

# TEAM MEMBER CHANGE, FLUX IN COORDINATION, AND PERFORMANCE: EFFECTS OF STRATEGIC CORE ROLES, INFORMATION TRANSFER, AND COGNITIVE ABILITY

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**We developed and tested the conditions under which team member change results in flux in team coordination and consequently affects team performance. Results showed that team member change caused high levels of flux in coordination when a member changed to a more strategically core role, or there was low information transfer during the change. Furthermore, coupling strategic “core role holder” change with the relative cognitive ability of a new member was associated with even greater levels of flux in coordination.**

Change happens. Whether at the individual, team, or organizational level, change impacts all aspects of organizational life (Weick & Quinn, 1999). Past scholars have had various views on the impact of change on organizations, groups, and individuals. As Kurt Lewin (1951: 624) pointed out, “You cannot understand a system until you try to change it.” Some have argued that change is detrimental because it disrupts internal processes and external linkages (e.g., Hannan & Freeman, 1984). Others have argued that change can be both a disruption and/or a powerful adaptive force (e.g., Amburgey, Kelly, & Barnett, 1993). In either case, scholars seem to agree that change causes some sort of disruption or flux within systems (Arrow & McGrath, 1995).

Although it is both intuitive and amply evidenced that change occurs frequently in teams (Arrow, McGrath, & Berdahl, 2000; McGrath & Tschan, 2004), studying team effectiveness conventionally takes an input-process-output (I-P-O) approach, wherein team inputs (e.g., member characteristics) are hypothesized to be transformed through team processes (e.g., coordination) to produce team outputs (e.g., goal accom-

plishment). That is, scholars frequently examine teams in static environments, assessing the relationships between variables in cross-sectional studies (Arrow et al., 2000).

With an increased focus on how teams develop, and a concomitant focus on time in teams (Ancona, 1990; Gersick, 1988, 1989; Lim & Murnighan, 1994; Tuckman, 1965; Tuckman & Jensen, 1977; Waller, 1999), recent research has begun to shed more light on change in team settings (e.g., Beersma, Hollenbeck, Conlon, Humphrey, Moon, & Ilgen, 2009; Choi & Levine, 2004; DeRue, Hollenbeck, Johnson, Ilgen, & Jundt, 2008; Droege & Hoobler, 2003; Gruenfeld, Martorana, & Fan, 2000; Hollenbeck, Ellis, Humphrey, Garza, & Ilgen, 2011; Kane, Argote, & Levine, 2005; Parker, 2003). Given that organizational teams do not exist in isolation without any changes to their membership, role structure, task, or external environment (and in fact, change is an integral part of a team’s life [Harrison & Humphrey, 2010; Okhuysen, 2001]), examining how change affects team work is critical.

One of the most common types of change in teams is member change. Members change for many reasons (e.g., new opportunities for a departing member, or low performance, or lack of critical skills). Yet the research on member change in teams often has focused on member change as a simple stimulating effect for team creativity (Choi & Thompson, 2005), rather than treating change as potentially disruptive to teamwork. Specifically, teams often experience disruptive events (Arrow et

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al., 2000; Brett, Weingart, & Olekalns, 2003; Okhuysen, 2001; Tyre & Orlikowski, 1994; Zellmer-Bruhn, 2003), which are change or nonroutine events followed by periods of rapid activity (Gersick, 1988, 1989).

Previous research (Gersick & Hackman, 1990; Langer, 1978, 1989; Louis & Sutton, 1991) suggests that disruptive events trigger active cognitive processing, and thus, teams experiencing disruptive events are more likely to mindfully examine their patterns of interaction for potential changes (Zellmer-Bruhn, 2003). In fact, according to Gersick's (1988, 1989) punctuated equilibrium perspective, teams experience a midpoint transition during which they radically change their structures in order to finish their tasks. What is missing in this conceptualization is an explanation of the contents of the black box—that is, what are teams experiencing when they are changing? By developing a construct that captures the disruption a team undergoes, we shine a light inside the black box by further articulating the role of flux in team performance and linking it to theory on equilibrium and established frameworks (e.g., Marks, Mathieu, & Zaccaro, 2001).

In equilibrium models of teams, flux describes the time after change occurs and before a team has restructured and is performing. In Marks and colleagues' (2001) framework, flux describes the period between the action and transition phases of team performance. Thus, immediately following disruptive events, teams' established patterns of interaction (e.g., coordination mechanisms) become destabilized (Arrow et al., 2000), causing *flux* (an unstable, unbalanced, or changing pattern of interaction in a collective) in team processes (e.g., coordination).

The purpose of this study was to identify several of the critical factors influenced by team member change and to test operationalizations of them. First, our study introduces “flux in coordination”—flux in the process of orchestrating the sequence and timing of interdependent actions (Marks et al., 2001)—as a central teamwork emergent state during member change. Missing from the current literature on team change is an examination of what exactly member change does to teamwork. In an effort to remedy that deficiency, we propose that member change affects the ability of a team to enact processes by creating flux in those processes.

We focus specifically on flux in coordination, as opposed to other team processes, primarily because of the centrality of coordination to teamwork models (e.g., Arrow et al., 2000; Brown & Eisenhardt, 1995; Gladstein, 1984; Nieva, Fleishman, & Reick, 1978; Okhuysen & Bechky, 2009; Salas, Dickinson,

Converse, & Tannenbaum, 1992; Shea & Guzzo, 1987; Tannenbaum, Beard, & Salas, 1992; Zalesny, Salas, & Prince, 1995) and the tight connection between coordination and the other constructs in our theoretical model (Faraj & Xiao, 2006). Following an existing discussion about the definition of coordination (Brannick, Roach, & Salas, 1993; Fleishman & Zaccaro, 1992; Zalesny et al., 1995), we relied on Marks et al.'s definition of coordination as “the process of orchestrating the sequence and timing of interdependent actions” (2001: 367–368). This process involves the management of synchronous and/or simultaneous activities, as well as information exchange and mutual adjustment of action (Brannick et al., 1993), as means to align the pace and sequencing of team member contributions with goal accomplishment. This component of teamwork is closely intertwined with the task work required of a team (Marks et al., 2001) and has been described as the essence of teamwork (Arrow et al., 2000). Moreover, coordination has been conjectured to be a critical team action process relating to team effectiveness (Marks et al., 2001) and has been meta-analytically supported as such (LePine, Piccolo, Jackson, Mathieu, & Saul, 2008). Consequently, we specifically argue that flux in coordination—the disruption a team experiences in its coordination mechanisms as a result of change—is a critical emergent state during member change. We further hypothesize that the inability to enact coordination processes following member change severely limits the effectiveness of a team.

Second, we focus on identifying how characteristics of the role (defined as an expected pattern or set of behaviors [Biddle, 1979]) held by a member being replaced influence teamwork (i.e., flux in coordination) during member change. Specifically, we examine how changes to more strategically core versus less strategically core roles (Humphrey, Morgeson, & Mannor, 2009) impact a team's ability to coordinate its behavior. Roles are strategically core to the extent that role holders encounter more of the problems a team needs to overcome, have a greater exposure to the tasks that the team is performing, and/or are more central to its work flow (Humphrey et al., 2009). Given that research suggests that roles are regarded as one of the fundamental, defining, and important characteristics of teams (Hackman, 1990; Katz & Kahn, 1978; Mumford, Campion, & Morgeson, 2006; Stewart, Fulmer, & Barrick, 2005), focusing on the characteristics of the role involved in member change will provide insight into teamwork beyond what typically is observed in team change research.

Third, we focus on identifying how characteristics of a member change itself influence teamwork.

We examine how information transfer (i.e., information dissemination during member change) influences teamwork. Access to and knowledge of relevant information often is thought to be critical for successful teamwork (Dennis, 1996; Wittenbaum, Hollingshead, & Botero, 2004), and inability to transfer relevant information should be detrimental to a team (Lewis, Lange, & Gillis, 2005).

Finally, we focus on identifying how the interaction between the characteristics of the role of a member being replaced and the characteristics of that role holder influence teamwork during member change. Ample evidence supports an effect of team member characteristics on teamwork (Bell, 2007; Stewart, 2006). In contrast, less theoretical and empirical research examines how the characteristics of a team member affect teamwork as a function of the role held by the member (cf. Hickson, Hinings, Lee, Schneck, & Pennings, 1971; Humphrey et al., 2009).

In our study, we were particularly interested in how the relative cognitive ability of a new member who replaces a departing member (i.e., the cognitive ability of the new member compared to the cognitive ability of the departing member) is more or less important as a function of the team role involved in the member change. Research suggests that cognitive ability is one of the more important factors for individual performance, as it impacts how quickly individuals learn (Hunter, 1986). Given that we are interested in member change, which involves some period of role acquisition by the new member, that individual's high cognitive ability should help a team better manage the change process.

In the remainder of the article, we provide a deeper discussion of flux in coordination, develop

our hypotheses, and present a test our theoretical model in a longitudinal study of 108 four-person teams completing a marketing simulation. It is important to note that because we are interested in how teams interpret and react to change, we take member change as a given in our theoretical model, which Figure 1 presents in full.

