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Team adaptation in context: An integrated conceptual model and meta-analytic review

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ABSTRACT

In modern work teams, successful performance requires adaptation to changing environments, tasks, situations, and role structures. Although empirical studies of *team adaptive performance* have generated key inferences about team adaptation in specific contexts, there are important conceptual differences across the adaptive stimuli examined in the literature (e.g., novel environments vs. downsizing). We extend theories of team adaptation by suggesting that the effectiveness of team processes and emergent states in driving team adaptive performance will vary based on the nature of the adaptive stimulus. We integrate and extend the team adaptation literature using an IMOI framework to empirically examine a process model of team adaptive performance and examine two distinct contextual moderators: (a) internal versus external changes (i.e., *origin*), and (b) temporary versus sustained changes (i.e., *duration*). We meta-analytically examine the processes, emergent states, and inputs that lead to effective team adaptation in general, and in specific contexts. The results of our meta-analysis generally support our proposed model. We discuss implications and directions for future theory and research.

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1. Introduction

Successful teams must be able to adapt to changing demands (e.g., Burke, Stagl, Salas, Pierce, & Kendall, 2006). Competition, globalization, and technological changes have created a need for more flexible responses (Kozlowski & Bell, 2003; Volberda, 1996). In the past 15 years, management research has thus increasingly focused on team adaptation: the adjustments teams make when faced with emergent contextual changes and the outcomes of such adjustments (e.g., Baard, Rench, & Kozlowski, 2014; Burke et al., 2006). Although the literature on routine team performance has been reviewed (see Ilgen, Hollenbeck, Johnson, & Jundt, 2005; Mathieu, Maynard, Rapp, & Gilson, 2008), we know much less about the characteristics and processes that influence successful team adaptation. Given that one of the primary reasons that teams are used is that they are thought to have adaptive advantages over individuals (Kozlowski, Gully, Nason, & Smith, 1999), an important next step is to move beyond routine team performance towards quantifying our understanding of team adaptation to non-routine circumstances.

A key question within the team adaptation literature revolves around understanding the varying effectiveness of team processes and emergent states *across* differing contexts. For example, communication has an equivocal effect on team performance in some adaptive contexts (Johnson et al., 2006; Moon et al., 2004; Waller, 1999), whereas in others, the effect is significant and positive (e.g., Grote, Kolbe, Zala-Mezo, Bienefeld-Seall, & Kunzle, 2010; Stachowski, Kaplan, & Waller, 2009; Summers, Humphrey, & Ferris, 2012). Similarly, team learning has a positive impact on performance in some situations (e.g., Woolley, Bear, Chang, & DeCostanza, 2013), but no effect in others (e.g., Vashdi, Bamberger, & Erez, 2013). We propose that inconsistencies of this type can be resolved by taking the *context* of the adaptive situation into account. We theorize that the effectiveness of adaptive responses to changes are bound by the nature of the change itself. In doing so, we address calls from researchers to consider the role of stimuli in theorizing about adaptation. For example, Baard et al. (2014) point out that we lack an understanding of “what it is to which an entity is adapting” and “what mechanisms underlie that particular form of adaptation” (p. 89). Similarly, Ilgen et al. (2005) and Maynard, Kennedy, and Sommer (2015) suggest that a more fine-grained understanding of team adaptation is needed. To this end, we develop and test a framework to organize the adaptive stimuli faced by teams, examining two distinct contextual moderators: (a) internal versus external changes (i.e., origin), and (b)

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temporary versus sustained changes (i.e., duration). We both integrate and differentiate within the team adaptation literature by developing a typology of stimuli which we use to formulate and test predictions for the effectiveness of teams in various contexts.

Our primary goal is to examine how team mechanisms (i.e., processes and emergent states) influence adaptive performance across differing contexts. This is critically important, as there is a great deal of variation between studies in (a) how researchers conceptualize and operationalize adaptation, and (b) the effect sizes reported in individual studies. The extant literature is broad, and encompasses a wide array of adaptive stimuli, including internal disruptions (e.g., communication breakdowns; LePine, 2003, 2005), structural alterations (e.g., team member loss; DeRue, Hollenbeck, Johnson, Ilgen, & Jundt, 2008), and external challenges (e.g., novel environments; Marks, Zaccaro, & Mathieu, 2000). Each of these studies has generated important inferences about team adaptation in specific contexts. However, it is unlikely that a team's responses will be similarly effective across different situations (cf. Johns, 2006), making the generalization of results and inferences difficult across studies. We argue that the reason that studies report inconsistent effects of team processes and cognition (e.g., communication, coordination, learning) on adaptive performance is due to the moderating role of context. Thus, our primary goal contributes to the literature by extending our understanding of when and why a team's response to an adaptive stimulus may be more or less effective.

The extant literature has matured to a point where an empirical review can quantitatively identify the effectiveness of specific team processes, both by context and in general. Thus, our secondary goal is providing an overall quantitative summary of the literature. We build on recent theoretical work that qualitatively reviews the process and predictors of successful team adaptation (Baard et al., 2014; Burke et al., 2006; Maynard et al., 2015). In their reviews, Maynard et al. (2015) develop a process model of adaptation, and Baard et al. (2014) provide a useful taxonomy of individual and team adaptation, reviewing different viewpoints on adaptation and whether it has been conceived as a process, individual difference, or as changes in performance. These theoretical works have provided important insights. However, a quantitative review of the adaptive process is a necessary next step in extending theory and guiding further conceptual development. Although we believe context to be an important source of variance, we also believe that an understanding of the adaptive process in general holds value.

Therefore, our goals are to (a) extend prior theories of team adaptation by examining the roles of differing adaptive stimuli (i.e., context), and (b) to empirically test predictions derived from existing theories of team adaptation. First, we briefly review prior work (e.g., Baard et al., 2014; Burke et al., 2006; Ilgen et al., 2005; Kozlowski et al., 1999; Maynard et al., 2015; Rosen et al., 2011), building a general model upon which we base predictions throughout the manuscript. Next, we develop a typology of adaptive stimuli and hypothesize that these contextual factors moderate the associations between processes and emergent states with team adaptive performance.[1] Along the way, we move towards our secondary goal of providing a quantitative review of the expected general effects among the primary variables of interest—adaptive mechanisms and team adaptive performance. Finally, we consider the associations of input factors with our variables of interest.

1.1. An integrated conceptual model of team adaptive performance

Consistent with both the input-mediator-output-input (IMOI) framework (Ilgen et al., 2005), and recent theoretical models (e.g., Burke et al., 2006; Maynard et al., 2015; Rosen et al., 2011), team adaptation is an unfolding process whereby factors associated with *adaptability* (i.e., inputs) influence *adaptive mechanisms* (i.e., team processes and emergent states). These mechanisms in turn affect *team adaptive performance* (i.e., task-related outcomes following changes), see Fig. 1. In Burke et al.'s (2006) model of team adaptation, adaptability is determined by relatively stable team characteristics, which are *inputs* that impact the start of the adaptive cycle; similarly, Maynard et al. (2015) view team adaptability as an *input* factor. Adaptability inputs build from individual adaptive abilities but are "capabilities that are critical long-term characteristics of team effectiveness" (Kozlowski et al., 1999, p. 242). At the team-level, inputs are typically conceptualized as team compositional factors such as abilities, dispositional traits, and knowledge and skills (Burke et al., 2006; Maynard et al., 2015; Randall, Resick, & DeChurch, 2011) that are functionally isomorphic to those at the individual-level (cf. Morgeson & Hofmann, 1999). Although typically conceptualized as input variables, certain adaptability "inputs" can improve through team interactions over time (Kozlowski et al., 1999), such as team knowledge or expertise. Inputs help to build a team's stable adaptive capacity—and we include them in our model—but our primary theoretical focus is on *processes and emergent states*, which are more malleable and thus may be altered in reaction to adaptive contexts.

Team processes and emergent states (i.e., *adaptive mechanisms*) result from adaptability inputs and team interactions, and build on each other recursively, enabling a team to assess an adaptive situation, learn what is needed to respond to demands, and develop strategies and responses for successful adaptation (Burke et al., 2006; Maynard et al., 2015).[2] Team processes are "members' interdependent acts that convert inputs to outcomes through cognitive, verbal, and behavioral activities directed towards organizing taskwork to achieve collective goals," (Marks, Mathieu, & Zaccaro, 2001, p. 357). Emergent states are "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., 2001, p. 357).[3] Emergent states both result from and precede processes, but are not processes themselves (Ilgen et al., 2005).

We focus on the processes and emergent states most relevant to adaptive performance—those that are enacted and emerge *during or following a change*—rather than the myriad factors that are helpful for routine team performance (e.g., Ilgen et al., 2005; Mathieu et al., 2008). For example, LePine (2003) examined role structure adaptation, a set of behaviors that involve reactive adjustments to the role structure system, such as changing communication patterns within the team. Beersma et al. (2009) examined the degree to which team members wasted resources as an indicator of suboptimal coordination behavior, whereas teams that "'think on their feet' and react swiftly to unexpected events under dynamic conditions" (Waller, 1999, p. 127) are seen as engaging in stronger team processes within an adaptive context.

[1] Although the effectiveness of inputs (e.g., adaptability-related factors such as team composition or leader briefings) may vary based on stimuli, we focus on mechanisms for two reasons. First, processes and states are more malleable and likely to change in response to stimuli compared to inputs, which are more stable. Second, few primary studies examine inputs across contexts, prohibiting stable meta-analytic tests.

[2] Burke et al. (2006) refer to both *team adaptation* and *adaptive team performance* as behaviors. We differentiate processes from performance here, consistent with the IMOI framework and with Beal, Cohen, Burke, and McLendon (2003), who argue that performance behaviors are distinct from goals achieved (i.e., outcomes).

[3] Emergent states may be classified as inputs; however, because they represent the product of team experiences, they are generally viewed as proximal mechanisms (e.g., mental models; Marks et al., 2001).

