the same test using the time 2 performance of teams that remained in a competitive reward structure. Figure 2 plots the means for each condition. These results support Hypothesis 2 and indicate that the friendly competition teams exhibited a pattern of performance similar to that shown by other competitive teams.

In contrast, the cutthroat cooperation teams did not exhibit a pattern similar to that of other cooperative teams. Table 3 shows the results of a repeated-measures regression that compared the performance of cutthroat cooperation teams to the time 1 performance of teams who operated under a cooperative reward structure. The main effect for performance dimension was marginally statistically significant ($\beta = .17$, $p = .07$, $\Delta R^2 = .03$), meaning that the teams performed better on accuracy than on speed. The interaction term was statistically significant, however ($\beta = -.56$, $p < .05$, $\Delta R^2 = .03$), indicating that the cutthroat cooperation teams differed significantly in their pattern of performance from the time 1 cooperative teams. This pattern of results was nearly identical when we examined it using the time 2 performance of teams remaining in a cooperative reward structure. Figure 3 plots the means for each condition. These results support Hypothesis 3, in that the cutthroat cooperation teams did not display a performance pattern similar to other cooperative teams'; instead of being higher on accuracy than on speed, they were higher on speed than on accuracy.

We also tested Hypotheses 2 and 3 by using dependent-samples *t*-tests to examine speed and accuracy changes over time within each condition. Hypothesis 2 would be supported if we found that friendly competition teams performed significantly better on speed and significantly worse on accuracy at time 2 as opposed to time 1, and Hypothesis 3 would be supported if the cutthroat cooperation teams performed equally well on speed and accuracy at both time 1 and time 2. Indeed, the friendly competition teams increased on speed (mean difference = .26, $p < .05$) and decreased on accuracy (mean difference = −.32, $p = .07$), lending additional support for Hypothesis 2. This result is interesting when compared to the result for the teams that played under a cooperative structure both times. These teams did not show significant improvements on speed (mean difference = .09, n.s.) or accuracy (mean difference = .09, n.s.).

On the other hand, cutthroat cooperation teams actually became slower at time 2 (mean difference = −.34, $p = .05$) and did not gain on accuracy (mean difference = −.02, n.s.). These results tentatively support Hypothesis 3 but are somewhat surprising in that the cutthroat cooperation teams actually slowed down but remained low on accuracy—a finding suggesting they accrued the costs associated with cooperative structures but not the benefits. Contrast these with the results of the teams that were in a competitive structure both times. These teams actually became more accurate (mean difference = .37, $p < .01$) without losing

FIGURE 2
Plot of the Performance Patterns of Teams Operating under a Competitive Reward Structure