## THEORETICAL DEVELOPMENT AND HYPOTHESES

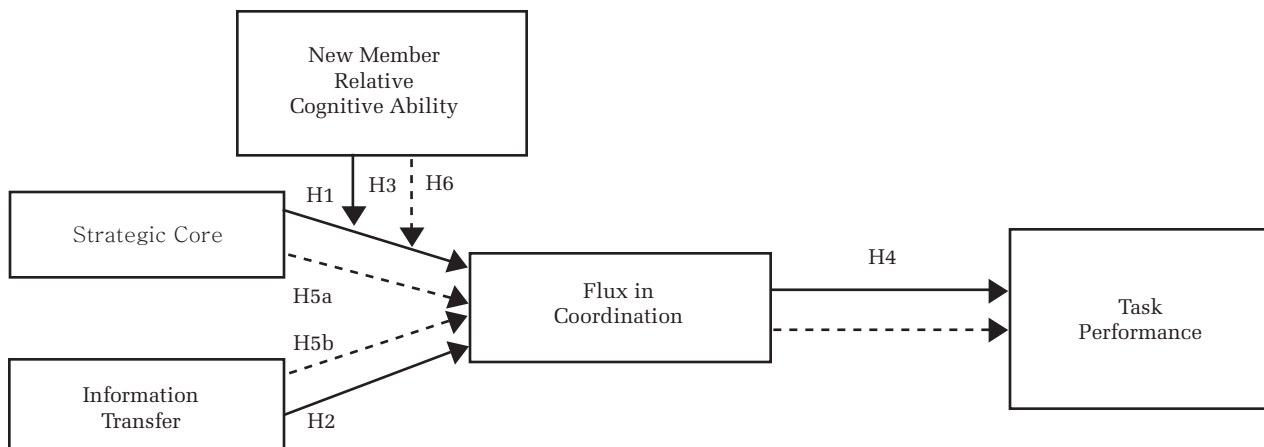
### Conceptualization of Flux

Because flux in coordination is a key construct of the tested model, we begin with the development of this construct and theory. No concept in the organizational sciences to date adequately addresses, conceptualizes, or measures the impact that change has on individuals, groups/teams, and so on. Research commonly theorizes or investigates general outcomes (e.g., good or bad, higher or lower task performance) of change rather than describing what change is, what it affects, and how it can be measured. Thus, we introduce flux as a means to conceptualize and measure the degree to which change or change events affect individuals and teams.<sup>1</sup>

Prior to a disruptive event, teams develop and establish the means to carry out tasks (e.g., coordination) and to handle conflict, emotions, and a variety of "action processes" (Marks et al., 2001), such as goal specification and affect management. The establishment of processes then be-

<sup>1</sup> Note that this is not the first time the term "flux" has been used to measure variability or fluctuations in social science research, as Moskowitz and Zuroff (2004) relied on it to describe variability in personality.

**FIGURE 1**  
**Relationships Between Team Member Change, Flux in Coordination, and Performance<sup>a</sup>**



<sup>a</sup> The dashed lines represent mediation paths.

comes ingrained in the team's structure, and routines develop (Arrow et al., 2000). As teams develop and enact routines, they move toward stable patterns of interaction and become more internally consistent (Tushman & Romanelli, 1985), which can be described as moving toward equilibrium (Meyer, Gaba, & Colwell, 2005). In the team literature, Gersick (1988, 1989) explicitly used the concept of equilibrium, and Arrow and colleagues (e.g., Arrow et al., 2000; Arrow & McGrath, 1995) rely on it implicitly. Furthermore, a relevant stream of research has built upon Gersick's model (e.g., Brett et al., 2003; Okhuysen, 2001; Zellmer-Bruhn, 2003).

In the present context, flux in coordination can be described as an emergent state, rather than a process. Emergent states "characterize properties of the team that are typically dynamic in nature and vary as a function of team context, inputs, processes, and outcomes" (Marks et al., 2000: 357). In contrast, processes are defined as "members' interdependent acts that convert inputs to outcomes through cognitive, verbal, and behavioral activities directed toward organizing task work to achieve collective goals" (Marks et al., 2000: 357). Flux in coordination does not describe converting inputs to outcomes, but rather, a team's *ability* to convert inputs to outcomes via variation in coordination mechanisms.

Inevitably, when a disruptive event occurs, teams undergo some sort of unbalancing to or instability of their coordination (Arrow et al., 2000). Teams experiencing member change likely suffer a jolt to their established coordination patterns. These jolts thrust teams out of equilibrium (Gersick, 1988, 1989), which may result in their turning from action process enactment (i.e., conducting activities leading directly to goal accomplishment) back to transition process enactment (i.e., focusing on evaluation and/or planning activities to guide accomplishment of a team goal or objective [Marks et al., 2001]). Although the teams can still function, their once established coordination mechanisms are disrupted.

The interruption of coordination creates flux in coordination. Flux in coordination impacts a team's ability to accomplish well-coordinated activities because efforts are fragmented or duplicated (Cheng, 1984) and interdependent activities are not organized logically (Cheng, 1983). Thus, the greater the variance in flux in coordination, the more costly it is in terms of team members' time, energy, and attention, as more attention, time, and energy are required to orchestrate the sequence and timing of the team's interdependent actions.

Flux in coordination is different from lack of coordination, in that coordination is essentially a patterned set of routines that represent the degree of functional expression and accord of effort among distinct entities (Georgopoulos & Mann, 1962; Lawrence & Lorsch, 1969) that can and do exist following change. Yet these coordination behaviors may not be able to be efficiently or effectively enacted because of the disruption. Team coordination still exists; however, after member change, a team's ability to enact coordination is more limited. Furthermore, teams may already be enacting low levels of coordination, yet the member change affects the established coordination patterns, creating the need to, at the very least, modify existing coordination mechanisms, if not create new coordination patterns.

For example, a four-person team may develop coordination routines in which member A always passes her completed work on to member B. This handover may have been adaptive for the team, as member B is very conscientious and detail oriented and always catches small mistakes. If member B is replaced and the new person filling his role is not detail oriented, the existing coordination process (A's completed work gets passed to the person holding B's role) is likely to result in problems in producing high-quality team output. There is adequate reason to believe that this maladaptive coordination pattern will result in awkward handoffs (e.g., member A sends an e-mail with a joke about how she hopes the new member can fill the shoes of the prior member), or perhaps even continue on without change (Ancona & Chong, 1996).

Of notable importance, flux in coordination is not necessarily a bad thing, as stronger and more efficient coordination patterns can result. It is during flux in coordination that team members reevaluate strategies (Arrow & McGrath, 1993) such as transition processes (Marks et al., 2001) to reestablish equilibrium. As Gersick (1989) described it, teams are presented with two distinct tasks: terminating the old structure and initiating a new one; the latter can range from making small modifications (under low levels of flux in coordination) to enacting drastic transformations (under high levels of flux in coordination). Here, the member change initiates the termination of the old patterns of interaction, which then leads to initiating new patterns of interaction among team members. Teams undergoing transition periods first experience a breakdown of the old equilibrium before choosing a new basis around which to crystallize a new pattern of interaction (Gersick, 1991).



## The Strategic Core

Team members tend to possess differentiated roles with varied obligations (Belbin, 1993; Mumford et al., 2006). In fact, Humphrey and colleagues (2009) argued that certain roles in a team exercise greater influence on the team's performance (see also Pearsall & Ellis, 2006) and that these roles can be identified prior to performance episodes on the basis of specific role characteristics. Strategic core roles involve responsibilities of one or more of the following types (Humphrey et al., 2009).

First, a strategic core role encounters more of the problems that need to be overcome in a team, given that for teams to be successful they must overcome the problems they face (Cummings, 1978). Second, the role has a greater exposure to the tasks that the team is performing, as some role holders have greater responsibilities within the team (Moon et al., 2004). Third, the role is more central to the work flow of the team, as centrality is defined as how connected a role is to other roles in a team (Sparrowe, Liden, Wayne, & Kraimer, 2001).

The components of the definition can range in intensity (e.g., a role may have no, some, or a great deal of exposure to the tasks a team is performing), so one can think of a strategic core role as existing on a continuum. That is, the more that a role meets the above criteria, the more core the role is to the team. Thus, the possession of these characteristics (and how they are dealt with) can influence how a collective performs (Hickson et al., 1971), and changing members holding strategically core roles has clear implications for how the collective manages interdependencies.

For example, printing teams often are composed of members filling roles including operator, paper loader, cutting blade replacer, and printed output monitor. The operator role is considered to be critical for a printing team's success (i.e., the operator controls the operation of the printing press and must adjust it if any problems occur during the printing process), as it encounters more of the problems in the team than any other role (Humphrey et al., 2009). If member change in the operator role occurs, a printing team will find it highly challenging to resolve the flux in coordination, because the team needs to concentrate on making sure the team's coordination mechanisms are enacted effectively through the core role and the new member filling that core role.

To be successful in a particular role, an individual must have an understanding of the role requirements as well as the ability to fulfill those requirements. The assumption of a new role and integration into a new team are expected to require

some socialization (Chen & Klimoski, 2003) and to create some short-term performance detriments for the new role holder (Barker, 1993), given that he/she is unlikely to possess all of the requisite knowledge for role completion.