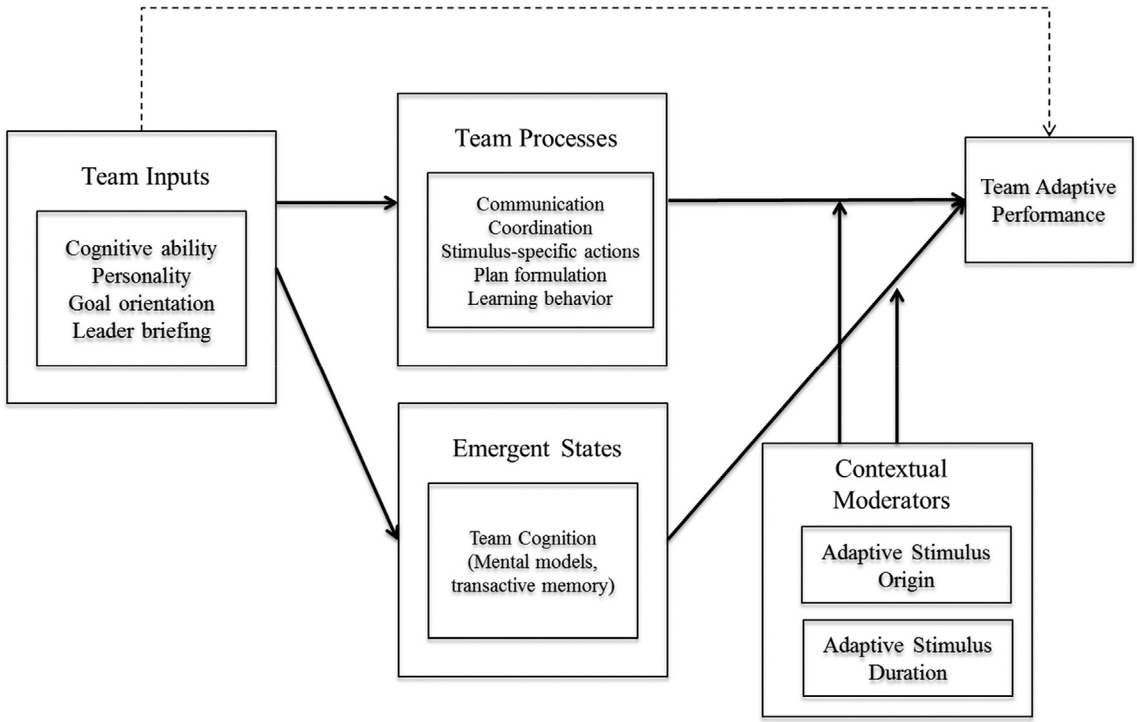

Fig. 1. Model of the team adaptive process in context.

Team processes and emergent states can facilitate successful team adaptive performance.[4] We differentiate *team adaptive performance* from *routine team performance*. Routine team performance typically involves the aggregation of each team member's efforts in completing the same (or similar) tasks, and is the result of both skill and experience as teams improve in their effectiveness over time (Gersick & Hackman, 1990). Team adaptive performance, in contrast, "typically emerges as team members engage in different tasks and display different types and amounts of actions during performance," (Burke et al., 2006, p. 1192). Further, team adaptive performance reflects the effectiveness of enacted changes in behaviors, subsequent to or during a change. As Burke et al. (2006) suggest, theories of adaptive performance should differentiate behaviors from their consequent performance outcomes (see also Beal et al., 2003). As such, team adaptive performance is an outcome measured by indicators of task effectiveness *within the context of a change*, often operationalized as accuracy or quality, supervisory ratings, or objective scores (e.g., Kirkman & Rosen, 1999; Langfred, 2000; Pearsall, Christian, & Ellis, 2010).

The IMOI framework allows us to organize predictions for the magnitude of effects using theory and relative conceptual distance among variables in the proposed causal chain (e.g., Burke et al., 2006; Campbell, McCloy, Oppler, & Sager, 1993; Kanfer, 1990; see Christian, Bradley, Wallace, & Burke, 2009 for a meta-analytic example). Inputs are relatively stable, exerting indirect effects on performance through malleable mechanisms, and are thus distal to performance. These indirect effects manifest through team processes and emergent states, which are dynamic and change in response to demands, exerting moderate to strong proximal effects on performance during specific performance episodes. Thus, we expect that in general, distal inputs will have a moderate to strong relationship with proximal mechanisms, but will have a weaker effect on team adaptive performance than proximal mechanisms (see Fig. 1). Given our primary theoretical focus on the role of team processes and emergent states, we begin our discussion with these mechanisms and return later to the role of inputs.

1.2. Adaptive mechanisms

The IMOI framework suggests that adaptive mechanisms convey the effects of inputs—which "set the stage" as stable capacities—to team adaptive performance. Burke et al. (2006) and Maynard et al. (2015) discuss several adaptive mechanisms that are associated with adaptive performance, and we draw from both frameworks.

1.2.1. Team processes

According to Maynard et al. (2015), when teams face a change, they engage in both general action processes, and adaptive processes *specific* to addressing the change. Each should improve team adaptive performance. First, general action processes do not directly address a stimulus, yet improve team performance (e.g., Marks et al., 2001; Maynard et al., 2015), and our review identified two general action processes[5]: (1) communication, and (2) coordination. *Communication* is a process of clear and accurate exchange and receipt of general task-relevant information with correct terminology (Cannon-Bowers, Tannenbaum, Salas, & Volpe, 1995). For example, both Marks, Zaccaro, and Mathieu (2000) and Waller, Gupta, and Giambatista (2004) trained raters to assess the quality of team communication behaviors during a change. *Coordination* is "orchestrating the sequence and timing of interdependent actions," (Marks et al., 2001, p. 363), and involves beneficial behaviors that align member contributions with goal accomplishment (Brannick,

[4] We note that when teams face adaptive stimuli, generally, performance will suffer. This is because almost all adaptive stimuli disrupt performance routines and require alterations to team roles and resources. As such, we view successful team adaptive performance as a minimization of losses or performance recovery. The amount of "loss" faced by the team should be minimized by effective adaptive mechanisms.

[5] Although Maynard et al. (2015) classify team cognition as a general mediating process, we argue that it is an emergent state and discuss it in an upcoming section.

Roach, & Salas, 1993). For example, Beersma et al. (2009) examined the degree to which members' attacks lacked coordination by calling for the wrong vehicle for a particular region, resulting in the attack "coming up short" (lacking sufficient power) or being wasteful (i.e., used unnecessary power). In sum, general action processes help teams to orchestrate and synchronize their behaviors, and should increase team adaptive performance (e.g., Marks et al., 2001; Rosen et al., 2011).

Second, adaptive processes involve behaviors such as altering roles and structures to *address a change directly* (Burke et al., 2006; Maynard et al., 2015). For example, teams may alter their structures in the face of new information (Diedrich, Freeman, Entin, Weil, & MacMillan, 2005) or develop a plan for "dealing" with the new situation (Christian, Pearsall, Christian, & Ellis, 2014; Waller, 1999). Based on our review, we identified three adaptive processes: (1) stimulus-specific actions (SSAs), (2) learning behavior, and (3) plan formulation. *SSAs* are actions or behaviors enacted by the team that directly address, and are limited to, a particular and discrete demand. These behaviors represent unique adjustments "as dictated by the type of disruption or trigger," (Maynard et al., 2015, p. 8). Examples include teams creating work-arounds in their communication patterns when breakdowns occur (LePine, 2003), or an increased frequency and speed of task prioritization activities, in response to a non-routine event (Waller, 1999). *Learning behavior* occurs when a team engages in activities that create iterative and shared action-reflection experiences (Vashdi et al., 2013), such as experimentation or adding new information to one's repertoire (Bouton, 2002). The results of such experiences are enhancements in knowledge and skills that create "a relatively permanent change in the team's collective level of knowledge and skill produced by the shared experience of the team members," (Ellis et al., 2003, p. 822).

Plan formulation is a specific type of communication or collective action that clarifies future strategies and action steps, defined as "deciding on a course of action, setting goals, clarifying member role and responsibilities ... discussing relevant environmental characteristics and constraints, prioritizing tasks, clarifying performance expectations, and sharing information related to task requirements (Burke et al., 2006, p. 1194)." Plan formulation is the generation of specific plans to transform the team's current situation into their desired end point (Rosen et al., 2011), and has been found to help teams succeed following a non-routine event (Waller, 1999). In sum, adaptive processes help teams interpret and react to the new environment or disruptive event (Rosen et al., 2011; Waller, 1999). Each of these processes involves a beneficial behavioral reaction to an environmental change, and should have positive effects on team adaptive performance. Therefore, we hypothesize:

Hypothesis 1. Team processes are moderately to strongly related to team adaptive performance.

1.2.2. Emergent states

Research examining *emergent states* typically focuses on team cognition, despite a handful of studies investigating team empowerment or efficacy (e.g., Chen, 2005; Chen, Thomas, & Wallace, 2005; Randall, 2008). Team cognition "emerges from the interplay of the individual cognition of each team member and team process behaviors," (Cooke, Salas, Keikel, & Bell, 2004, p. 85) influencing performance through members' shared understanding of tasks, roles, and situations, and enhancing implicit task coordination (e.g., Klimoski & Mohammed, 1994; Mohammed & Dumville, 2001). Team cognition is a higher order factor represented by *team mental models* and *transactive memory* (Zajac, Gregory, Bedwell, Kramer, & Salas, 2014). Team mental models are "knowledge structures held by members of a team that enable them to form accurate explanations and expectations for the task, and in turn, to coordinate their actions and adapt their behavior to demands of the task and other team members" (Cannon-Bowers, Salas, & Converse, 1993, p. 228). Transactive memory systems are organized knowledge stores in team members' memories, or a set of knowledge-related transactive behaviors that occur within the team (Wegner, Giuliano, & Hertel, 1985).

Team cognition is positively related to team processes and performance in routine settings (e.g., Austin, 2003; Lewis, 2004; Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000; Orasanu, 1990), and should be particularly important for team adaptive performance, as more developed cognitive structures facilitate integration of new knowledge or the use of existing knowledge in a new way. For instance, mental models help teams adapt to novel task environments (Marks et al., 2000), and transactive memory has been associated with adaptive performance after member loss (Christian et al., 2014) and in helping teams respond to disasters (Majchrzak, Jarvenpaa, & Hollingshead, 2007). We therefore hypothesize:

Hypothesis 2. Team cognition is moderately to strongly related to team adaptive performance.

1.3. The adaptive stimulus: a model of contextual factors

Within organizations, and across research contexts, teams may face many different types of adaptive stimuli. These stimuli may necessitate changes to their situation, environment, resources, membership, or structure, requiring teams to alter their actions and interactions in order to perform. Although each situation requires teams to adapt in order to perform successfully, the form and effectiveness of that adaptive response may vary considerably. Recent work suggests that certain features of the context will moderate the effectiveness of team processes and emergent states. For example, Burke et al. (2006) suggest that the adaptive process will fluctuate with contextual changes that signal the need for adaptation, and Maynard et al. (2015) suggest examining the type of disruption that a team faces when evaluating responses. Similarly, Baard et al.'s (2014) evaluation of the adaptation literature notes that "although rich, this work has been diverse with different theoretical underpinnings, intended applications, and conceptualizations ... making it challenging to extract principles, integrate findings, and identify research gaps," (p. 49). The authors also suggest that "there is a compelling need to explicitly ... specify what it is to which the entity is adapting (i.e., key environment/task drivers)" (p. 89). In modeling the complex nature of adaptive stimuli, we argue that the *origin* and *duration* of a stimulus are two key factors that can determine the effectiveness of adaptive mechanisms (see Table 1).

Table 1
Definitions of adaptive stimuli moderators.