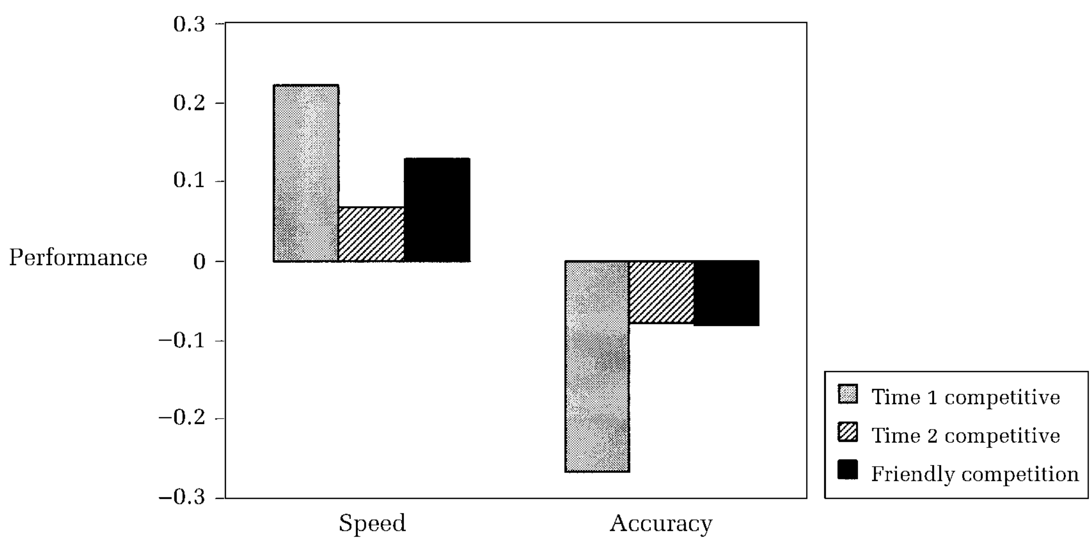
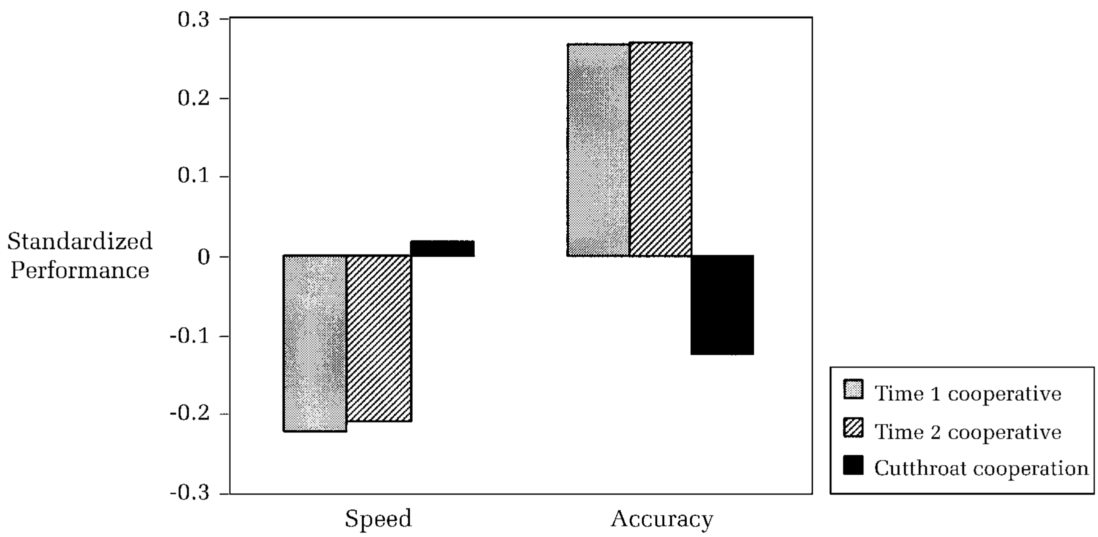


TABLE 3
Results of Repeated-Measures Regression Analysis of Performance of Cooperative Teams on Performance Dimension and Reward Structure[a]

Step	Independent Variable[b]	β	ΔR^2	Incremental Variance within Teams
1	Performance dimension[b]	.17*	.03	.06
2	Reward structure[c]	−.04	.00	
3	Performance dimension × reward structure	−.56*	.03*	.06

[a] n = 61 teams (41 time 1 cooperative, 20 time 2 cutthroat cooperation).
[b] Codings were as follows: speed = 1; accuracy = 2. Time 1 competitive = 0; time 2 cutthroat cooperation = 1.
Within-teams factors accounted for 48 percent of performance.
* $p < .05$

FIGURE 3
Plot of the Performance Patterns of Teams Operating under a Cooperative Reward Structure



speed (mean difference = −.02, n.s.). This pattern illustrates the true difficulty of adapting to reward structures that change from competitive to cooperative, and it seriously calls into question nondirectional generalizations of static social interdependence theory inferences to dynamic contexts.

Our fourth hypothesis was that information sharing mediates the effects of reward structure on accuracy and speed. More specifically, we expected that at time 2, cutthroat cooperation teams would be found to share less information than other cooperative teams and that controlling for the effects of information sharing would eliminate the effects for reward structure. As in the previous analysis, we standardized all of the variables within time to remove any time-related effects and followed the procedure outlined in Baron and Kenny (1986). The relationship between information sharing and the dummy variable that captured the distinction between time 1 cooperative teams and time 2 cutthroat cooperation teams was marginally significant (r = −.22, $p < .10$). Although the time 2 reward structure experienced by cutthroat cooperation teams did result in higher levels of information sharing relative to either set of teams operating under a competitive structure at time 2 (friendly competition or competition), the cutthroat cooperation teams shared significantly less information at time 2 than the cooperation teams.

There was a statistically significant, positive relationship between reward structure and accuracy (r = −.22, $p < .05$), but not between reward structure and speed (r = .14, n.s.). Thus, we did not continue the mediation analysis for speed. When the relationship between information sharing and accuracy was controlled, the effect of reward structure on accuracy became nonsignificant, dropping to −.17. This change indicated that information sharing at least partially mediated the relationship between reward structure and accuracy, lending support for Hypothesis 4a. We note, however, that the relationship between reward structure and information sharing was only marginally significant, so the results should be interpreted cautiously. Hypothesis 4b was not supported, as we found no support for the second condition for mediation.