Unlike in less strategically core roles, in more strategically core roles the impact of lowered performance is amplified throughout the team, because the role holder encounters more team problems, has greater exposure to team tasks, and/or is more central to team work flow (Hambrick, 1981). For example, quarterback is widely considered the most important role on a football field, as the role is central to team work flow. Quarterback injury and replacement create a great deal of flux in a football team's ability to work together (i.e., enact coordination) effectively. Therefore, a greater degree of variance in coordination results, which requires team members to devote more attention and energy to sequencing and timing interdependent actions. Additionally, teams experiencing member change to more strategically core roles will find that their ability to develop new patterns of interaction and routines is impacted; changes to a team's strategic core influence its ability to modify, develop, and/or enact coordination behaviors. This is expected to result in higher levels of flux in coordination than changes to less strategically core roles.

*Hypothesis 1. The more strategically core the team role experiencing member replacement, the higher the level of flux in coordination.*

## Moderation by New Member's Relative Cognitive Ability

Just as the importance of the role whose occupant is being replaced affects the amount of flux in coordination experienced, the relative characteristics of the new member filling the role matter. In this section, we focus on how the relative cognitive ability of the new member entering a team (i.e., relative to that of the member being replaced) aids in managing the transition in the team and thus affects the resultant flux in coordination.

Given the characteristics of strategic core roles, one can reasonably conclude that the role requirements for performing the strategic core roles are higher than those for performing non-strategic core roles. Research showing that job-related skill exhibits greater influence on team effectiveness when possessed by strategic core role holders supports this conclusion (Humphrey et al., 2009). We expect that this finding can be generalized to cognitive ability, because it has been shown to be a critical factor in how much and how quickly individuals

learn (Hunter, 1986). Additionally, a positive relationship between team members' cognitive ability and team performance has been consistently demonstrated (for early reviews, see Heslin [1964] and Mann [1959]; for a more recent meta-analysis, see Bell [2007]).

The extent to which the relative cognitive ability of a new member affects flux in coordination is a function of the complexity of the role being filled. In a simple role, both the connections between team members and how these interdependencies are managed are rather straightforward (Morgeson & Humphrey, 2008). In contrast, part of what makes a role strategically core is the extent to which the role is complex (at least in terms of requiring its occupant to handle more problems, have greater exposure to tasks, and/or be central to work flow).

A new member entering a team who possesses high levels of cognitive ability (relative to the departing member) has a context in which to take advantage of that ability, rather than be constrained by the situation. Team members with higher relative cognitive ability are more effective at developing effective systems for interaction (Hollenbeck, LePine, & Ilgen, 1996; LePine, Hollenbeck, Ilgen, & Hedlund, 1997) and thus should possess the resources necessary for managing (or avoiding entirely) the disruption associated with a change.

*Hypothesis 2. Cognitive ability moderates the relationships between the degree to which a team role experiencing member replacement is strategically core and the level of flux in coordination: the relationship is stronger when new member cognitive ability is low relative to departing member cognitive ability.*

### **Information Transfer**

A team's ability to disseminate information (Dennis, 1996; Wittenbaum et al., 2004) during member change also impacts its ability to attenuate flux in coordination. In teams with differentiated role structures, team members often specialize in areas of relative expertise (Hollingshead, 2001), creating knowledge structures with respect to the encoding, storage, retrieval, and communication of information (Wegner, 1987). These knowledge structures facilitate coordinated access to deep, specialized knowledge, so a greater amount of task-relevant expertise can efficiently surface during team tasks (Lewis, 2003). Thus, in the context of member change, the ability to successfully transfer pertinent codified information to a new member becomes paramount for the quick development of

critical knowledge structures, and thus, for team effectiveness (Lewis et al., 2005).

Information transfer is particularly important for managing flux in coordination, as it provides support when member change occurs. In the present context, transferring information during member change allows teams to disseminate task-relevant information to new members, attenuating flux in coordination by increasing their knowledge. It is often advantageous for a team to be able to develop and transfer codified knowledge (Edmondson, Winslow, Bohmer, & Pisano, 2003), as opposed to being unable to transfer the tacit knowledge that is lost when a member leaves (Berman, Down, & Hill, 2002). This ability eases flux in coordination, as the team is in better condition to manage the member change (McGrath & Beehr, 1990).

Thus, a team's ability to transfer information (Lewis et al., 2005) during member change has a direct impact on the flux experienced in coordination. If the team has the ability to transfer information as a team member leaves and a new member enters, the new team member enters the team in a much better situation, in which the ease of the transition should facilitate more efficient establishment of coordination.

When members share similar or compatible conceptualizations of a team and its tasks and environment, they are better able to predict others' actions and coordinate their activities effectively and efficiently (Klimoski & Mohammed, 1994). Moreover, a precondition for coordination is that team members have or develop moderately predictive expectations about the "who, what, when, and how" of others' actions, and also about what others expect of them. Thus, without the means to properly transfer established, codified knowledge to new members, teams will experience higher levels of flux in coordination as a result of lack of a shared understanding of each others' capabilities.

*Hypothesis 3. Information transfer in a team is negatively related to flux in coordination.*

### **Flux in Coordination and Team Performance**

Two theoretical frameworks, small groups as complex systems (Arrow et al., 2000) and entrainment theory (Ancona & Chong, 1996), are particularly helpful for articulating why member change affects team coordination and how the disruption to coordination in turn affects team effectiveness. Both theories specify that coordination is the most critical process for transforming team inputs into team outputs. The theory of small groups as complex systems focuses on relationships among peo-

ple, tools, and tasks activated by a combination of individual and collective purposes and goals that change and evolve as a group interacts over time (Arrow et al., 2000). Entrainment theory (Ancona & Chong, 1996) offers a complementary approach to explain coordination, as it addresses the effects of time rather than activity.

Ability to successfully coordinate roles and activities is paramount for team effectiveness (Reagans, Argote, & Brooks, 2005). For example, because a high level of coordination among team members is a significant indicator of effective production (e.g., Ancona & Caldwell, 1992; Kraut & Streeter, 1995; Pinto, Pinto, & Prescott, 1993), breakdowns in coordination are seen as a major obstacle inhibiting teams from realizing their objectives (Curtis, Krasner, & Iscoe, 1988). Thus, when the experience of flux in their coordination hinders team members' ability to effectively work together, performance is consequently affected.

The theory of small groups as complex systems (Arrow et al., 2000) suggests that different kinds of change have different meanings to team members and various implications for team coordination; a team's reaction to change is due, at least partially, to the makeup of the coordination system. This is affected by how long and under what circumstances a team has been in existence. Routines and strategies that have been consistently successful will be quite tenacious, whereas team members will be less attached to behavior patterns that are associated with a mixed record.

For teams to function and perform effectively, coordination must exist among team members (Reagans et al., 2005). When member change occurs, some of a team's coordination patterns remain because linkages and routines exist among the remaining members. These remaining linkages and routines become obsolete when a new member enters the team, as the team cannot effectively enact its existing coordination mechanisms because of the disruption.

*Hypothesis 4. Flux in coordination is negatively related to team task performance.*

Coordination is a key mediating process relating to team effectiveness (LePine et al., 2008; Marks et al., 2001; Reagans et al., 2005). As a team's coordination process becomes more disrupted through low levels of information transfer and/or changes to its strategic core, the more difficult it becomes for it to effectively carry out its tasks. Thus, we expect flux in coordination to mediate these relationships. Specifically, member changes to more strategically core roles should lead to higher levels of flux in coordination, which should, in turn, lead to lower

task performance. Conversely, teams having the ability to transfer codified information (Dennis, 1996; Wittenbaum et al., 2004) should experience lower levels of flux in coordination, which should then lead to higher levels of task performance. Thus,

*Hypothesis 5a. Flux in coordination mediates the relationship between the degree to which a team role experiencing member replacement is strategically core and task performance following member change.*

*Hypothesis 5b. Flux in coordination mediates the relationship between team information transfer and task performance following member change.*

Extending this line of reasoning, we also propose that the effect of strategic core roles will be weaker under conditions of higher relative new member cognitive ability on task performance as mediated by flux in coordination. Given the relative importance of a strategic core role to team outcomes (Humphrey et al., 2009) and of cognitive ability to team functioning (Hollenbeck et al., 1996), when new member relative cognitive ability is high, the influence of member change on flux in coordination is lower, which will not impact task performance as much. Conversely, when the new team member has lower relative cognitive ability and replaces a member in a more strategically core role, this interaction effect on task performance as mediated by flux in coordination will be stronger. Thus, a new member's relative cognitive ability will have a smaller impact if the member is taking on a less strategically core role.

*Hypothesis 6. Flux in coordination mediates the effect of the interaction between the degree to which a team role experiencing member replacement is strategically core and new member cognitive ability (relative to departing member cognitive ability) on task performance.*

## METHODS

### Research Participants and Design

Research participants were 432 upper-level undergraduate business students at a large U.S. university who were assigned to 108 four-person teams. The average age was 21 years old, and 51 percent of the participants were female. All individuals were randomly assigned to teams and then randomly assigned to a specific role within a team. All teams were randomly assigned to experimental conditions in a 2×2 design (i.e., member change to

either a strategic core role or a nonstrategic core role and either allowing or restricting a team from transferring information to the new member; see the section on manipulations for details on experimental conditions). In return for their participation, each student received class credit, and teams were eligible for cash prizes based on performance as well as distributed randomly.