Dimension	Definition
Origin: Internal	A change in roles, membership, rewards, or structural form of the team
Origin: External	A change in the collective task environment, including changes in situational contingencies and the occurrence of non-routine events
Duration: Temporary	A change that is transient and short term, and/or when the team will return to its previous state during its lifecycle
Duration: Sustained	A change that is enduring, long-term, or persistent, and/or when the team will face the change for the duration of its lifecycle

1.3.1. Adaptive stimulus origin

Work on team adaptation (e.g., Burke et al., 2006; Maynard et al., 2015), as well as the broader teams literature (Ancona & Caldwell, 1990; Arrow & McGrath, 1993; Gersick & Hackman, 1990; Klein & Pierce, 2001), tends to view teams as discrete, bounded units and divides the environment into two spheres—factors internal to the team, and those external to the team. For example, Kozlowski and colleagues point out that teams must adapt to "rapidly shifting contingencies, both *internal* and *external*" (1999, p. 241). Gersick and Hackman (1990) suggest that stimuli may be either *externally* imposed or *internally* generated, and Ancona and Caldwell (1990) discuss the concept of "boundary spanning," demonstrating the necessity of coordinating both *internally* within the team and *externally* with outsiders. Teams inherently view boundaries between themselves and external entities, viewing "process[es] as divided into an internal and an external component," (Ancona & Caldwell, 1992, p. 635). Maynard et al. (2015) suggest a similar classification scheme, noting that teams face adaptive stimuli that impact factors within the team itself (teamwork-based triggers) or those external to the team (task-based triggers). Paralleling the team adaptation literature, the internal vs. external dichotomy is also used when discussing threats to a system or organization (e.g., crisis management; Cancel, Cameron, Sallot, & Mitrook, 1997; Rosenthal & Kouzmin, 1997).

An internal adaptive stimulus—generally a structural alteration that requires team members to modify their roles and interactions—will influence the internal workings of the team, requiring a shift among member roles and changes in coordination while the task environment remains unchanged.[6] For example, DeRue, Hollenbeck, Johnson, Ilgen, and Jundt (2008) examined how teams responded to the loss of a leader or team member. Much of the work examining internal stimuli has focused on changes to team structure, a team's ability to adapt their structure when needed, and the asymmetrical nature of structural changes (i.e., Structural Adaptation Theory; Johnson, Hollenbeck, DeRue, Barnes, & Jundt, 2013; Johnson et al., 2006; Moon et al., 2004). When faced with internal stimuli, teams must turn their focus inward and redistribute workload appropriately to meet new situational demands. In contrast, an external adaptive stimulus—a demand residing in the team's external environment—requires an intact and unchanged team to adapt to an emergent situation. Examples of external adaptive stimuli appear in Waller's (1999) and Morgeson's (2005) studies of novel and disruptive events, where teams were forced to respond to external changes (e.g., flight crews' adaptation to a lack of nose wheel steering; Waller, 1999).

In general, we expect that there will be a *stronger* positive relationship between adaptive mechanisms and team adaptive performance when a team encounters an external stimulus than when the team faces an internal stimulus. When a team faces an internal stimulus, team processes and cognition are disturbed, which make them less effective, and teams will need to make adjustments in terms of how they interact with one another (Maynard et al., 2015) and to determine if they need to develop new routines (Klein & Pierce, 2001). Internal stimuli involve changes to the team's composition (e.g., losing or gaining a member) or a shift in member roles (e.g., change in roles, a change from divisional to functional structure). In such cases, teams must redesign *how* they work together, rather than collectively apply their routines and existing strategies to a new context. Previous patterns may no longer be optimal, following a shift in roles. For example, Moon et al. (2004) reported overall negative relationships between communication and coordination and team adaptive performance following an internal structural change. Internal stimuli will also disrupt team cognition and the knowledge base of the team, with the result that they are less able to apply their collective knowledge to the new situation. Further, teams are more likely to misunderstand the nature of internal demands and to respond with misdirected adaptive strategies (Johnson, Hollenbeck, DeRue, Barnes, & Jundt, 2013). Importantly, we still expect that adaptive mechanisms will positively impact team adaptive performance following an internal stimulus, but expect the relationship to be weaker than when teams face an external stimulus.

External stimuli allow the team to remain intact, keeping internal processes in place and relatively stable, allowing them to be collectively applied to the new situation, which enhances their effectiveness. In such situations, the intact team can collectively work together to respond to the changed situation. The successful application of established routines and coordination efforts should positively impact team adaptive performance. According to Rico, Sánchez-Manzanares, Gil, and Gibson (2008), this is because "the ability to predict others' actions and needs during collective undertaking promotes helping, monitoring, and workload sharing" (p. 170) and should improve team performance. For example, for teams faced with significant changes in a task environment, communication strongly predicts team adaptive performance, as teams have to identify the nature of the changes in the environment, and then collectively discuss how to alter their behaviors in the novel situation (Marks et al., 2000). Also, in terms of cognition, when a team faces an external change, a shared understanding of the task and "who knows what" should be positively related to team adaptive performance (Majchrzak et al., 2007). For example, Resick et al. (2010) found that mental models were positively related to team adaptive performance following a disruptive event. We therefore hypothesize:

Hypothesis 3a–e. Origin of the adaptive stimulus moderates the relationship between team processes and team adaptive performance, such that the relationship is stronger for external stimuli compared to internal stimuli for (a) communication, (b) coordination (c) stimulus-specific actions, (d) learning behavior, and (e) plan formulation.

Hypothesis 4. Origin of the adaptive stimulus moderates the relationship between team cognition and team adaptive performance, such that the relationship is stronger for external stimuli compared to internal stimuli.

1.3.2. Adaptive stimulus duration

Both the team adaptation literature (Burke et al., 2006; Kozlowski et al., 1999) and the broader teams literature (Gersick & Hackman, 1990; Marks et al., 2000), view time as a critical factor in understanding team dynamics. Adaptation occurs over time, and the degree and scope of the adaptation and the effectiveness of a team's response is dependent on the duration of a change (Kozlowski et al., 1999). Burke et al. (2006) suggest that a "temporary" problem requires only a single situational assessment, a simple plan, or change in response, whereas more permanent changes require greater sense-making, communication, cycles of planning, and updated cognitions. When faced with changes, teams must "reconfigure their workflows and modify their performance to satisfy *short*- and *long-term* demands for

[6] We refer to internal stimuli as those that affect the internal structure or workload distribution within the team, regardless of whether the change itself is internally or externally instigated. For example, membership change may be internally instigated (a member is fired), or externally instigated (a member is hired away). In our model, both of these situations would be classified as internal stimuli, as they force alterations in the internal workings of the team. We thank an anonymous reviewer for this example.

change," (Kozlowski et al., 1999, p. 253). The duration of a change is also implicit in Gersick and Hackman's (1990) theory of team routines. They argue that more sustained factors such as the reconfiguration of the team or a redesign of the group task are most likely to result in substantive changes to routines, while changes and feedback limited to current performance episodes are not. Other adaptation researchers have similarly noted the issue of duration. For example, LePine (2005) expressly discusses the issue of time in adaptation, noting that the nature of the response should depend on the temporal nature of a change: "teams would have been better off not changing their role structure if the disruption was only temporary," (p. 1157).

A temporary stimulus is a change that is short-term, after which teams expect to revert back to a state of normalcy. For example, Waller's (1999) examination of teams facing non-routine constraints imposed by air traffic control, and Stachowski et al.'s (2009) study of power plant control room crews facing non-routine events are studies of temporary adaptive stimuli. In contrast, a sustained stimulus is a change that is long-term, relatively sustained, or permanent—there is no obvious indication that the situation will return to the previous state. For example, Chen's (2005) study of newcomers entering teams, Johnson et al.'s (2013) study of structural and strategy changes, and Randall, Resick, and DeChurch's (2011) study of task changes represent sustained changes. With the exception of learning behavior, we expect that there will be a *stronger* positive relationship between adaptive mechanisms and team adaptive performance when a team faces a temporary stimulus than a sustained stimulus.

When faced with a temporary adaptive stimulus, teams do not need to develop new processes, but can simply create short-term "workarounds" to the problem. Having strong levels of coordination and other team processes should allow teams to quickly determine how to best "deal" with the change. For example, teams facing a temporary workload increase benefitted from high levels of backup behavior, which points to the importance of team processes in allowing teams to quickly "deal with" a temporary adaptive stimulus (Porter et al., 2003). The team is likely to be most successful by increasing members' connectivity to find ways to effectively create a "workaround" for the problem until the situation returns to normal and the team can resume routine functioning. Thus, strong team processes allow for temporary fixes, increasing short-term efficiency. Also, team cognition should be particularly effective in helping teams respond to temporary stimuli. Team cognition provides an in-depth understanding of member roles, knowledge stores, and communication patterns, and therefore should be incredibly useful when teams must engage in a quick and coordinated response.

Sustained stimuli, however, harm teams' internal interactions because they require teams to develop new processes. For example, dealing with a team member out sick for a day requires a different level of response than dealing with the permanent loss of a position within the team. In the latter case, long-standing team processes may become outdated and lack a direct application to the changed situation. When a team is faced with a sustained stimulus, more resources or new knowledge may be required to overcome the changed situation (Jin & Cameron, 2007). As an example, Johnson et al. (2006) found that overall, information sharing was negatively related to team performance (in terms of attack speed) following a change in reward structure. Further, for sustained changes, team cognition patterns may need to be altered as they will be less effective unless updated to include new knowledge. While we still expect a positive relationship between adaptive mechanisms and team adaptive performance when teams face sustained stimuli, we expect the relationship to be weaker than when teams face temporary stimuli. We therefore hypothesize:

Hypothesis 5a–d. Duration of the adaptive stimulus moderates the relationship between team processes and team adaptive performance, such that the relationship is stronger for temporary stimuli compared to sustained stimuli for (a) communication, (b) coordination (c) stimulus-specific actions, and (d) plan formulation.

Hypothesis 6. Duration of the adaptive stimulus moderates the relationship between team cognition and team adaptive performance, such that the relationship is stronger for temporary stimuli compared to sustained stimuli.

Alternatively, we expect adaptive stimuli duration to have different implications for the relationship between learning behavior and team adaptive performance. A team's efforts to fully understand the nature and consequences of a demand in order to make significant changes to their interactions and routines is needed to thrive within the "new reality" created by a sustained stimulus. Sustained stimuli necessitate that the team learn about the situation and develop new strategies for completing work that can be maintained over time. In contrast, for temporary stimuli, learning behavior is less useful because the situation will soon return to its previous state. Burke et al. (2006) suggest that learning is really only necessary for long-term adaptation, as learning requires that members jointly reflect on the nature of the change to develop new routines to replace the old ones. For example, Ellis et al. (2003) introduced persistent new threats into the task environment, forcing teams to invest resources to collectively learn about the threats, and to formulate new routines for dealing with them. Teams that engaged in a trial-and-error learning process were most successful. Teams engaged in learning behavior are generally focused on learning strategies for how to perform successfully in a new environment and thinking about applying that knowledge in the future, rather than focusing on short-term challenges or workarounds. We therefore hypothesize:

Hypothesis 5e. Duration of the adaptive stimulus moderates the relationship between learning behavior and team adaptive performance, such that the relationship is stronger for sustained stimuli compared to temporary stimuli.

1.4. Inputs

Models of the team adaptation process include input factors that "set the stage" for successful team adaptive performance (Burke et al., 2006; Maynard et al., 2015). An examination of theoretically relevant inputs allows us to address our secondary goal of reviewing the literature. Yet, we do not offer formal hypotheses for these factors because (a) inputs are less relevant to our theoretical model of mechanisms, and (b) the paucity of studies prohibits moderation analyses by context. Instead, based on our IMOI model and the relative conceptual distance among variables, we offer the general expectation that inputs will be (a) moderately to strongly related to adaptive mechanisms and (b) weakly to moderately related to team adaptive performance.