DISCUSSION

Social Interdependence Theory in a Dynamic Context

This experiment tested whether predictions based on social interdependence theory (demonstrated in teams by Beersma et al. [2003]) would generalize to dynamic situations. According to social interdependence theory, teams that are rewarded competitively will be fast but inaccurate, whereas teams that are rewarded cooperatively will be slow but accurate. This experiment replicated those findings and found that the relationship between reward structure and accuracy can be explained partially by teams' levels of information sharing. This finding furthers the work of Beersma and her colleagues by establishing one of the causal mechanisms underlying differences in accuracy across reward structures.

In keeping with the findings of Moon and his colleagues (2004), we discovered that teams that are subject to changing reward structures also demonstrate asymmetric adaptability. Specifically, teams that started in a cooperative reward structure were able to effectively manage the shift to a competitive reward structure, demonstrating the predicted competitive performance pattern of being high on speed and low on accuracy. These friendly competition teams were able to engage in constructive competition with each other. In contrast, teams that started in a competitive reward structure were not able to effectively manage the shift to a cooperative reward structure, demonstrating a performance pattern that was more consistent with that of competitively rewarded teams than that of cooperatively rewarded teams. These cutthroat cooperation teams were significantly lower on accuracy than teams that had only experienced cooperative rewards, and this could be explained partially by the amount of information shared within each team. Teams that had only known cooperative rewards engaged in significantly higher levels of information sharing than the cutthroat cooperation teams, and these differences in information sharing partially mediated the relationship between reward structure and accuracy. Thus, although the friendly competition teams did not appear to carry over their habits from time 1, the cutthroat cooperation teams did, inhibiting them from experiencing the predicted benefits of the cooperative reward structure. Our findings with respect to information sharing as the mediating influence suggest that this asymmetry in reactions to reward structures can be attributed to the fact it takes longer to create trust than to undermine it.

Practical Implications

This research has implications for social interdependence theory and contingency theories in general and also has direct applicability to team management. For example, imagine a team that had been cooperatively rewarded because management desired to emphasize quality in the development of a product. On their next project, management wishes to deemphasize product quality and instead emphasize the speed of getting the next product to market. If the theoretical conclusions we offer here generalize to that setting, shifting the team to a competitive reward structure should accomplish just that. If, however, a team was competitively rewarded in a first project to emphasize speed to market, and in the next project management wishes to emphasize quality and deemphasize speed, shifting the team to a cooperative reward structure is not likely to accomplish the desired change in emphasis. Instead, the team is likely to engage in behaviors that are more consistent with their previous reward structure, and the result will be team performance that is relatively fast but not accurate.

This implication is all the more compelling given the call for rewarding teams on the basis of their team product rather than individual products in order to motivate group-oriented behavior (Campion, Medsker, & Higgs, 1993). Our data indicate that this reward structure may indeed work if team-based rewards are implemented initially; in our experiment, teams that were rewarded cooperatively at the beginning shared more information with each other than teams that were rewarded competitively. For existing teams, however, switching from individually based rewards to team-based rewards may not achieve the sort of group-oriented behavior that is hoped for; the cutthroat cooperation teams here shared significantly less information under a cooperative reward structure than did teams who were rewarded cooperatively both times.

We also suspect that this phenomenon is valid across levels of analysis. The example given earlier of the CIA and FBI hints that the problems of cutthroat cooperation occur at an organizational level, as well as with individuals in teams. Our observed phenomenon may also hold in multiteam systems in which teams must cooperate with each other to accomplish shared goals (Mathieu, Marks, & Zaccaro, 2002). In this case, teams that have had a history of competing with each other may find it difficult to cooperate when conditions change. For example, an organization may hold a competition among its product development teams to design a new product. After the competition, these teams may need to cooperate with each other to further develop the "winning" product, but their competitive history would likely inhibit their future cooperation.

Limitations and Boundary Conditions

This study has at least four limitations. First, the participants in this experiment were undergraduate students engaging in an activity for course credit and cash prizes, and they were not subject to the various real-world influences on organizational teams. On the one hand, this fact allowed us to reduce contaminating influences on the dependent variable; on the other, it means that we cannot be certain that the findings will generalize to other populations.