### Task and Objectives

Teams participated in a computer simulation called SouperHot, which is designed to illustrate basic marketing concepts in a dynamic and participative way and has been established in prior research (see Hall and Cox [1994] for a full description). Participants made a series of marketing decisions, the results of which were simulated via a model that explored the major topics of product life cycle, pricing, promotion, and implications of profit and cash flow.

The simulation gave participants the opportunity to practice their planning, decision making, and team working skills. According to the designers of this simulation, when approaching the simulation, participants should: (1) analyze the facts, (2) discuss the implications, (3) define objectives, and (4) prepare a plan and set goals. Because they deliberately provide only a short overview of the simulation, participants' initial analysis must be limited. This means that initially participants work with incomplete information, which is realistic; teams should realize that they will build up a full picture of the market and its problems and opportunities only as the simulation progresses.

Although the overview is short, it includes sufficient information for a team to set broad objectives, make a plan of action, and make initial decisions. However, it is likely that these objectives and goals will need to be refined as the simulation progresses. If the objectives are too vague, the team may degenerate into "fire fighting" (i.e., bickering among team members as to how to go about the task). However, the chance of this is lessened if the team develops and uses measures that link their results with their objectives. In turn, this necessitates considering how the market is likely to respond. The simulation divides into three distinct stages: (1) initial market penetration, (2) response to competition, and (3) phased withdrawal from the market.

### Procedures

Participants were assigned to teams upon entering the research lab. After they had completed a

consent form, we assessed the participants' cognitive ability using the Wonderlic Personnel Test (Wonderlic & associates, 1983). Following this, participants were introduced to the SouperHot simulation through a PowerPoint presentation. Teams progressed through eight trials of the simulation over the course of approximately one hour (this is time 1). When they finished, they returned their disks (to establish a permanent record of their performance results) to the investigator present in the lab and then filled out a survey. A listing of team names and their performance was then posted so teams would be aware of their standing relative to other teams.

Teams then met three more times, separated by one-week intervals. After time 2, all teams experienced member change. One member was moved out and replaced by someone who had existing experience with the specific role held by the departing member, but no experience with the specific team. The member being changed held either a strategic core role (vice president of production) or a non-strategic core role (vice president of finance), and the information transfer manipulation was administered during the change (see below for specifics of manipulations). After all participants had completed all four runs of the simulation, participants were debriefed. The highest scorers (i.e., those with the most accumulated profit) of each section were announced, as were the winners (i.e., teams) of the random drawing.

### Manipulations and Measures

**Strategic core.** Each four-member team was composed of one vice president (VP) of production, one VP of promotion, and two VPs of finance. The VP of production was responsible for setting the number of units produced, price, and inventory levels. The VP of promotion was responsible for advertising. Last, the VPs of finance oversaw cash flow, sales income, and net profit and helped manage assets.

As noted, the strategic core of the team was the VP of production. Meeting the criteria for a strategic core role (Humphrey et al., 2009), this role encountered more of the problems a team needed to overcome (i.e., the role incumbent was responsible for directly responding to competitor behaviors through changes in price and production); had greater exposure to the tasks the team was performing (had more task responsibilities than other roles); and was more central to the work flow (the role incumbent was responsible for entering all data into the computer, running the program, and serving as the liaison with the researcher).



The VP of finance, on the other hand, did not encounter many problems; this role primarily entailed responsibility for assisting the VP of production and the VP of marketing in their decisions; had less exposure to the tasks (i.e., two people filled this role, increasing role redundancy); and was less central than the VP of production (i.e., communication did not have to flow through this role). Thus, member change to the role of vice president of production was the strategic core manipulation ( $n = 52$ ), and member change to the role of a vice president of finance was the non-strategic core manipulation ( $n = 56$ ).

**Team information transfer.** We manipulated team information transfer by allowing some teams (including the departing member) to have the ability to pass along information (i.e., notes and any verbal communication deemed necessary) that they felt was important to the new member ( $n = 52$ ). These teams were in the team information transfer condition. Other teams did not have the ability to pass along information to the new member ( $n = 56$ ). Specifically, when a team was in the no information transfer condition, a researcher read the following text to the participants:

Now that you are undergoing this change, the following rules apply:

[Name], the departing team member, is not allowed to speak with the incoming member about the team or the task.

[Name], the departing team member, is not allowed to leave behind any notes, nor is [s]he allowed to pass any notes to the incoming member.

In addition, one researcher present at the experimental session was tasked with overseeing the transition and integration process to insure that these rules were followed. In no situation did the participants violate these rules, and thus there was no need for additional intervention from the researcher. We did not restrict the team from talking to the new member about how the team performed the task (as that would destroy all realism). Instead, because we assumed that the individual performing a specific role had unique knowledge for that specific role (e.g., knowledge of the finances of the project, etc.) that all members might not have, we were interested in how limiting the hand-off process between members worked.

**Flux in coordination.** Flux in coordination was measured via a scale adapted from an established coordination scale (Lewis, 2003) that taps team members' perception of the flux in coordination caused by member change. This measure has the same wording assessing team members' perceptions of coordination that Lewis used, except for

the wording of items concerning perceptions of disruption. These items include: "This change caused disruptions in the way the team carried out its tasks," "increased the number of misunderstandings about what to do," "created more instability in the way the team interacted," and "made accomplishing the task more difficult." The measure utilized the same anchor points as the Lewis (2003) measure (i.e., 1 = "strongly disagree," to 5 = "strongly agree"). Cronbach's alpha was computed to measure the internal reliability of the measure. The value reported was .96, which is well above the .70 value typically recommended (Nunnally, 1978).

Given that the hypotheses reside at the team level and this measure was collected at the individual level, the data had to be aggregated. One piece of evidence that supports aggregation is demonstrating that team members agree with each other in their assessments of team attributes, through a measure of within-team agreement. Within-team agreement was measured via James, Demaree, and Wolf's (1984, 1993) index of interrater agreement ( $r_{wg}$ ), which assesses the homogeneity of team member perceptions on a multi-item scale. The within-group agreement index on flux in coordination ( $r_{wg} = .86$ ) did in fact exceed the .70 level that James et al. (1984) recommended as necessary to justify the aggregation of individual-level data to group-level measures. In addition, the index ICC1, which assesses interrater reliability (James & Brett, 1984), indicated that less variation existed within teams than between teams. Team members agreed with one another about the scores they provided on flux in coordination (ICC1 = .92,  $F = 11.95$ ,  $p < .01$ ).

**New member relative cognitive ability.** Individual cognitive ability ( $g$ ) was measured via Form WP-R of the Wonderlic Personnel Test (Wonderlic & associates, 1983). For analysis purposes, we determined new member relative cognitive ability by controlling for the departing member's cognitive ability and entering the new member's cognitive ability into the analyses.

**Team performance.** The computer simulation objectively measured and recorded the team effectiveness metric, cumulative profit, after each stage of a team's simulation run. For the purposes of our analyses, time 3 cumulative profit was used as the dependent variable, as it immediately followed member change.

**Control variables.** Because the simulation focused on marketing, we controlled for participants' academic majors and marketing experience. In addition, in all analyses we controlled for the cognitive ability of the departing member and prior team task performance.

## Data Analysis

The research design employed, as well as the research question explored in this study, required several different data analytic techniques. To test the first four hypotheses, we employed hierarchical and moderated hierarchical regression, per the recommendation of Cohen and Cohen (1983), whereas for the next two hypotheses, we tested mediation effects following Preacher and Hayes (2004) and Edwards and Lambert (2007). The regression and mediation techniques are well established and are employed in a majority of social science research. However, the final hypothesis requires moderated mediation analysis (Preacher, Rucker, & Hayes, 2007), which warrants further discussion, although a full description of moderated mediation is beyond the scope of this article (see Preacher et al. [2007] for an extensive treatment).

James and Brett (1984) coined the term “moderated mediation,” suggesting it for mediation models involving relations that “require the addition of a moderator for either the  $\hat{m} = F(x)$  or  $\hat{y} = f(m) = f(x)$  relations, or both” (1984: 314). Moderated mediation models represent attempts to explain both how and when a given effect occurs (Frone, 1999). Formally, moderated mediation occurs when the strength of an indirect effect depends on the level of some variable, or in other words, when mediation relations are contingent on the level of a moderator.

Thus, often, it is of critical interest to determine whether or not a mediation effect remains constant across different contexts, groups of individuals, and values of an independent variable (Preacher et al., 2007). That is, does mediation hold across varying levels of a moderator? Conditional indirect effects may be relevant and interesting in many settings but may remain unnoticed and go unexamined because clear methods for investigat-

ing whether (and, if so, how) an indirect effect varies systematically as a function of another variable (Preacher et al., 2007) have not yet been articulated. Consequently, addressing the impact of new member relative cognitive ability on the relationship between strategic core and flux in coordination and on the relationship between flux in coordination and task performance adds explanatory power to the proposed model.