Cognitive ability is of particular importance for complex situations requiring high levels of information-processing (e.g., Hunter, 1986; Hunter & Hunter, 1984; Schmidt, 2002), which is necessary when teams face an adaptive stimulus. At the team-level, cognitive ability positively impacts performance, as members with high cognitive ability are more effective in their roles and in integrating their roles (Devine & Philips, 2001), especially when a task involves learning, unlearning, or reacting in innovative ways (Hunter, 1986; LePine, 2003; LePine, Colquitt, & Erez, 2000). When a situation changes, teams with high cognitive ability should be able to enact adaptive mechanisms by effectively reworking and redeveloping systems and learning from their experiences, which will translate to adaptive performance.

The Big Five personality traits (e.g., Costa & McCrae, 1985) of team members are related to routine team performance—particu larly conscientiousness (e.g., Bell, 2007; Kristof-Brown, Barrick, & Stevens, 2005). The literature on performance in routine environments suggests that each trait will have a positive effect on the team's enactment of adaptive mechanisms, which will translate to improved adaptive performance. *Openness* should increase acceptance of changes and suggestions for solutions (LePine, 2003; Stokes, Schneider, & Lyons, 2010). *Conscientiousness* should increase sense of responsibility and duty in noticing and planning responses to change (Porter et al., 2003; Stokes, Schneider, & Lyons, 2010). *Extraversion* should increase communication about the change (DeRue et al., 2008; Porter et al., 2003). *Agreeableness* should increase cohesive teamwork in responding to change (Porter et al., 2003). Finally, *emotional stability* should reduce anxiety and stress associated with change (DeRue et al., 2008; Porter et al., 2003).

Individuals high in *learning orientation* tend to approach tasks with a focus on mastery, while those high in *performance orientation* focus on avoiding failure or gaining favorable evaluations (e.g., Button, Mathieu, & Zajac, 1996). Teams with members high in *learning orientation* tend to seek out challenges and display an adaptive response pattern characterized by persistence and the use of complex learning strategies (e.g., Bunderson & Sutcliffe, 2003; LePine, 2005; Porter, 2005), which are adaptive mechanisms that should translate to adaptive performance. The effect of *performance orientation* on adaptation is less well understood. Some studies report negative or equivocal relations with adaptive outcomes due to fear of failure, reliance on habitual routines, and decreased interest in difficult tasks (e.g., LePine, 2005; Porter, 2005). Yet, others report positive relations (e.g., Porter, Webb & Gogus, 2010; Woolley, 2009), suggesting that outcome-focused teams deal effectively with task-related changes due to their high-level performance drive and tendency to plan and break tasks down into more easily adapted components (Woolley, 2009).

Leader briefings reflect information inputs conveyed to the team about the task environment, and provide knowledge that should help the team adapt (Marks et al., 2000). Briefings are a form of communication (e.g., Hackman & Walton, 1986) that may include anticipated flexible or adaptive responses should unforeseen circumstances arise (Vashdi et al., 2013). Briefings can act as a form of "sensegiving," which help teams to interpret and process information (Randall, 2008), and are particularly important in changing environments (e.g., Dunford & Jones, 2000). Leader briefings positively impact shared understanding of the team environment (Zaccaro, Rittman, & Marks, 2001) and mental model development (Marks et al., 2000), which should also translate to increased adaptive performance.

1.4.1. Additional inputs and moderators

Team characteristics, such as size, tenure, and task-related knowledge may also relate to adaptive mechanisms and team adaptive performance, but findings are mixed. In terms of *team size*, some studies report that size negatively impacts performance due to process loss (e.g., Gooding & Wagner, 1985), whereas other studies report a positive impact on performance (e.g., Stewart, 2006). *Team tenure* may have a positive impact on performance (Finkelstein & Hambrick, 1990; Tuckman, 1965). Yet, a recent meta-analysis reported a non-significant effect of team tenure on routine performance (Bell, Villado, Lukasik, Belau, & Briggs, 2011), while other work shows that tenure hinders team processes (Katz, 1982). While *task-related knowledge* positively impacts performance in routine situations (e.g., Mathieu & Schulze, 2006), predictions are less clear in adaptive contexts. We investigate these factors as research questions.

We also examine the potential moderating effect of three other important factors: research strategy (field vs. laboratory), performance measurement type (objective vs. subjective), and team type.[7] We chose these moderators because of their importance to the literature; however, we do not have a theoretical basis to make any explicit expectations for these factors.

2. Method

2.1. Literature search

We searched the literature in order to identify all peer-reviewed empirical publications examining input, process, and emergent state predictors of team adaptation. We used ISIWeb and searched using combinations of the words *team, adapt, adaptation,* and *adaptive* as a topic and in article titles from 1900–2016. We also conducted manual searches of relevant major journals (e.g., *Academy of Management Journal, Journal of Applied Psychology, Journal of Management, Organizational Behavior and Human Decision Processes, Group Dynamics: Theory, Research, and Practice*) to locate any articles that did not appear in the database search. We consulted reference sections of relevant and recent major review articles to locate any additional articles. We also searched the *Online First, In Press*, or *Articles in Advance* sections of major journals (*Academy of Management Journal, Journal of Applied Psychology, Personnel Psychology, Organizational Behavior and Human Decision Processes, Organization Science, Management Science, Journal of Management, Administrative Science Quarterly, Group Dynamics: Theory, Research, and Practice*, and *Small Group Research*) to locate any articles not yet included in the online database. Finally, we searched for relevant dissertations using Proquest's Dissertation and Thesis search engine, and emailed authors who had published previously in the adaptation literature requests for unpublished work.

2.2. Criteria for inclusion

First, in order to be included, studies must have been conducted at the team-level. Second, they had to empirically test proposed relationships and include a performance-based dependent variable. For example, we excluded work that investigated satisfaction with leadership or leader behavior as a dependent variable (e.g., Krabberød, 2014; Morgeson, 2005). Third, studies must have investigated team responses to a change *over a defined time period*. For example, we excluded articles examining teams that were not faced with time-defined changes, such as the pioneering work by Ancona and Caldwell (1990, 1992, 2007). These studies investigated team behaviors that facilitate adaptive responses (i.e., scouting behavior), yet they do not investigate what such teams actually do when faced with a change, and focus on *routine* activities. As another example, we excluded *general* work on virtual teams, such as work examining virtual team environments that did not involve a change (e.g., Hambley, O'Neill, & Kline, 2007; Yoo & Alavi, 2004). Finally, we excluded work on teams adapting to new cultural contexts (e.g., American teams working in Japan) in our analysis. In total, we identified 50 studies to use for our meta-analysis.

[7] We classify team type based on Hollenbeck, Beersma, and Schouten's (2012) team typology. *Skill differentiation* refers to the degree of team members' specialized knowledge. *Authority differentiation* refers to the degree to which decision-making responsibility is vested in individual members vs. the collective. *Temporal stability* refers to the degree to which members have a shared working history and expect to continue working together in the future.

2.3. Categorizing criterion and adaptive mechanism variables

First, we generated a list of all of the mechanism variables used in each study. From this list, two researchers independently grouped together identical predictors, and conceptually similar predictors at a higher-order and lower-order levels based on logic, empirical evidence, and theory. The raters also categorized our criterion variable. Initial agreement was 91%. All discrepancies were resolved through discussion, which resulted in 100% agreement.

We conceptualized *team adaptive performance* as performance outcomes after a change. Typically, team adaptive performance outcomes are operationalized in the same fashion as routine performance, and differentiated with the label "adaptive," "post-change," or "time 2" to indicate that the variable refers to outcomes *after* an adaptive stimulus. For example, Johnson et al. (2006) altered reward structures between two rounds of a simulation, with round 2 representing "adaptive performance." Labels included decision effectiveness, decision-making accuracy, offensive/defensive score, service revenue, quantity, quality, sales, accuracy, or speed.

We conceptualized *team processes* as a higher-order construct with five lower-order factors. We aggregated processes into a composite, given confirmatory factor analytic evidence that team processes load together on a higher-order construct (LePine, Piccolo, Jackson, Mathieu, & Saul, 2008; Marks et al., 2001). We use this composite as an outcome in our analysis of inputs, and as a predictor in our analyses of performance. Although the relative dearth of studies reporting input-process relations restricted our ability to analyze relations between inputs and the five specific processes (i.e., lower order of specificity), we analyzed each specific process's relation with adaptive performance. *Communication* refers to the amount of interaction and transfer of task-relevant information between team members (Smith et al., 1994). Labels included information sharing, communication, and quality of communication. We coded *coordination* as *general* task or team-focused actions that helped to direct the pattern and timing of member activities to achieve the team's overall goal (Montoya-Weiss, Massey, & Song, 2001). Labels included anticipation ratio, coordination, and flux in coordination. We coded *stimulus-specific actions* as specific behavior that served to *directly* address the changed task or team environment. Labels included adaptive recovery behavior, reactive strategy adaptation, and role structure adaptation. We coded *learning behavior* as behavior focused on learning new task- or team-related information. Labels included team learning, knowledge transfer effort, and knowledge acquisition. We conceptualized *plan formulation* as a *specific* type of communication that is targeted towards clarifying future strategies and action steps (e.g. Burke et al., 2006). Labels used included plan formulation, task prioritization, and task distribution.

We conceptualized *team cognition* as a higher-order aggregate factor that included two lower-order dimensions: transactive memory and mental models. We provide analyses at both higher- and lower-order levels of specificity. Transactive memory was operationalized either behaviorally (Christian et al., 2014) or cognitively (Lewis, Belliveau, Herndon, & Keller, 2007; Marques-Quinteiro, Curral, Passos, & Lewis, 2013), and mental models were typically assessed through concept maps (Marks et al., 2000) or ratings of knowledge (Resick et al., 2010).

2.4. Categorizing input variables and moderators

We generated a list of all of the input variables used in each study. Two researchers independently grouped together identical and conceptually similar predictors at a higher-order and lower-order level. Initial agreement was 98%, and through discussion, was resolved to 100%. We coded cognitive ability as general mental ability, usually reported as scores on an instrument such as the Wonderlic test (e.g., LePine, 2003, 2005; Moon et al., 2004; Randall et al., 2011). We coded the Big Five personality dimensions (e.g., Costa & McCrae, 1985) of conscientiousness, extraversion, openness to experience, emotional stability, and agreeableness to be analyzed as lower-order dimensions, but also collapsed them into an exploratory higher-order omnibus personality category to maximize sample size (see Bowers, Pharmer, & Salas, 2000; Ones, Viswesvaran, & Schmidt, 1993). Learning and performance goal orientation were typically measured using surveys (e.g., LePine, 2005; Porter, Webb, & Gogus, 2010) but in some cases, were coded from team interactions (Woolley, 2009). Leader briefings were manipulations (Randall et al., 2011; Vashdi et al., 2013). We coded three sub-categories of team characteristics factors: team tenure, team size, and task-related knowledge.