Second, this task, like many, may not be generalizable to all contexts. Although we contend that it is representative of the speed-accuracy distinction that is prevalent in many work teams (e.g., manufacturing teams, emergency medical teams, air traffic controllers, military strike teams), the strength of the parameter estimates—although not the direction—may vary across specific tasks.

Third, we only examined this phenomenon for two time periods in ad hoc teams. Thus, it is not known whether the problems of cutthroat cooperation persist over time. It may be that cutthroat cooperation is temporary, existing only during the transition phase immediately after a change in reward structure. It may also be that the phenomenon only arises among team members who do not know each other well. We would suggest, however, that the problems of cutthroat cooperation are likely to be much more pronounced in existing teams; that is, if a team has been competitively rewarded for two years and then is changed to a cooperative reward structure, the problems of cutthroat cooperation would likely be stronger and persist longer. Thus, our results may actually underestimate the effects.

Moreover, we recognize that at least two factors bound the theory outlined in this article. First, the task undertaken by a team may affect the degree to which cutthroat cooperation is a problem. Task interdependence has been shown to affect both group-oriented behavior and team performance (Bishop & Scott, 2000; Gully, Incalcaterra, Joshi, & Beaubien, 2002; Thompson, 1967). In this simulation, the degree of task interdependence depended on the team members' interpretation of the task. Highly interdependent tasks with more obvious demands may cause team members to engage in interdependent behaviors even when their structure may not encourage them. Thus, teams with high degrees of task interdependence may avoid the problems of cutthroat cooperation because they will not engage in the types of behaviors initially that one would expect from competitively rewarded teams.

Second, our research was carried out in a Western culture, and it is unclear whether it will generalize to other cultures. In particular, cultures in which collectivism is strong (Wagner, 1995) may find cutthroat cooperation to be less of a problem. Although the force of entropy would act similarly on them, they would be less likely to exhibit behavior conforming to social interdependence theory predictions initially. That is, highly collectivistic teams would be likely to share more information initially under a competitive reward structure and thus would find the shift to a cooperative reward structure easier than highly individualistic teams.

Directions for Future Research

The problem of cutthroat cooperation is a profound one with serious practical implications for teams in organizations. A clear next step, then, would be to establish ways in which the problem of cutthroat cooperation can be circumvented. We suggest six possible tactics that may help organizations overcome the problem of cutthroat cooperation and that may be fruitful avenues of future research.

First, organizations could implement transitional reward structures that do not go all the way or "none of the way," but rather, go part of the way when it comes time to change. That is, instead of switching directly from a completely competitive reward system to a completely cooperative reward system, an organization could implement elements of a cooperative reward system while retaining elements of the competitive system. For example, if an organization utilizes both base pay and variable pay in its compensation system, the base pay could continue to be individually based and the variable pay could be based on team output. This hybrid transitional structure may help teams to begin to develop the communication norms necessary for improvements in accuracy. Later, the base pay could be based on team output, completing the transition to cooperatively based rewards.

Second, organizations could implement hybrid reward structures from the start, rather than using purely competitive or cooperative reward structures. We speculate that hybrid reward structures present from the start are likely to bring about performance marked equally by speed and accuracy. If this is the case, these structures may be more robust than the pure reward types and therefore may not have to change at all. Alternatively, if an organization's management really wishes to emphasize accuracy at the expense of speed, fewer problems may arise if teams switch from a hybrid structure to a purely cooperative structure than if they switch from a purely competitive structure to a purely cooperative structure. One possible hybrid structure could be totally team-based rewards for accuracy-related behaviors with totally individually based rewards for speed-related behaviors. For example, members of a production team may be individually rewarded for the number of pieces they produce (a speed-related behavior) but be cooperatively rewarded for the number of defects they produce (an accuracy-related behavior). This type of tailored reward system may end up being the best of both worlds because it matches the reward system with the appropriate performance dimension.

Third, organizations could develop separate teams, some "built for speed" and others "built for accuracy." Rather than asking people to change their behavior when the organization needs to emphasize a different aspect of performance, management could plug in a different team whose reward system is consistent with the appropriate aspect of performance. For example, the military might utilize two different types of medical teams: one designed for speed and specializing in treating patients quickly (e.g., a MASH [mobile army surgical hospital] unit), and another designed for accuracy and specializing in minimizing errors (e.g., a clinical unit). One can imagine a situation in which the speed unit's function is no longer vital and reducing errors becomes more essential (for instance, active combat ends in a region but a military presence is still to be maintained). In this case, it may be more effective to substitute a different medical unit rather than to ask the speed unit to slow down and focus on accuracy.