## RESULTS

### Descriptive Statistics and Manipulations

Table 1 reports the means, standard deviation, and correlations of all variables in the study. Task performance at time 2 and time 3 were standardized. The average marketing experience of a team was 8.22 months. As seen in Table 1, time 2 task performance was significantly correlated with time 3 task performance ( $r = .55, p < .001$ ). Time 3 task performance was significantly correlated with team marketing experience ( $r = .24, p = .01$ ) but was not significantly correlated with academic major ( $r = -.03, p = .831$ ).

Checks also were conducted to determine whether the independent variables were in fact manipulated as we intended. We first examined the strategic core manipulation by asking team members questions about the role of the departing member that were based on Humphrey et al.’s (2009) conceptualization of team strategic core roles. Examining the strategic core manipulation (sample items: “The departing member was more central to the workflow of the team,” “The departing member had a greater exposure to the tasks that the team was performing,” and “The departing member was critical to the success of the team”), we found that the team condition significantly accounted for differences in the importance of the team member

TABLE 1  
Means, Standard Deviations, and Correlations<sup>a</sup>

Variable	Mean	s.d.	1	2	3	4	5	6	7	8
1. Task performance, time 2	0.00	1.00								
2. Marketing experience	9.16	12.95	.19*							
3. Major	0.60	0.81	-.04	.05						
4. Leaving member cognitive ability	23.79	4.27	.08	.03	-.03					
5. Strategic core	0.48	0.50	.32**	-.01	.06	.20*				
6. Information transfer	0.44	0.50	-.06	.00	.00	.01	.07			
7. Flux in coordination	2.30	1.19	.34**	.00	-.01	.18	.68**	-.35**		
8. New member cognitive ability	23.34	3.78	.12	.04	.04	-.01	.12	.11	-.02	
9. Task performance, time 3	0.00	1.00	.55**	.24*	-.03	.03	-.08	.33**	-.27**	.15

<sup>a</sup>  $n = 108$ .

\*  $p < .05$

\*\*  $p < .01$

change ( $F = 383.93, p < .01$ ) and accounted for 78 percent of the variance in the strategic core manipulation ( $\eta^2 = .78$ ) and 98 percent of the proportional variance in the manipulation (i.e., the eta-square values reflect the proportion of variance accounted for by a particular effect). Moreover, the information transfer manipulation was not related to this manipulation check item.

We also measured the influence of the information transfer manipulation by asking the participants to rate the following item: "We had the ability to transfer information to the new member." The manipulation check for information transferability was significant ( $F = 249.33, p < .01$ ) and accounted for 70 percent of the variance in the manipulation ( $\eta^2 = .70$ ) and 98 percent of the proportional variance in the manipulation. Further, the strategic core manipulation was not significantly related to this manipulation check item. Thus, the results suggest that the participants receiving the manipulations did perceive them as intended.

### Tests of Hypotheses

**Hypotheses 1–3.** Table 2 shows the results of the hierarchical moderated regression analyses used to examine Hypotheses 1–3, which test the main effects of strategic core and information transfer on the flux experienced in coordination, as well as the moderated effect of new member's cognitive ability and strategic core role on flux in coordination. This regression was based on a sample of 108 teams. In the first of five models, the control variables of marketing experience, major, and leaving member's cognitive ability were entered. These three controls accounted for approximately 3 percent of the total variance, with none of the variables being statistically significant.

Hypothesis 1 proposes that the role of a team member being replaced (i.e., whether or not it is a strategic core role) leads to higher levels of flux in coordination. The results, shown in model 2, indicate that member change to the strategic core results in higher levels of flux in coordination ( $\beta = .68, p < .001, \Delta R^2 = .44$ ), providing support for Hypothesis 1.

Hypothesis 2 tests the moderating effect of a new member's relative cognitive ability on the relationship between changes to more strategically core roles versus less strategically core roles and flux in coordination. The regression results presented in model 5 indicate that the strategic core and new member relative cognitive ability interaction term ( $\beta = -.25, p = .017, \Delta R^2 = .02$ ) is significant, supporting Hypothesis 2. Figure 2 graphically depicts this moderating effect of new member relative cognitive ability both under the condition of member change to a team's strategic core and the condition of member change that is not to a team's strategic core.

As shown, the influence of member changes to strategic core roles on flux in coordination is stronger when new member relative cognitive ability is low. We conducted a simple slopes analysis at one standard deviation above and below the mean (Preacher, Curran, & Bauer, 2006). Results indicate that the simple slope for low new member relative cognitive ability (1.939,  $t = 10.08, p < .01$ ) is stronger than that for high relative new member cognitive ability (1.453,  $t = 7.55, p < .01$ ), even though both are significant.

Hypothesis 3 predicts that more information transfer will decrease levels of flux. As shown in model 3, the results indicate that information transfer ( $\beta = -.40, p < .001, \Delta R^2 = .16$ ) is a significant

TABLE 2  
Results of Hierarchical Moderated Regression Analysis for Flux in Coordination<sup>a</sup>

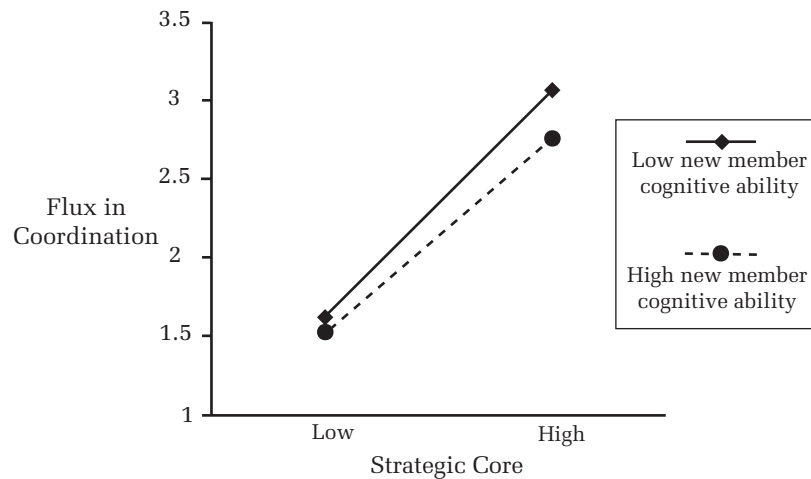
Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Marketing experience	-.00	.01	.01	.01	-.01
Major	-.00	-.05	-.05	-.05	-.04
Leaving member cognitive ability	.18	.05	.04	.04	.03
Strategic core		.68**	.70**	.71**	.84**
Information transfer			-.40**	-.39**	-.25**
New member cognitive ability				-.06	-.04
Strategic core $\times$ new member cognitive ability					-.25*
Percent of total variance explained	.03	.47	.63	.63	.65
$\Delta R^2$	.03	.44	.16	.00	.02
$\Delta F$	1.21	84.41**	42.56**	.99	5.85*
Full model statistics		Total $R^2 = .65$		$F(7, 100) = 26.46**$	

<sup>a</sup>  $n = 108$ ; standardized regression coefficients are reported.

\*  $p < .05$

\*\*  $p < .01$

**FIGURE 2**  
**Interaction of Strategic Core and New Member Cognitive Ability on Flux in Coordination**



predictor of flux in coordination, thus supporting this hypothesis.

**Hypothesis 4.** Hypothesis 4 predicts that flux in coordination will affect team task performance. Once again, we used hierarchical regression analysis to test this prediction. Table 3 shows results. In step 1, we entered the control variables, including marketing experience, major, leaving member cognitive ability, and time 2 task performance. Only time 2 task performance was statistically significant ( $\beta = .70, p < .01$ ), with step 1 accounting for 32 percent of the variance. In step 2, flux in coordination was entered ( $\beta = -.52, p < .01$ ), accounting for an additional 23 percent of variance, supporting Hypothesis 4.

**Hypotheses 5a and 5b.** We tested Hypotheses 5a and 5b via mediation analyses to assess whether or not flux in coordination mediated the relationships of strategic core (i.e., Hypothesis 5a) and information transfer with task performance (i.e., Hypothesis 5b). Table 4 presents the direct, indirect, and total effects for the mediation decomposition (Preacher & Hayes, 2004); time 2 task performance, marketing experience, and major are controlled for.

The indirect effects of strategic core ( $\beta = -.67, p < .01$ ) and information transfer ( $\beta = .25, p < .05$ ) were both significant, thus demonstrating mediation.

More specifically, flux in coordination mediates 82 percent of the relationship between strategic core and task performance, whereas flux in coordination mediates 36 percent of the relationship between information transfer and task performance. Moreover, Table 5 provides 95% bootstrap confidence intervals for the conditional indirect effects of the strategic core and information transfer. Because these intervals do not include zero, the conditional indirect effect is significantly different from zero (at  $\alpha = .05$ ), which corroborates the results. Thus, results support Hypotheses 5a and 5b.

**Hypothesis 6.** The last hypothesis concerns the mediating effect of flux in coordination on the strategic core–task performance relationship under varying conditions of new member relative cognitive ability. The results presented in Table 6 indicate a differential impact of new member relative cognitive ability on the relationship wherein strategic core change affects flux in coordination,

**TABLE 3**  
**Results of Hierarchical Regression Analysis Predicting Time 3 Performance<sup>a</sup>**

Step	Independent Variables	$\beta$	$\Delta R^2$	$\Delta F$
1	Major	-.00	.32	12.30**
	Marketing experience	.10		
	Leaving member cognitive ability	.06		
	Time 2 task performance	.70**		
2	Flux in coordination	-.52**	.23	25.15**
Full model statistics		Total $R^2 = .55$		$F(5, 102) = 25.15**$

<sup>a</sup>  $n = 108$ ; standardized regression coefficients are reported.