We also coded two exogenous situational factors that should positively relate to team adaptive performance: training and feedback. Training interventions were typically manipulations (e.g., Entin & Serfaty, 1999; Lewis, Belliveau, Herndon, & Keller, 2007), but in one case was measured as the number of training activities that members had attended (Chandler & Lyon, 2009). Feedback was also typically operationalized as a manipulation where teams were given feedback concerning their performance or the effectiveness of their behaviors (e.g., Johnson et al., 2013; Konradt, Schippers, Garbers, & Steenfatt, 2015), but in one case was operationalized as a continuous measure of the extent to which upper-management provided the team with customer reactions to service quality (de Jong & de Ruyter, 2004).

We also coded prior performance (i.e., Time 1 performance), which reflects team performance before the stimulus. Time 1 performance was typically operationalized in the same manner as team adaptive performance (i.e., Time 2 performance). For example, labels included decision effectiveness, decision-making accuracy, and accuracy, and were often delineated as "time 1" or "pre-change" performance.

Finally, we coded three potential moderating variables based on available information. First, we coded whether the research was conducted in the field versus in the laboratory. Second, we coded whether performance was assessed using an objective or subjective measurement strategy. Third, we coded team type, based on Hollenbeck et al.'s (2012) typology of dimensions (i.e., authority differentiation, skill differentiation, and temporal stability).

2.5. Coding of effect size information

The initial coding process involved the two coders recording relevant information (e.g., correlations, sample size, internal consistency). Using this process, initial agreement was 73%, and discussion resulted in 100% agreement.

2.6. Meta-analytic calculations

To analyze the data, we used a program (Burke, Borrero, Beal, & Christian, 2016) which applies procedures proposed by Raju and colleagues (RBNL; Raju, Burke, Normand, & Langlois, 1991). The RBNL method estimates construct-level effect sizes by correcting for artifactual error using sample-based artifact data (i.e., reliability estimates from the primary studies) to correct for error in the effect size estimate (i.e., sampling error, unreliability of measures). We used a random effects model to estimate standard errors of the mean corrected correlations (Burke & Landis, 2003), which results in more accurate Type I error rates and more realistic confidence intervals than do fixed effects models (e.g., Erez, Bloom, & Wells, 1996; Overton, 1998). In the case where reliability information was not provided for a particular effect, we substituted estimates of reliability, based on sample size-weighted mean reliabilities for each construct measure within the study population (see Table 3). For objective measures (e.g., simulation score), no corrections for unreliability were made. Finally, when a single study reported measuring the same construct in multiple ways (i.e., non-independence), we computed a sample-weighted mean correlation within each analysis. To address the file-drawer problem—that non-significant findings are unlikely to be published—we calculated the fail-safe *k* statistic (Dalton, Aguinis, Dalton, Bosco, & Pierce, 2012; Rosenthal, 1979). The fail-safe *k* indicates the number of additional studies with an effect size of zero needed to reduce our estimates to 0.01.

2.7. Meta-analytic path analysis

We applied path analysis techniques to our meta-analytic data to test an exemplar model of the theoretical relationships among our focal variables. We created an input correlation matrix of corrected correlations using two decision criteria: (a) the variables should be a representative test of our model (i.e., they must represent a theoretically derived combination of distal inputs, proximal adaptive mechanisms, and adaptive performance); and (b) the variables should represent the largest possible combination of sample-sizes in each cell of the matrix (see Christian et al., 2009). After these decision rules were applied, we settled on a model integrating conscientiousness, cognitive ability, team processes, team cognition, and team adaptive performance. The input matrix consisted of 10 cells. Following recommendations by Viswesvaran and Ones (1995), in the one cell for which our primary studies did not have data (cognitive ability's relation with conscientiousness), we computed an assumed meta-analytic effect size using available data from general team studies. The harmonic mean was input as the overall sample size as it gives less weight to large samples than the arithmetic mean and is more conservative (Viswesvaran & Ones, 1995). We report overall model fit statistics and the magnitudes of direct and indirect effects.

3. Results

For a description of the information coded, see Appendix A, and for sample-based mean reliability estimates, see Table 2. We present correlations disattenuated for unreliability in both predictor and criterion, consistent with our focus on construct-level relationships. Unless otherwise stated, the reported effects are statistically significant at $p < 0.05$ (i.e., the 95% confidence interval excludes zero).

3.1. Fail-safe analyses

We report the results of the fail-safe *k* tests for the main and for the moderators. Guidelines for interpreting the fail-safe *k* statistic suggest that the fail-safe *k* should be larger than five times the number of the studies included in the effect size calculation plus ten (Hedges & Olkin, 1985; Rosenthal, 1979). As shown in Tables 6 and 7, some input variables failed to meet this criterion, and thus the effects should be interpreted with caution.

3.2. General expectations

We expected to find moderate to strong effects on team adaptive performance for proximal factors and weak to moderate effects for distal input factors. Although much research has followed Cohen's (1988) guidelines for magnitude, which suggest that effect sizes between 0.1 and 0.3 are considered weak, effect sizes between 0.3 and 0.5 are considered moderate, and effect sizes greater than 0.5 are considered strong, more recent work has found that these effect sizes are arbitrarily high (e.g., Bosco, Aguinis, Singh, Field, & Pierce, 2014; Hemphill, 2003). Bosco et al. (2014) analyzed 147,328 correlations, and made recommendations based on the actual distributions of effect sizes reported in the literature. Their results suggest that when examining relationships that include actual behaviors (k = 7958), they report effect sizes of 0.10 at the 33rd percentile, 0.16 at the 50th percentile, and 0.24 at the 67th percentile. Given these recent findings, we use the benchmark of less than 0.10 to represent a weak effect, between 0.10 and 0.24 to represent a moderate effect, and greater than 0.24 to represent a strong effect.

Table 2
Sample-based mean reliability estimates.

	k	N_t	Mean reliability estimate
Criterion			
Team adaptive performance	10	716	0.89
Predictors			
Adaptive mechanisms			
Team processes			
Communication	8	356	0.89
Coordination	10	747	0.86
Stimulus-specific actions	9	607	0.91
Learning behavior	7	584	0.88
Plan formulation	6	345	0.83
Team cognition			
Mental models	1	98	0.88
Transactive memory	1	42	0.75
Inputs			
Cognitive ability	7	623	0.90
Personality			
Conscientiousness	4	350	0.85
Emotional stability	4	338	0.83
Extraversion	2	206	0.82
Openness	3	314	0.83
Agreeableness	2	180	0.87
Team goal orientation			
Learning orientation	4	330	0.79
Performance orientation	2	201	0.82
Leader briefing	–	–	–
Team characteristics			
Team tenure	–	–	–
Team size	–	–	–
Task-related knowledge	–	–	–
Situational factors			
Feedback	2	202	0.72
Training intervention	–	–	–
Prior performance	4	261	0.95

Note. When no reliability (alpha) was reported (for leader briefing, team tenure, team size, task-related knowledge, and training), we present non-disattenuated correlations. N_t = Sample size (team-level).

3.3. Adaptive mechanisms and team adaptive performance

Hypothesis 1 predicted that all five team processes would be moderately to strongly related to team adaptive performance. Overall, team processes were strongly related to team adaptive performance ($M_\rho = 0.34$), and for the lower-order factors, effect sizes were $M_\rho = 0.22$, $M_\rho = 0.30$, $M_\rho = 0.41$, $M_\rho = 0.27$, and $M_\rho = 0.24$ for communication, coordination, SSAs, learning behavior, and plan formulation, respectively (see Table 3). Thus, Hypothesis 1 was supported. Hypothesis 2, that team cognition would be moderately to strongly related to team adaptive performance was supported; overall, team cognition was moderately related ($M_\rho = 0.19$), and for the lower-order factors, transactive memory

Table 3
Results of meta-analysis of team processes and emergent states with team adaptive performance.

Construct category	k	N_t	M_r	SD_r	M_ρ	$SE_{M\rho}$	95% CI L	95% CI U	SDp	80% CV L	80% CV U	Q	k_{FS}
Team processes	38	2424	0.32	0.20	**0.34**	0.03	0.28	0.41	0.17	0.13	0.55	173.70***	1235
Communication	12	653	0.20	0.19	**0.22**	0.06	0.11	0.32	0.14	0.03	0.40	30.99**	235
Coordination	16	1098	0.28	0.22	**0.30**	0.05	0.20	0.41	0.19	0.06	0.54	81.14**	457
Stimulus-specific actions	14	902	0.39	0.11	**0.41**	0.03	0.35	0.47	0.03	0.37	0.45	21.43†	569
Learning behavior	9	704	0.24	0.24	**0.27**	0.08	0.11	0.43	0.22	−0.01	0.55	88.07**	222
Plan formulation	6	345	0.21	0.08	**0.24**	0.03	0.17	0.30	0.00	–	–	1.99	134
Team cognition	9	593	0.18	0.17	**0.19**	0.06	0.08	0.30	0.12	0.04	0.34	18.69*	156
Mental models	6	403	0.13	0.14	**0.13**	0.06	0.02	0.25	0.07	0.04	0.23	7.86	76
Transactive memory	3	190	0.28	0.16	**0.30**	0.09	0.12	0.49	0.11	0.16	0.45	6.46*	82

Note. k = the number of independent effect sizes included in each analysis; N_t = sample size (team-level). Mr = mean uncorrected correlation; SDr = standard deviation of uncorrected correlations; M_ρ = mean corrected correlation (corrected for unreliability in the predictor and criterion; **bolded values = p < 0.05**); $SE_{M\rho}$ = standard error of M_ρ; 95% CI = 95% Confidence Interval for M_ρ; SD_ρ = standard deviation of estimated ρ's; 80% CV = 80% Credibility Interval; consistent with past work, ***SDp*** was recoded as 0 when variance estimates were negative (e.g., Steel & Kammeyer-Mueller, 2008; Steel, Kammeyer-Mueller, & Paterson, 2015); Q = homogeneity statistic; k_{FS} = fail-safe k statistic.
† $p < 0.10$.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

was strongly related to adaptive performance ($M_\rho = 0.30$), and mental models were moderately related to adaptive performance ($M_\rho = 0.13$).[8]

3.4. Adaptive stimulus origin as a moderator

We tested moderation using the Q statistic, which compares the level of variance across the studies to the sampling error variance (Hedges & Olkin, 1985). The Q test is analogous to an F test in ANOVA and can be interpreted similarly (Liu, Huang, & Wang, 2014). A significant Q statistic indicates that there may be unknown variables accounting for differences between studies (Liu et al., 2014). From the Q statistic, a between-groups Q can be calculated (Q_B), and a significant Q_B statistic indicates that the effect sizes significantly differ across levels of the proposed moderator (Liu et al., 2014; Park & Shaw, 2013).