Fourth, organizations may be able to select personnel who are better able to perform in cooperative settings. Individuals may possess dispositional characteristics that aid them in working cooperatively with other team members, even if the team members were originally competing against each other. Two examples of these types of dispositional characteristics may come from the five-factor model of personality (Costa & McCrae, 1992): agreeableness and extraversion. Costa and McCrae described agreeable people as "fundamentally altruistic, sympathetic to others, eager to help and be helped in return" (1992: 15). Extraverted people are thought to enjoy working in groups and being in the presence of other people (Costa & McCrae, 1992). Beersma and her colleagues (2003) found that overall, teams composed of highly agreeable and highly extraverted people performed better when rewarded cooperatively than did teams composed of team members with low scores on agreeableness and extraversion. On the basis of that finding, we suggest that teams made up of extraverted and agreeable people may be more willing to work together in cooperative situations after initially competing against each other. This cooperation, then, would likely lead to higher levels of accuracy. One potential problem that would need to be examined, however, is that teams composed this way may not perform as expected when initially rewarded competitively (that is, they may not exhibit high levels of speed and low levels of accuracy).

Fifth, team training may overcome the problems of cutthroat cooperation. Team leaders who recognize these problems could make concerted efforts to introduce cooperative norms to their teams. For example, training team members to share information—even during competitive tasks—could lead to easier transitions in the event of an environmental shift and the need to become more cooperative. More fundamentally, managers could focus on the organizational socialization process whereby new organization members learn and adopt organizational norms to inculcate cooperative norms in individuals regardless of the reward structure under which they will be expected to perform. This procedure might dampen the initial effects of reward structures we found in our experiment and ease transitions from competitive to cooperative reward structures.

Sixth, team member expertise may also reduce the problems of cutthroat cooperation. Successful adaptation has been shown to be associated with expert individual performance (Ericsson & Charness, 1994). As Berman, Down, and Hill (2002) noted, experience in team situations helps create both explicit and tacit knowledge (i.e., information developed without direct instruction). Both individual job experience and collective team experience provide a team with a pool of knowledge that team members can use to adapt to new situations. In particular, this knowledge can help the team deal with the challenges associated with the changing reward structure. High levels of experience increase the likelihood that team members will have encountered a given type of change before and can use the successes and failures from their past to help their current team bridge the transition.

Concluding Remarks

The recognition among teams researchers that teams are not static but instead perform in dynamic contexts over time (McGrath et al., 2000) challenges traditional approaches to theory building. One could accept the static logic underlying many contingency theories and yet still question the dynamic generalization of these theories when it comes to making recommendations about how teams should change. Although predictions based on contingency theories tend to be supported in static contexts, this study and others show they receive much less support when teams actually try to execute the structural changes recommended by those theories (Ellis et al., 2003; Moon et al., 2004). Instead, it appears that (1) *history matters,* and the past habits of team members developed through their entrainment to particular group structures reach forward, affecting their future behaviors, and (2) *direction matters,* in that certain structural changes are easier to execute than are changes in the opposite direction.

Structural adaptation theory explains why this might be the case. Generalizing the notion of entropy from the second law of thermodynamics in closed physical systems and applying it to social systems, which are more open, we have suggested that moving a system from a highly ordered state to a less ordered, more chaotic state may be more natural and easier to execute than changes in the opposite direction. Although the purpose of this study was not to test structural adaptation theory per se, we did examine one axis of this theory—reward structure—and the results we obtained, combined with those of previous studies on departmentation and centralization (Ellis et al., 2003; Moon et al., 2004), are at least consistent with that theory. It appears that functional, centralized, and cooperative reward structures represent more highly ordered systems, whereas divisional, decentralized, and competitive structures represent less ordered, more chaotic systems, and hence it is easier to move from the former to the latter than from the latter to the former.

Those making future theory-building efforts need to approach this task by explicitly asking not only what makes sense under different conditions, but also makes sense when groups experience a *change* from one set of conditions to another; that is, they need to ask how a team's history relates to the direction of change its member are being asked to make. Moreover, although it is a cliché to urge researchers to conduct longitudinal rather than cross-sectional studies, this recommendation seems particularly critical when it comes to contingency theories. Without examination of team behavior over time, researchers miss crucial time-related effects and may draw erroneous conclusions, supporting many different varieties of contingency theories that in fact fail to generalize to dynamic contexts.

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