\*\*  $p < .01$



**TABLE 4**  
Effects Decomposition for Mediation<sup>a</sup>

Independent Variables	Effects			<i>R</i> <sup>2</sup>	<i>F</i>
	Direct: Unmediated	Indirect: Mediated by Flux in Coordination	Total		
Strategic core	.15	-.67**	-.51	.55	24.72**
Information transfer	.45**	.25*	.70**	.59	29.03**

<sup>a</sup> *n* = 108. The analysis was controlled for time 2 task performance, marketing experience, and major.

\* *p* < .05

\*\* *p* < .01

affecting task performance. The indirect effect for low new member relative cognitive ability ( $\beta = -.46$ , *s.e.* = .22, *p* < .05) and high new member relative cognitive ability ( $\beta = -.79$ , *s.e.* = .21, *p* < .01) were both significant (see also Figure 3's breakdown of the simple and indirect effects). However, although both indirect effects were significant, this relationship was stronger under conditions of high new member relative cognitive ability ( $t = 4.91$ , *p* < .05). Thus, the effect of the interaction term on task performance as mediated by flux in coordination is weaker under conditions of high new member relative cognitive ability than under conditions of low new member relative cognitive ability, supporting Hypothesis 6.<sup>2</sup>

<sup>2</sup> In addition, we examined how our predictors influenced time 4 task performance controlling for time 3 task performance. The results of these analyses replicate the effects described thus far, with flux in coordination significantly mediating the effect of strategic core (-.61) and information transfer (.11) on time 4 task performance (note that the effect of information transfer was smaller than its effect on time 3 task performance, as shown in Table 4). Moreover, the results show a more modest moderator effect, which is such that although Hypothesis 6 was supported at high levels of relative new member cognitive ability, it was not supported at low levels of relative cognitive ability.

**TABLE 5**  
Bootstrap Results for Indirect Effects of Flux in Coordination<sup>a</sup>

Variables	Bias-Corrected Confidence Intervals	
	Lower	Upper
Strategic core	-.90	-.44
Information transfer	.16	.50

<sup>a</sup> Confidence interval does not include zero; thus, the indirect effect is indeed significantly different from zero at *p* < .05 (two-tailed test) for strategic core and information transfer.

### Additional Analysis

We also conducted a polynomial regression analysis (Edwards, 2007) to produce a surface plot of the relationship between departing member cognitive ability and new member cognitive ability. The analysis showed a significant quadratic effect for the relationship with departing member cognitive ability and new member cognitive ability on flux in coordination ( $\Delta R^2 = .06$ ,  $\Delta F = 2.69$ , *p* = .01). Figure 4 is the plot of this relationship, and Table 7 presents associated statistics. These results reinforce the fact that a departing team member's cognitive ability has a main effect on flux in coordination: the higher the cognitive ability of the departing member, the more flux occurred.<sup>3</sup>

What is particularly interesting, however, is the way the cognitive ability of the new members interacts with this. New members with relatively high levels of cognitive ability seem to manage the

<sup>3</sup> We would like to thank the editor and an anonymous reviewer for recommending this analysis.

**TABLE 6**  
Results of Moderated Mediation Analysis of the Effect of New Member Relative Cognitive Ability on the Strategic Core-Flux-Task Performance Relationship

Interaction	$\beta$	<i>s.e.</i>
Strategic core $\times$ new member cognitive ability	.09**	.04
Flux in coordination $\times$ new member cognitive ability	-.05**	.02
Low new member cognitive ability (indirect effect)	-.46*	.22
High new member cognitive ability (indirect effect)	-.79**	.21

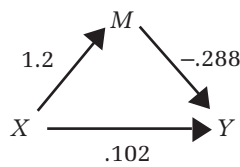
*n* = 108. This analysis was controlled for time 2 task performance, leaving member cognitive ability, marketing experience, and major.

\* *p* < .05

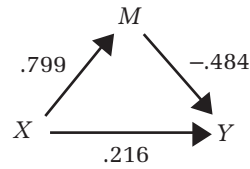
\*\* *p* < .01

**FIGURE 3**  
**Simple Effects for Moderated Mediation<sup>a</sup>**

(3A) Simple Effects for Low New Member *g*      (3B) Simple Effects for High New Member *g*



Indirect effect:  $-.46$ , *s.e.* =  $.22$ ,  $p < .05$ .



Indirect effect:  $-.79$ , *s.e.* =  $.21$ ,  $p < .01$ .

<sup>a</sup> In these mediated models showing simple effects for low and high new member relative cognitive ability (*g*), *X* represents strategic core, *M* signifies flux in coordination, and *Y* indicates task performance. For low new member cognitive ability, the total effect for strategic core role on team performance is  $-.816$ . For high new member cognitive ability, the total effect for strategic core role on team performance is  $-.477$ . A test of the indirect effects indicated that although both indirect effects are also significant, the differences in indirect effects are also significant ( $t = 4.91$ ,  $p < .05$ ).

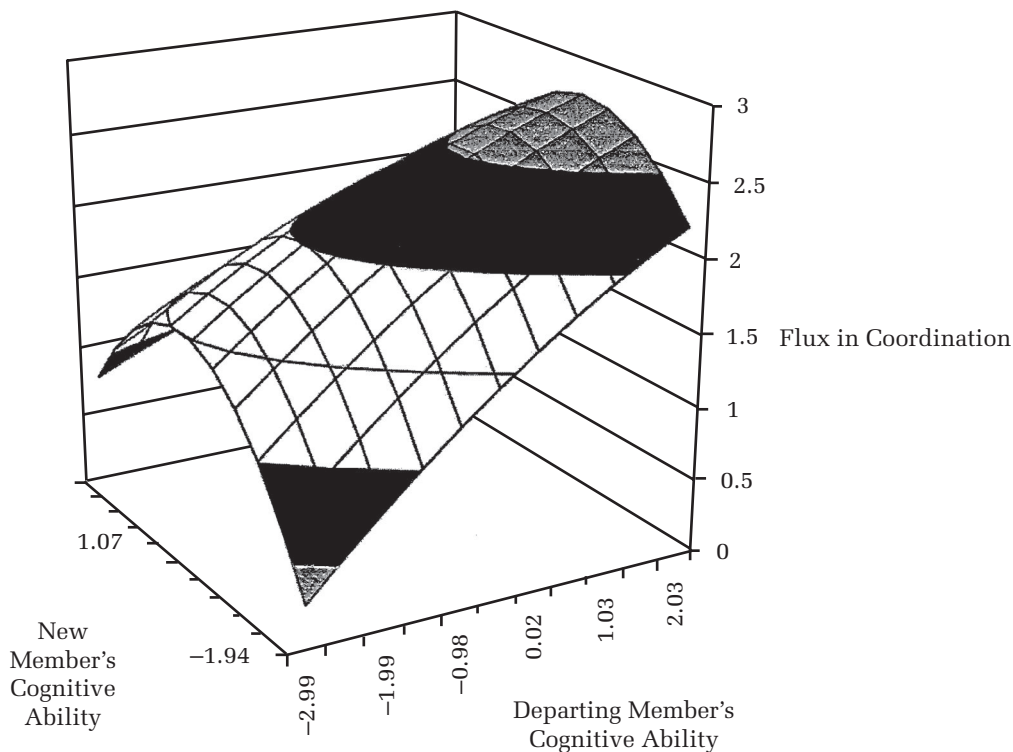
change process well, producing less flux in coordination. This was our expectation, and we found confirmation for it. In contrast, these results also show that at low levels of new member cognitive ability, relatively low levels of flux in coordination also occur. This was surprising to us. Finally, there are relatively high levels of flux in coordination at moderate levels of new member cognitive ability.

After considering these findings in light of extant theory, we can speculate on why they occurred. A new member with a high level of cognitive ability can fit into a team fairly well and thus does not

produce a great deal of flux in coordination. That is, the new member quickly figures out his/her role in the team, and the team can get back to business quickly. A new member with a moderate level of cognitive ability struggles to fill the role of the departing member, trying to match his/her prior experiences and expectations with the new team's (perhaps poorly). Thus, when new member cognitive ability is moderate, change severely disrupts a team.

In contrast, when a new member has low cognitive ability, a team is not particularly disrupted.

**FIGURE 4**  
**Surface Plot for Polynomial Regression of Cognitive Ability**



**TABLE 7**  
**Results of Polynomial Regression Analysis Predicting Flux in Coordination<sup>a</sup>**

Step	Independent Variables	$\beta$	$\Delta R^2$	$\Delta F$
1	Major	-.00	.12	4.74**
	Marketing experience	.10		
	Information and control	-.35**		
2	New member $g$	.20*	.06	2.69*
	Leaving member $g$	.22*		
	New member $g^2$	-.15		
	Leaving member $g^2$	-.16		
	New member $g \times$ leaving member $g$	-.02		
Full model statistics		Total $R^2 = .18$	$F(5, 102) = 3.65^{**}$	

<sup>a</sup>  $n = 108$ . Standardized regression coefficients are reported.