The results of the moderator tests for stimulus origin are reported in Table 4.[9] For these tests, we had sufficient k to focus on the lower-order factors for team processes, and we focus on the aggregate level for team cognition. Hypothesis 3a predicted that adaptive stimulus origin would moderate the relationship between communication and team adaptive performance, and was supported, Q_B (1) = 10.48, $p < 0.01$, as the relationship was stronger for teams facing external ($M_\rho = 0.33$) versus internal adaptive stimuli ($M_\rho = 0.10$). Hypothesis 3b proposed that adaptive stimulus origin would moderate the relationship between coordination and team adaptive performance, and was supported, Q_B (1) = 13.25, $p < 0.01$, as the relationship was stronger for teams facing external ($M_\rho = 0.36$) versus internal adaptive stimuli ($M_\rho = 0.18$). Hypothesis 3c proposed that adaptive stimulus origin would moderate the relationship between SSAs and team adaptive performance, and was supported, Q_B (1) = 4.73, $p < 0.05$, as the relationship was stronger for teams facing external ($M_\rho = 0.45$) versus internal adaptive stimuli ($M_\rho = 0.34$). Unfortunately, due to lack of availability of primary studies, we could not examine Hypothesis 3d, the moderating role of origin in the relationship between learning behavior and adaptive performance. Hypothesis 3e proposed that adaptive stimulus origin would moderate the relationship between plan formulation and team adaptive performance, and was not supported, Q_B (1) = 1.33, p = *ns*. Hypothesis 4 proposed that adaptive stimulus origin would moderate the relationship between team cognition and team adaptive performance, and was not supported, Q_B (1) = 0.03, p = *ns*.

3.5. Adaptive stimulus duration as a moderator

The results of the moderator tests for stimulus duration are reported in Table 5.[10] As with origin, we focus on the lower-order factors for team processes, and the aggregate for team cognition. Hypothesis 5a predicted that adaptive stimulus duration would moderate the relationship between communication and team adaptive performance, and was supported, Q_B (1) = 12.26, $p < 0.01$, as the relationship was stronger for teams facing temporary ($M_\rho = 0.49$) versus sustained adaptive stimuli ($M_\rho = 0.18$). Hypotheses 5b, 5c, and 5d were not supported, as adaptive stimulus duration did not moderate the relationship between adaptive team performance and coordination (Q_B (1) = 2.88, p = *ns*), SSAs (Q_B (1) = 0.68, p = *ns*), or plan formulation (Q_B (1) = 0.02, p = *ns*) respectively. Hypothesis 5e proposed that adaptive stimulus duration would moderate the relationship between learning behavior and team adaptive performance, and was supported, Q_B (1) = 3.90, $p < 0.05$, as the relationship was stronger for teams facing sustained ($M_\rho = 0.32$) versus temporary adaptive stimuli ($M_\rho = 0.20$). Hypothesis 6 proposed that adaptive stimulus duration would moderate the relationship between team cognition and team adaptive performance, and was supported, Q_B (1) = 4.49, $p < 0.05$, as the relationship was stronger for teams facing temporary ($M_\rho = 0.37$) versus sustained adaptive stimuli ($M_\rho = 0.16$).

3.6. Inputs

Our general expectations concerning the input-process and input-team adaptive performance relationships received some support (see Tables 6 and 7). Cognitive ability was strongly related to team processes ($M_\rho = 0.29$) and moderately related to team adaptive performance ($M_\rho = 0.18$). Conscientiousness ($M_\rho = 0.14$), extraversion ($M_\rho = 0.11$), and openness ($M_\rho = 0.12$) were moderately related to processes. Emotional stability was moderately related ($M_\rho = 0.14$) and openness was weakly related ($M_\rho = 0.08$)

[8] Although we focused on team cognition, we also analyzed the relationship between team adaptive performance with team efficacy (k = 3, $M_\rho = 0.22$, CI (−0.05, 0.48) and empowerment (k = 2, $M_\rho = 0.09$, CI (−0.17, 0.35).

[9] Two studies (Woolley, 2009; Zellmer-Bruhn, 2003) contained elements of both types of origin and were excluded from the moderator tests.

[10] One study (Magni, Maruping, Hoegl, & Proserpio, 2013) contained both types of duration and was excluded from the moderator tests.

Table 4
Adaptive stimulus origin as a moderator of the team process-team adaptive performance relationship.

Construct category							95% CI			80% CV				
Origin	k	N_t	M_r	SD_r	M_ρ	$SE_{M\rho}$	L	U	SDp	L	U	Q	Q_B	k_{FS}
Prior performance														
Internal	9	671	0.38	0.15	**0.38**	0.05	0.28	0.48	0.12	0.23	0.53	21.56**	1.85	332
External	7	507	0.29	0.24	**0.30**	0.09	0.12	0.48	0.22	0.03	0.58	80.30**		201
Team processes														
Internal	10	727	0.23	0.20	**0.24**	0.06	0.11	0.37	0.17	0.02	0.46	47.32**	22.29**	222
External	26	1492	0.34	0.19	**0.38**	0.04	0.31	0.46	0.15	0.19	0.58	103.25**		965
Communication														
Internal	4	326	0.10	0.17	0.10	0.09	−0.07	0.27	0.14	−0.07	0.28	11.17*	10.48**	37
External	8	327	0.31	0.13	**0.33**	0.05	0.24	0.42	0.00	–	–	9.34		249
Coordination														
Internal	4	324	0.18	0.23	0.18	0.12	−0.05	0.41	0.21	−0.09	0.44	22.58**	13.25**	66
External	12	774	0.32	0.19	**0.36**	0.05	0.25	0.46	0.15	0.16	0.55	45.31**		415
Stimulus-specific actions														
Internal	3	208	0.33	0.09	**0.34**	0.05	0.24	0.44	0.00	–	–	2.19	4.73*	98
External	9	497	0.42	0.13	**0.45**	0.04	0.37	0.53	0.04	0.39	0.50	13.12		405
Learning behavior														
Internal	–	–	–	–	–	–	–	–	–	–	–	–	–	
External	8	667	0.22	0.22	**0.24**	0.08	0.09	0.40	0.19	−0.00	0.49	75.25**		178
Plan formulation														
Internal	2	156	0.27	0.04	**0.29**	0.03	0.24	0.35	0.00	–	–	0.22	1.33	57
External	3	99	0.13	0.07	**0.14**	0.04	0.06	0.22	0.00	–	–	0.44		38
Team cognition														
Internal	2	148	0.22	0.04	**0.22**	0.03	0.16	0.28	0.00	–	–	0.28	0.03	42
External	7	445	0.27	0.19	**0.18**	0.07	0.03	0.32	0.15	−0.01	0.37	18.38		112

Note. k = the number of independent effect sizes included in each analysis; N_t = sample size (team-level). Mr = mean uncorrected correlation; SDr = standard deviation of uncorrected correlations; M_ρ = mean corrected correlation (corrected for unreliability in the predictor and criterion; **bolded values = *p* < 0.05**); $SE_{M\rho}$ = standard error of M_ρ; 95% CI = 95% Confidence Interval for M_ρ; SD_ρ = standard deviation of estimated ρ's; 80% CV = 80% Credibility Interval; consistent with past work, ***SDp*** was recoded as 0 when variance estimates were negative (e.g., Steel & Kammeyer-Mueller, 2008; Steel et al., 2015); Q = homogeneity statistic; ***Q_B*** = homogeneity statistic Q between groups; k_{FS} = fail-safe k statistic.
* $p < 0.05$.
** $p < 0.01$.

Table 5
Adaptive stimulus duration as a moderator of the team process-team adaptive performance relationship.

Construct category							95% CI			80% CV				
Duration	k	N_t	M_r	SD_r	M_ρ	$SE_{M\rho}$	L	U	SDp	L	U	Q	Q_B	k_{FS}
Prior performance														
Temporary	3	241	0.37	0.13	**0.37**	0.07	0.23	0.52	0.08	0.27	0.47	4.12	1.33	109
Sustained	13	937	0.33	0.21	**0.34**	0.06	0.22	0.47	0.19	0.10	0.58	98.26**		424
Team processes														
Temporary	16	865	0.36	0.17	**0.38**	0.04	0.30	0.46	0.12	0.23	0.53	40.86**	1.04	598
Sustained	21	1488	0.30	0.22	**0.32**	0.05	0.22	0.41	0.19	0.08	0.56	131.58**		622
Communication														
Temporary	4	80	0.45	0.12	**0.49**	0.06	0.37	0.61	0.00	–	–	2.22	12.26**	192
Sustained	8	573	0.17	0.17	**0.18**	0.06	0.06	0.29	0.12	0.03	0.33	16.51*		129
Coordination														
Temporary	6	428	0.26	0.11	**0.29**	0.05	0.20	0.38	0.00	–	–	6.70	2.88	170
Sustained	10	670	0.29	0.26	**0.31**	0.08	0.15	0.47	0.24	0.00	0.62	71.56**		287
Stimulus-specific actions														
Temporary	7	422	0.42	0.12	**0.43**	0.05	0.34	0.52	0.06	0.35	0.51	12.25	0.68	299
Sustained	6	409	0.38	0.11	**0.40**	0.04	0.32	0.49	0.00	–	–	7.46		238
Learning behavior														
Temporary	2	254	0.18	0.23	0.20	0.16	−0.11	0.51	0.21	−0.07	0.47	28.25**	3.90*	37
Sustained	6	404	0.29	0.26	**0.32**	0.10	0.12	0.53	0.23	0.03	0.61	53.37**		175
Plan formulation														
Temporary	2	21	0.24	0.05	**0.27**	0.04	0.20	0.35	0.00	–	–	0.05	0.02	52
Sustained	4	324	0.21	0.08	**0.23**	0.04	0.16	0.31	0.00	–	–	1.92		89
Team cognition														
Temporary	2	82	0.31	0.24	**0.37**	0.17	0.03	0.70	0.19	0.12	0.62	5.52*	4.49*	62
Sustained	7	511	0.16	0.13	**0.16**	0.05	0.06	0.26	0.07	0.07	0.24	8.68		108

Note. k = the number of independent effect sizes included in each analysis; N_t = sample size (team-level). Mr = mean uncorrected correlation; SDr = standard deviation of uncorrected correlations; M_ρ = mean corrected correlation (corrected for unreliability in the predictor and criterion; **bolded values = *p* < 0.05**); $SE_{M\rho}$ = standard error of M_ρ; 95% CI = 95% Confidence Interval for M_ρ; SD_ρ = standard deviation of estimated ρ's; 80% CV = 80% Credibility Interval; consistent with past work, ***SDp*** was recoded as 0 when variance estimates were negative (e.g., Steel and Kammeyer-Mueller, 2008; Steel et al., 2015); Q = homogeneity statistic; ***Q_B*** = homogeneity statistic Q between groups; k_{FS} = fail-safe k statistic.
* $p < 0.05$.
** $p < 0.01$.

Table 6
Results of meta-analysis of inputs with team processes.