\*  $p < .05$

\*\*  $p < .01$

Individuals are generally proficient at quickly gauging cognitive ability (Porter, Hollenbeck, Ilgen, Ellis, West, & Moon, 2003). Following a change in membership, if and when a team's members determine that the new team member has relatively low cognitive ability, the team will likely marginalize that individual, lowering his/her role expectations and reducing his/her responsibilities. This was made abundantly clear in low-low situations, where both the departing member and new member were low on cognitive ability.

In this situation, the team was likely burdened by the low ability level of the original member and thus minimized his/her role to begin with. Upon learning that this member was leaving, perhaps the team was overjoyed, thinking that they would now have someone better. If the new member quickly demonstrates his/her low cognitive ability (Porter et al., 2003), the team almost completely marginalizes him/her. Thus, flux in coordination was fairly low following member change when both the departing and new member were low on cognitive ability.

## DISCUSSION

This study investigated the influence of team strategic core and information transferability on flux in coordination and team task performance in the presence of member change. Changes to more strategically core versus less strategically core roles and information transfer were found to affect the amount of flux teams experienced in their ability to coordinate their behavior effectively, which in turn shaped their capacity to carry out their tasks and perform. We also introduced the moderating effect of new team member relative cognitive ability on the strategic core-flux relationship.

When examining how change impacts a team, it is important to identify specific factors that limit the ability of a team's members to work together effectively (Arrow et al., 2000). We recognized three divergent factors thought to affect a team's ability to effectively coordinate its behavior after member change. Thus, our study addressed three questions involved in member change: (1) How do characteristics of a member's role on a team influence teamwork during member change? (2) How do characteristics of the member change itself (i.e., information transfer) influence teamwork during member change? (3) How does the interaction between characteristics of a role and characteristics of the role's holder influence teamwork during member change? Moreover, we introduced flux in coordination as a central teamwork emergent state existing during member change. Addressing these issues offers broad understanding of the longitudinal effects of team member change on flux in coordination and team task performance.

The results of our study suggest that flux in coordination partially mediates the relationships of both strategic core and information transfer to task performance. Prior research examining the impact of change on teams typically has bypassed most mediators or processes and focused exclusively on performance (for an exception, see Lewis, Belliveau, Herndon, and Keller [2007]). This study suggests that when teams undergo member change, they perceive disruptions to critical team processes, in the form of flux in coordination.

## Contributions to Theory

First, the notion of flux is a new construct that needs further theoretical and empirical development. Our study has first attempted to theoretically

develop the idea of flux and differentiate it from other constructs. Building on Gersick's (1988, 1989) idea that teams experience dramatic restructuring in the midst of change, we developed the flux construct to capture what teams experience during change. In Gersick's terms, punctuated equilibrium refers (in part) to teams' experiencing a midpoint transition, a point when they radically change their structure in order to finish their tasks. Yet the time between periods of equilibrium has never been specified or discussed in prior research. Thus, the flux construct helps clarify this important team state—that is, what is happening in a team when it is not in equilibrium. Furthermore, conceptualizing flux in coordination as an emergent state moves the literature beyond a simple statement about equilibrium, as flux characterizes team properties that are dynamic and that vary with team context, inputs, processes, and outcomes (Marks et al., 2001).

Researchers (e.g., Bales, 1953; Berrien, 1976; Carley, 1991; Katz & Kahn, 1978; Lewin, 1951; von Bertalanffy, 1968) have posited and empirically established that teams move toward equilibrium or stability, especially with regard to coordination patterns and core strategies or routines (Gersick & Hackman, 1990). Even when teams experience change or adaptation, their initial inclination is to develop continuity (Arrow & McGrath, 1995). In other frameworks (e.g., Marks et al., 2001), flux can be integrated to describe how change affects teams between action and transition phases. We next empirically established, with considerable support, the notion of flux in coordination. Thus, this study contributes by introducing a new construct that researchers can use to measure and investigate the effects of change.

Whereas the current study operationalized flux in coordination as a team-level construct, we expect flux (the more general construct) to actually be a multilevel construct that can be applied at any level of analysis. Because the effects of change are not isolated to the team level of analysis, we expect the range of the flux construct to include levels within organizations (e.g., departments, divisions), organizations, industries, and so on. Consequently, flux can be used as a descriptive term characterizing disruption at nearly all levels of analysis.

Second, this study contributes to role theory by examining, in greater detail, the idea of task roles, or those roles used to accomplish work (Mumford, Van Iddekinge, Morgeson, & Campion, 2008). Extant theory describes different types of task roles (e.g., contractor, cooperater, critic) but does not differentiate the importance of those roles to team

functioning in situations of change. By moving beyond the simplistic idea that "who changes" is unimportant, we have added a dynamic to role theory based upon the importance of roles. In fact, the results speak to this very point—the member who is changing impacts the extent to which a team is capable of interacting efficiently after membership change.

Further, we now have a better understanding of the impact of cognitive ability on a team's role structure. An assumption of prior research and theory is that "more is better"—the more team members who are more intelligent, the better. However, we theoretically conjectured and found that new member relative cognitive ability matters much more when membership changes are within more strategically core roles. Therefore, this study contributes to a well-established theory, role theory (e.g., Kahn, Wolfe, Quinn, Snoek, & Rosenthal, 1964) in specifying how individuals contribute in social contexts under different levels of change to their role structure.

This study additionally contributes to existing theory by delineating the circumstances surrounding teams by describing the effects of information transfer (Dennis, 1996; Wittenbaum et al., 2004) in team contexts under conditions of member change. Member change can be stressful, as new members have to be socialized and integrated into a team's existing social and role structures. In our study, teams either had the ability to transfer or disseminate knowledge or they did not have this ability. A primary contribution of this test was determining the effects of information transfer and how it affects a team's ability to orchestrate team members' interdependent actions.

### Contributions to Practice

The findings of this study have several practical implications. The first implications suggested are top-down influences that go from the organization level down to the team level. Central to the current study is the idea of information transfer. When a strategically core team member withdraws from a team, the individual's knowledge, skills, and abilities are also removed. More importantly, the tacit knowledge (Berman et al., 2002) of the prior team member typically is not transferred upon his/her leaving.

The findings suggest that when the members of a team have the ability to transfer information, the team experiences less flux in coordination. Thus, instituting more mechanisms, such as job rotation and management information systems, or allowing, when possible, the transfer of tacit knowledge via



training, will provide for more information transfer, which should reduce the amount of disruption a team experiences in its ability to interact efficiently. The less flux teams experience in their coordination patterns, the more quickly the teams will be operating at efficient levels.

This research also has demonstrated the importance of core roles, a notion that organizations need to attend to more (Humphrey et al., 2009; Huselid, Beatty, & Becker, 2005). Turnover in teams' key positions or roles causes much more disruption in how team members interact or coordinate their behavior to complete tasks than turnover in other roles. This loss of efficiency hinders performance, which can exhibit detrimental effects for organizational outcomes. From a human resource management perspective, it is imperative that organizations replace core role holders with talented personnel, because it is those individuals who are responsible for carrying out tasks and behaviors critical to success (Huselid et al., 2005). Replacement with inferior personnel could have detrimental impact on both team and organization.

Related to this point, proper socialization of new team members also is paramount, and organizations should ensure procedures for new member socialization. Appropriate socialization allows new team members to learn group norms (Feldman, 1984), expectations (Chen, 2005), and it affects information sharing, transfer, and processing (Arrow et al., 2000). Moreover, socialization becomes of further importance for more strategically core roles.

### Limitations and Strengths

To accurately understand of the results of this study, it is important to recognize several limitations. First, what is presented is an initial experiment testing a new concept in a laboratory. Although there are clear limits to what can be accomplished in laboratory settings, one needs to keep the nature of the research question in mind when assessing the relevance of external validity (Berkowitz & Donnerstein, 1982). Because no formal aspect of this theory implies that it would *not* work in this specific context, the latter was a legitimate venue in which to test the theory. As Ilgen (1986) noted, this is precisely the type of question that is well suited to laboratory contexts.

Second, the participants in this experiment were undergraduate students engaging in an activity for course credit and cash prizes and were not subject to the various real world influences on organizational teams. However, this absence allowed reduction of contaminating influences on the dependent variable. On the other hand, it raises questions as to

whether the findings will generalize to other populations.

A third limitation of the study was that the team change implemented was to one member at a time, and no other changes occurred in the teams' task, environment, or role structures. Further, new team members had prior experience in other teams performing the same task. Although this control allowed for more focus on the hypothesized relationships (thus limiting noise), organizational teams typically have to deal with multiple issues simultaneously (Kozlowski, 1998).

Fourth, the only boundary condition examined in the study was cognitive ability, which may have been subject to range restriction in this sample. Although the results indicate that when member change occurs in a less strategically core role, high and low new member cognitive ability differ little in their effect on flux in coordination, for a very simple task, it may be that flux is actually higher when a member with extremely high cognitive ability fills the role.

Beyond cognitive ability, a host of other factors could influence the relationships between strategic core and information transfer on flux in coordination. For example, the effects of task type (McGrath, 1984; Steiner, 1972) and level of interdependence (Saavedra, Earley, & Van Dyne, 1993) might be of interest. Steiner (1972) outlined the resources necessary for various task types, providing one option for conceptualizing tasks (i.e., as "additive," "disjunctive," and "conjunctive"). Although this is a useful framework for interpreting tasks, it is problematic in that it implies a very simple team structure.

More specifically, two issues are pertinent to application of these task types to our current study: the presence of role differentiation in the teams, and Steiner's (1972) focus on individual resources in the proportion of that member's ability, to the exclusion of the role that individual was filling. In determining boundary conditions based on McGrath's (1984) task types, we again face the same problems that we encountered with Steiner's model, in that the issue is not so much what task is being accomplished as it is the extent to which role differentiation occurs. Thus, we believe that our model is bounded by the role structure of a team and is thus most generalizable to work teams with differentiated roles (Cohen & Bailey, 1997) that can be parceled out for importance to team effectiveness. However, we would also argue that our theory is applicable to project teams, even though they produce one-time outputs (Mankin, Cohen, & Bikson, 1996), as projects can last several years, during which team membership may likely change.

The most important factor for the generalizability of our model, in terms of interdependence, is the extent to which interdependence produces tightly coupled coordination networks (Hollenbeck & Spitzmuller, in press). That is, teams that do not require (or even discourage) coordination among members are not likely to experience a meaningful amount of flux in coordination following member change. For example, given that members of teams with low task interdependence are not very dependent upon the contributions of other members, replacing a member, even a member holding a strategically core role, is not likely to cause flux in coordination as there is little coordination to begin with. Following Hollenbeck and Spitzmuller's framework, we would therefore expect teams that have greater role differentiation (Beersma et al., 2009), that are more hierarchical (Halevy, Chou, & Galinsky, 2011), that possess more cooperatively oriented rewards (Aime, Meyer, & Humphrey, 2010), and/or that have more face-to-face communication (Kirkman, Rosen, Tesluk, & Gibson, 2004) to all be more likely to be affected by changes to a strategic core role, variation in information transfer, and the relative cognitive ability of a new member.

Although not an expressed limitation of the current study, the idea of role redundancy (i.e., we partially manipulated strategic core roles by including two VPs of finance) must be addressed. Humphrey et al. (2009) did not explicitly discuss role redundancy, but our interpretation of the theory of the strategic core is that our operationalization fits into their structure. Yet in a field environment, the situation may not be as clean as the situation we were able to create in the laboratory. For example, consider a surgical team with two nurses. Generally, surgical teams are designed so that one role executes the surgical responsibilities, another role supports the surgical role (e.g., monitors heart rate and provides requested equipment), and a third role supplies and checks anesthesia. Even with redundant role obligations, a surgical team with two members filling the nurse role would still likely have informal role differentiation, such as shorthand being developed between a nurse and a surgeon who regularly work together, and/or a slight shift in team role responsibilities.

Lastly, an alternative hypothesis may be that socialization drove our results. In an effort to partially remedy this limitation, we examined whether new member socialization differed between the information transfer conditions, and it should be noted that our data suggest no difference between the information transfer (mean = 3.48) and the non-information transfer conditions (mean = 3.41,

$F = .21, p = .65$ ). In addition, we conducted an analysis that included a measure of newcomer socialization ( $\alpha = .84$ ) that tapped a new team member's perception of how he/she felt that he/she was socialized into a team. The results of the analysis indicated that neither the previously reported results nor the interpretation of those results changed when we controlled for new member socialization (note that we did not control for the newcomer's attempt to socialize him-/herself to the team via active information-seeking behavior that is in line with the notion of evaluation in Moreland and Levine's [1982] socialization model). Table-form results are available from the first author.

It is also important to note several important strengths of this research. First, the experimental design allows for inferences regarding causality, which is an important step in establishing that a phenomenon can occur. Second, all manipulations and surveys were separated by time, thus reducing common method bias concerns. Additionally, we used objective measures of cognitive ability (i.e., Wonderlic) and a performance criterion, thus eliminating self-serving biases and tendencies. Third, this study involved a relatively large sample ( $n = 108$ ), which provides more confidence that the results are not due to random chance.

### Directions for Future Research

The results of the present study pose a number of interesting directions for future research. First, future research should investigate the impact of other factors that could moderate the amount of flux in coordination experienced by teams undergoing change. For example, differences in personality (Barrick & Mount, 1991; Homan, Hollenbeck, Humphrey, van Knippenberg, Ilgen, & Van Kleef, 2008; Humphrey, Hollenbeck, Meyer, & Ilgen, 2007; Kinlaw, 1991; Varney, 1989) and interpersonal competency (e.g., political skill [Ferris, Treadway, Perrewé, Brouer, Douglas, & Lux, 2007]) could demonstrate differential effects on processes in the context of team change.

Similarly, work design (Humphrey, Nahrgang, & Morgeson, 2007; Morgeson & Humphrey, 2006; Munyon, Summers, Buckley, Ranft, & Ferris, 2010), leadership (DeRue, Nahrgang, Wellman, & Humphrey, 2011; Summers, Munyon, Ranft, Ferris, & Buckley), and organization-level factors, including environment (Thompson, 1967; Weick, 1979) and reward structure (Johnson, Hollenbeck, Humphrey, Ilgen, Jundt, & Meyer, 2006), could affect how team change impacts processes and effectiveness. Additionally, context or specific situations (e.g., high-pressure situations, task complexity, or creativity)

can exhibit varying influences on the change-process relationship. Although a comprehensive analysis of the determinants of the suggested moderators is beyond the scope of this article, exploring the plethora of potential determinants represents an important direction for extending the proposed framework.

A second opportunity for future research is to examine the impact of other team processes as mediators in the change-performance relationship. This study examined only the impact of flux in coordination. Marks et al. (2001) proposed a temporally based framework of team processes in which coordination was but one action-oriented process. Other processes, such as conflict management, strategy formulation, and team monitoring, affect team effectiveness (Marks et al., 2001; Rousseau, Aube, & Savoie, 2006). Moreover, examining multiple mediation models would be a logical next step to further elaborate the notion of flux.

Although this study focused solely on membership change, future research should explore other kinds of change that impact flux. The impact of role change in teams is an understudied area in team research. Even though teams are conventionally treated as if they have stable roles (Campbell, 1958; Guzzo & Dickson, 1996; Hackman, 1987; Sundstrom, 1999), the reality is that teams frequently experience role changes (Ancona, Bresman, & Kaeufer, 2002; Grant & Hofmann, 2011). Additionally, future research needs to examine team change in the context of "cluster hiring" or "team lift" (Munyon, Summers, & Ferris, 2011), as moving an intact team from one organization to another should create flux in organization and team.

Fourth, by treating change as exogenous, the present research has not taken a stance on the effect of various antecedents of change. As prior work has indicated that teams may change for a variety of reasons, future research should examine antecedents of member and role change. For example, members may actively choose to reshuffle existing roles as a means of revitalizing their team (Boeker, 1997; Wiersema & Bantel, 1993), or management or some other external force may impose change (Wiersema & Bantel, 1993). Different sources of change (e.g., mergers and acquisitions vs. turnover) may demonstrate different effects on team coping with the change. Thus, future research should examine the moderating effect of a variety of endogenously and exogenously generated changes on the change-process-performance relationship.

Fifth, although examining how flux in coordination impacts team performance in the long run is beyond the scope of this study, a longer-term focus on the impact of flux remains warranted. In fact,

new team members with high levels of ability filling more strategically core roles could be very beneficial for team performance. However, this benefit likely will not be realized in the short term, but a long-term focus creates a new avenue for future research. Specifically, as Chang, Bordia, and Duck (2003) noted, the introduction of small changes (e.g., low levels of flux) to interrupt a team's inertia and create an environment of instability may increase the team's propensity for larger changes in the future.

Last, Humphrey et al.'s (2009) theory of the strategic core leads to a number of role-level issues and questions. According to Bradford (1995), although successful role change is critical to sustaining and growing a dynamic and innovative team, ineffective role change can be detrimental to team performance. This leads us to search for other mediators that are of interest to future research, as the impact of role change on social loafing and other political and social influence behaviors or processes deserve addressing. It may be that the negotiation of roles and role posturing that can surface as a result of role ambiguity and role conflict can be a major avenue of research in the largely untapped arena of social influence in teams. Furthermore, even though new member socialization has been studied in the team context (Chen, 2005; Chen & Klimoski, 2003), future research should differentiate between the socialization characteristics of more and less core roles as well as between the stages of socialization based upon these roles (Moreland & Levine, 1982).

## Conclusions

The objective of this study was to examine the impacts of changes to a team's strategic core and of information transfer accompanying member change on the flux experienced in the team's coordination, depending on the new team member's cognitive ability. Using a sample of 108 teams, we found support for all seven hypothesized relationships. In particular, changes to the strategic core were shown to exacerbate flux, and information transfer attenuated flux in coordination following member change. Moreover, the results demonstrate that flux in coordination mediated the relationships of strategic core change and team information transfer with performance: increases in flux resulted in low levels of performance. Hopefully, this study has generated insight and will stimulate further research in this area.

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