Construct category	k	N_t	M_r	SD_r	M_ρ	$SE_{M\rho}$	95% CI L	95% CI U	SDp	80% CV L	80% CV U	Q	k_{FS}
Cognitive ability	7	623	0.27	0.12	**0.29**	0.04	0.20	0.37	0.06	0.21	0.36	8.67	193
Personality	6	530	0.06	0.10	0.07	0.04	−0.01	0.15	0.00	–	–	4.92	35
Conscientiousness	4	350	0.13	0.09	**0.14**	0.04	0.05	0.23	0.00	–	–	2.41	52
Emotional stability	3	274	0.04	0.05	0.05	0.03	−0.01	0.11	0.00	–	–	0.56	12
Extraversion	2	142	0.10	0.03	**0.11**	0.02	0.06	0.15	0.00	–	–	0.12	19
Openness	3	314	0.11	0.10	**0.12**	0.06	0.01	0.23	0.00	–	–	2.71	33
Agreeableness	2	180	−0.11	0.13	−0.12	0.10	−0.30	0.07	0.08	−0.22	−0.02	2.90	21
Team goal orientation	2	154	0.25	0.19	**0.26**	0.13	0.00	0.52	0.15	0.08	0.45	4.78*	54
Learning orientation	2	154	0.23	0.09	**0.26**	0.06	0.13	0.38	0.00	–	–	1.17	47
Performance orientation	2	154	0.26	0.46	0.27	0.33	−0.37	0.91	0.45	−0.31	0.85	38.69**	59
Leader briefing	2	291	0.22	0.03	**0.23**	0.02	0.19	0.27	0.00	–	–	0.30	44
Team characteristics													
Tenure	4	207	0.05	0.07	0.05	0.03	−0.01	0.11	0.00	–	–	0.80	15
Size	6	549	−0.01	0.06	−0.01	0.03	−0.06	0.04	0.00	–	–	2.13	0
Task-related knowledge	3	192	0.06	0.16	0.06	0.09	−0.11	0.24	0.09	−0.06	0.19	4.64	14
Feedback	5	404	0.09	0.20	0.11	0.09	−0.07	0.28	0.17	−0.11	0.32	17.40**	44
Training intervention	5	189	0.34	0.27	**0.36**	0.12	0.12	0.59	0.24	0.05	0.66	22.26**	168
Prior performance	6	394	0.10	0.10	**0.10**	0.04	0.02	0.18	0.00	–	–	3.87	54

Note. k = the number of independent effect sizes included in each analysis; N_t = sample size (team-level). *M*r = mean uncorrected correlation; *SD*r = standard deviation of uncorrected correlations; M_ρ = mean corrected correlation (corrected for unreliability in the predictor and criterion; **bolded values = p < 0.05**); $SE_{M\rho}$ = standard error of M_ρ; 95% CI = 95% Confidence Interval for M_ρ; SD_ρ = standard deviation of estimated ρ's; 80% CV = 80% Credibility Interval; consistent with past work, ***SDp*** was recoded as 0 when variance estimates were negative (e.g., Steel and Kammeyer-Mueller, 2008; Steel et al., 2015); Q = homogeneity statistic; k_{FS} = fail-safe k statistic.
* $p < 0.05$.
** $p < 0.01$.

Table 7
Results of meta-analysis of inputs with team adaptive performance.

Construct category	k	N_t	M_r	SD_r	M_ρ	$SE_{M\rho}$	95% CI L	95% CI U	SDp	80% CV L	80% CV U	Q	k_{FS}
Cognitive ability	7	623	0.16	0.15	**0.18**	0.06	0.06	0.28	0.11	0.03	0.31	14.76*	112
Personality	7	594	0.04	0.06	0.05	0.02	−0.00	0.09	0.00	–	–	1.96	24
Conscientiousness	4	350	0.03	0.05	0.03	0.02	−0.02	0.08	0.00	–	–	0.68	9
Emotional stability	4	338	0.12	0.10	**0.14**	0.05	0.04	0.24	0.00	–	–	3.10	49
Extraversion	3	206	0.02	0.04	0.03	0.03	−0.02	0.08	0.00	–	–	0.33	5
Openness	3	314	0.08	0.07	**0.08**	0.04	0.01	0.16	0.00	–	–	1.37	22
Agreeableness	2	180	−0.04	0.06	−0.04	0.04	−0.12	0.04	0.00	–	–	0.52	6
Team goal orientation	6	460	0.20	0.09	**0.22**	0.04	0.15	0.29	0.00	–	–	3.03	129
Learning orientation	6	460	0.19	0.07	**0.21**	0.03	0.16	0.26	0.00	–	–	1.95	119
Performance orientation	3	291	0.23	0.15	**0.24**	0.09	0.07	0.41	0.11	0.10	0.38	5.58	71
Leader briefing	2	291	0.01	0.04	0.01	0.02	−0.04	0.06	0.00	–	–	0.35	0
Team characteristics													
Tenure	3	77	−0.12	0.15	−0.13	0.09	−0.30	0.04	0.00	–	–	1.57	35
Size	6	587	0.10	0.13	**0.11**	0.05	0.00	0.21	0.07	0.01	0.20	9.90	59
Task-related knowledge	4	367	0.10	0.07	**0.11**	0.04	0.04	0.18	0.00	–	–	1.84	40
Feedback	5	404	0.06	0.23	0.05	0.10	−0.15	0.26	0.20	−0.21	0.31	20.26**	37
Training intervention	7	333	0.35	0.21	**0.36**	0.08	0.21	0.51	0.17	0.14	0.58	20.36**	242
Prior performance	16	1178	0.34	0.20	**0.35**	0.05	0.25	0.44	0.17	0.12	0.57	103.71**	535

Note. k = the number of independent effect sizes included in each analysis; N_t = sample size (team-level). *M*r = mean uncorrected correlation; *SD*r = standard deviation of uncorrected correlations; M_ρ = mean corrected correlation (corrected for unreliability in the predictor and criterion; **bolded values = p < 0.05**); $SE_{M\rho}$ = standard error of M_ρ; 95% CI = 95% Confidence Interval for M_ρ; SD_ρ = standard deviation of estimated ρ's; 80% CV = 80% Credibility Interval; consistent with past work, ***SDp*** was recoded as 0 when variance estimates were negative (e.g., Steel and Kammeyer-Mueller, 2008; Steel et al., 2015); Q = homogeneity statistic; k_{FS} = fail-safe k statistic.
* $p < 0.05$.
** $p < 0.01$.

to team adaptive performance. Learning orientation was strongly related to team processes ($M_\rho = 0.26$) and was moderately related to team adaptive performance ($M_\rho = 0.21$). Performance orientation was moderately related to team adaptive performance ($M_\rho = 0.24$). Leader briefing was moderately related to team processes ($M_\rho = 0.23$). Feedback did not have a significant relation with either team processes or team performance. Training interventions were strongly related to both team processes ($M_\rho = 0.36$) and performance ($M_\rho = 0.36$). Prior performance had a moderate relation with team processes ($M_\rho = 0.10$) and a strong relation with performance ($M_\rho = 0.35$).

We report relations between emergent states and team processes in Table 8.

3.7. Exploratory moderator analyses

We found no evidence of moderation for *laboratory* versus *field studies* for team processes as a higher-order variable (see Table 9). However for the lower-order factors, we did find some differences. The communication-team adaptive performance relationship was stronger in field versus laboratory studies ($M_\rho = 0.57$ vs. 0.19), whereas the learning behavior-team adaptive performance

Table 8
Results of meta-analysis of emergent states with team processes.

							95% CI			80% CV			
Construct category	k	N_t	M_r	SD_r	M_ρ	$SE_{M\rho}$	L	U	SDp	L	U	Q	k_{FS}
Team cognition	8	505	0.26	0.17	**0.29**	0.06	0.17	0.41	0.12	0.14	0.44	15.50*	212
Mental models	6	385	0.23	0.16	**0.26**	0.07	0.13	0.38	0.10	0.13	0.39	9.76	143
Transactive memory	2	120	0.34	0.17	**0.39**	0.12	0.16	0.62	0.11	0.24	0.53	3.90*	71

Note. k = the number of independent effect sizes included in each analysis; N_t = sample size (team-level). Mr = mean uncorrected correlation; SDr = standard deviation of uncorrected correlations; M_ρ = mean corrected correlation (corrected for unreliability in the predictor and criterion; **bolded values = *p* < 0.05**); $SE_{M\rho}$ = standard error of M_ρ; 95% CI = 95% Confidence Interval for M_ρ; SD_ρ = standard deviation of estimated *ρ's;* 80% CV = 80% Credibility Interval; consistent with past work, ***SDp*** was recoded as 0 when variance estimates were negative (e.g., Steel and Kammeyer-Mueller, 2008; Steel et al., 2015); Q = homogeneity statistic; k_{FS} = fail-safe k statistic.
* $p < 0.05$.

Table 9
Moderator analyses by design, measurement, and team type: relations between team processes and team adaptive performance.

Construct category							95% CI			80% CV				
Moderator	k	N_t	M_r	SD_r	M_ρ	$SE_{M\rho}$	L	U	SD_ρ	L	U	Q	Q_B	k_{FS}
Team processes														
Field	12	564	0.29	0.18	**0.34**	0.05	0.23	0.44	0.12	0.18	0.49	30.93**	0.12	386
Laboratory	26	1861	0.32	0.21	**0.35**	0.04	0.27	0.42	0.18	0.12	0.57	141.98**		851
Communication														
Field	3	38	0.51	0.14	**0.57**	0.08	0.41	0.73	0.00	–	–	1.02	10.90**	169
Laboratory	9	615	0.18	0.17	**0.19**	0.06	0.08	0.30	0.12	0.03	0.35	19.07*		159
Coordination														
Field	6	407	0.24	0.11	**0.28**	0.05	0.19	0.37	0.00	–	–	6.25	3.63	161
Laboratory	10	691	0.30	0.26	**0.32**	0.08	0.15	0.48	0.24	0.01	0.62	71.26**		295
Stimulus-specific actions														
Field	5	234	0.33	0.10	**0.39**	0.05	0.31	0.48	0.00	–	–	3.19	0.28	196
Laboratory	9	668	0.41	0.12	**0.42**	0.04	0.35	0.50	0.06	0.34	0.50	17.39*		372
Learning behavior														
Field	3	304	0.18	0.21	0.20	0.12	−0.04	0.43	0.18	−0.04	0.43	29.43**	5.73*	54
Laboratory	6	400	0.29	0.25	**0.33**	0.10	0.12	0.53	0.23	0.04	0.62	52.91**		177
Plan formulation														
Field	2	21	0.24	0.05	**0.27**	0.04	0.20	0.35	0.00	–	–	0.05	0.02	52
Laboratory	4	324	0.21	0.08	**0.23**	0.04	0.16	0.31	0.00	–	–	1.92		89
Team processes														
Objective measure	27	2016	0.30	0.20	**0.32**	0.04	0.24	0.40	0.17	0.10	0.54	151.32**	5.87*	824
Subjective measure	11	408	0.39	0.16	**0.45**	0.05	0.35	0.55	0.06	0.37	0.53	16.97		483
Team processes														
Authority differentiation (low)	34	2457	0.23	0.14	**0.25**	0.02	0.20	0.30	0.08	0.15	0.35	88.47**	20.83**	800
Authority differentiation (high)	5	284	0.35	0.15	**0.36**	0.07	0.23	0.50	0.09	0.26	0.47	8.29		178
Skill differentiation (low)	6	490	0.26	0.20	**0.28**	0.08	0.13	0.44	0.17	0.07	0.49	25.15**	5.79*	157
Skill differentiation (high)	9	757	0.19	0.08	**0.19**	0.03	0.14	0.24	0.00	–	–	4.46		166
Temporal stability (low)	27	1935	0.24	0.15	**0.26**	0.03	0.20	0.32	0.10	0.14	0.39	81.18**	1.46	662
Temporal stability (high)	10	499	0.30	0.12	**0.33**	0.04	0.25	0.40	0.00	–	–	10.12		325

Note. k = the number of independent effect sizes included in each analysis; N_t = sample size (team-level). Mr = mean uncorrected correlation; SDr = standard deviation of uncorrected correlations; M_ρ = mean corrected correlation (corrected for unreliability in the predictor and criterion; **bolded values = *p* < 0.05**); $SE_{M\rho}$ = standard error of M_ρ; 95% CI = 95% Confidence Interval for M_ρ; SD_ρ = standard deviation of estimated *ρ's;* 80% CV = 80% Credibility Interval; consistent with past work, ***SDp*** was recoded as 0 when variance estimates were negative (e.g., Steel and Kammeyer-Mueller, 2008; Steel et al., 2015). Q = homogeneity statistic; $\mathbf{Q_B}$ = homogeneity statistic Q between groups; k_{FS} = fail-safe k statistic. Team types were only included when coded as "low" or "high"; "medium" levels were excluded.
* $p < 0.05$.
** $p < 0.01$.

relationship was stronger in lab studies than in field studies (M_ρ = 0.33 vs. 0.20). The team process-team adaptive performance relationship was significantly stronger for subjective (M_ρ = 0.45) versus objective measures (M_ρ = 0.32).[11] We found some evidence for the moderating effect of team type. The process-performance relationship was stronger for teams high in authority differentiation compared to those lower in differentiation (M_ρ = 0.36 vs. 0.25), and for teams low in skill differentiation compared to those higher in differentiation (M_ρ = 0.28 vs. 0.19).

3.8. Exemplar path model

Table 10 presents the team-level correlations between the variables included in the exemplar path model. We constructed a meta-analytic correlation matrix[12] using corrected effect sizes, and after removing one outlier correlation (r = −0.08 for the team cognition-performance relationship, Santos, Passos, & Uitdewilligen, 2015), the harmonic mean sample size was 228 teams (see Viswesvaran & Ones, 1995). In line with our theorizing, we tested a full mediation model in which conscientiousness and cognitive ability were exogenous and team processes and team cognition were endogenous mediators, which in turn were directly

[11] This result is consistent with other meta-analyses of the teams literature (e.g., Gully, Incalcaterra, Joshi, & Beaubien, 2002; Mesmer-Magnus & DeChurch, 2009) and can likely be explained by common-method inflation of scores for subjective measures, which are more likely to be contaminated by rater bias and other non-performance relevant variation (Campbell et al., 1993).

[12] The correlation between conscientiousness and cognitive ability was computed from correlations reported in Barrick, Stewart, Neubert, and Mount (1998), LePine (2003), and Neuman and Wright (1999).

Table 10
Meta-analysis of relationships between variables in exemplar path model.

Construct	Conscientiousness		Cognitive ability		Team processes		Team cognition		Team adaptive perf.	
	Mr, $\boldsymbol{M_\rho}$ (95% CI) *k*	SD_ρ ($SE_{M\rho}$) $\boldsymbol{N_t}$	Mr, $\boldsymbol{M_\rho}$ (95% CI) *k*	SD_ρ ($SE_{M\rho}$) $\boldsymbol{N_t}$	Mr, $\boldsymbol{M_\rho}$ (95% CI) *k*	SD_ρ ($SE_{M\rho}$) $\boldsymbol{N_t}$	Mr, $\boldsymbol{M_\rho}$ (95% CI) *k*	SD_ρ ($SE_{M\rho}$) $\boldsymbol{N_t}$	Mr, $\boldsymbol{M_\rho}$ (95% CI) *k*	SD_ρ ($SE_{M\rho}$) $\boldsymbol{N_t}$
1. Conscientiousness	–	–								
2. Cognitive ability	0.10, **0.11**[a] (−0.09, 0.32) 4	0.22 (0.11) 276	–	–						
3. Team processes	0.13, **0.14** (0.05, 0.23) 4	0.09 (0.04) 350	0.27, **0.29** (0.20, 0.37) 7	0.11 (0.04) 623	–	–				
4. Team cognition	0.12, **0.13** (0.13, 0.13) 1	0.00 (0.00) 74	0.28, **0.29** (0.29, 0.29) 1	0.00 (0.00) 74	0.26, **0.29** (0.17, 0.41) 8	0.17 (0.06) 505	–	–		
5. Team adaptive performance	0.03, **0.03** (−0.02, 0.08) 4	0.05 (0.02) 350	16, **0.17** (0.06, 0.28) 7	0.15 (0.06) 623	0.32, **0.34** (0.28, 0.41) 38	0.20 (0.03) 2424	0.21, **0.22** (0.12, 0.32) 8	0.15 (0.05) 525	–	–

Note. *k* = the number of independent effect sizes included in each analysis; N_t = sample size (team-level); *Mr* = mean uncorrected correlation; $\boldsymbol{M_\rho}$ = mean corrected correlation (corrected for unreliability in the predictor and criterion); 95% CI = 95% Confidence Interval for M_ρ; SD_ρ = standard deviation of estimated *ρ's;* $SE_{M\rho}$ = standard error of M_ρ. Data presented does not include the outlier study for the team cognition-team adaptive performance relationship.
[a] Assumed values, calculated as corrected sample-weighted mean correlations derived from Barrick et al. (1998), LePine (2003), and Neuman and Wright (1999).

related to team adaptive performance. We evaluated the fit of the model using the goodness of fit (GFI) index and the root mean squared residual (RMSR), which are typically indicators of good fit when the GFI is greater than or equal to 0.90 and the RMSR is less than or equal to 0.08 (e.g., Browne & Cudeck, 1993; Mathieu, Gilson, & Ruddy, 2006). Although we report fit indices, we focus on the magnitudes of direct and indirect effects when assessing fit (e.g., Christian et al., 2009).

During model specification we allowed conscientiousness and cognitive ability to correlate because they are related (e.g., Barrick et al., 1998; Neuman & Wright, 1999), and consistent with past research (e.g., Marks et al., 2000; Randall et al., 2011; Resick et al., 2010), we allowed the disturbance terms for team processes and team cognition to correlate. This model demonstrated a good fit with the data, $\chi^2(2) = 0.9$, p = ns, GFI = 0.99, RMSR = 0.01. Aside from the path from conscientiousness to team cognition, all paths were significant (*p*-values ranging from <0.001 to <0.10), which provides some support for our proposed model. Although the relationship between conscientiousness and team cognition was not significant, the effect was in the hypothesized direction and we decided to retain this model as our final model due to its good fit and to retain parsimony (see Fig. 2). In Table 11, we report the direct, indirect, and total effects and note that a majority of these effects are moderate to large, further supporting our model.

Table 11
Direct, indirect, and total effects of conscientiousness and cognitive ability for adaptive mechanisms and team adaptive performance.

Model	Direct effects	Indirect effects	Total effects
Team processes			
Conscientiousness	0.11	–	0.11
Cognitive ability	0.28	–	0.28
Team cognition			
Conscientiousness	0.10	–	0.10
Cognitive ability	0.28	–	0.28
Team adaptive performance			
Conscientiousness	–	0.05	0.05
Cognitive ability	–	0.12	0.12
Team processes	0.30	–	0.30
Team cognition	0.13	–	0.13

Note. All computations were conducted by inputting the harmonic mean for the sample size N_h = 228 teams.

3.9. Supplemental analysis

Communications research has operationalized communications in a variety of ways, from simple information transfer or allocation (e.g., Johnson et al., 2006; Moon et al., 2004) to in-depth information processing and elaboration (e.g., Randall et al., 2011; Resick, Murase, Randall, & DeChurch, 2014). As the

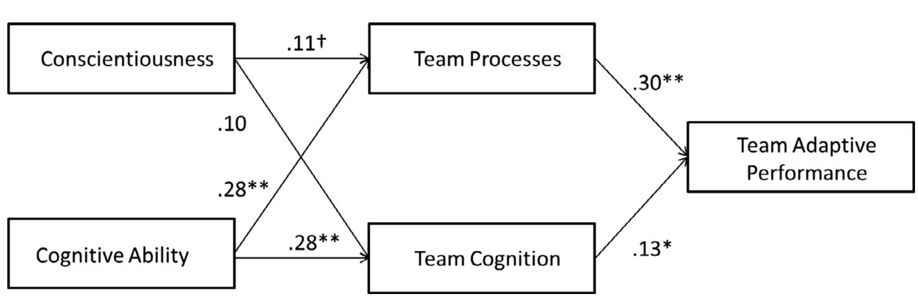

Fig. 2. Maximum-likelihood parameter estimate for the hypothesized model. Statistics are standardized path coefficients. † p < 0.10, * p < 0.05, ** p < 0.001.

Table 12
Analysis of the communication-team performance relationship by communication type.

Construct category	k	N_t	M_r	SD_r	M_ρ	$SE_{M\rho}$	95% CI L	95% CI U	SDp	80% CV L	80% CV U	Q	Q_B	k_{FS}
Type of communication														
Information transfer	6	321	0.15	0.22	0.15	0.09	−0.02	0.33	0.18	−0.07	0.38	22.63**	0.92	82
Elaboration	5	318	0.25	0.12	**0.26**	0.06	0.15	0.37	0.02	0.23	0.29	5.03		124

Note. k = the number of independent effect sizes included in each analysis; N_t = sample size (team-level). Mr = mean uncorrected correlation; SDr = standard deviation of uncorrected correlations; M_ρ = mean corrected correlation (corrected for unreliability in the predictor and criterion; **bolded values = $p < 0.05$**); $SE_{M\rho}$ = standard error of M_ρ; 95% CI = 95% Confidence Interval for M_ρ; SD_ρ = standard deviation of estimated ρ's; 80% CV = 80% Credibility Interval; Q = homogeneity statistic; $\mathbf{Q_B}$ = homogeneity statistic Q between groups; k_{FS} = fail-safe k statistic. k = 11 (not 12) because one study (Waller et al., 2004) could not be classified.
** $p < 0.01$.

type of the communication may determine its efficacy as an adaptive mechanism, we completed a supplemental analysis of the communications data where we coded communications as either one-way information sharing/transfer, or as the collective processing of information within the group (i.e., information elaboration). The results of this analysis show that richer elaboration processes have a stronger (and significant) relationship with team adaptive performance (M_ρ = 0.26, CI: 0.15, 0.37) whereas one-way information transfer communications did not demonstrate a significant relationship with team adaptive performance (M_ρ = 0.15, CI: −0.02, 0.33). These effects were not significantly different from each other (see Table 12).

4. Discussion

We have developed a conceptual model of the team adaptation process based on prior theorizing (e.g., Burke et al., 2006) that views adaptation within an IMOI framework. We extend prior work by developing theory and empirically examining the moderating role of the origin and duration of adaptive stimuli. We found some compelling support for our hypotheses that the origin and duration of an adaptive stimulus may determine the ways that teams can maximize performance under non-routine circumstances. Indeed, 6 of our 11 moderator hypotheses were supported. Adaptive stimulus origin moderated the relationships between communication, coordination, and stimulus-specific actions with team adaptive performance, but not those for plan formulation or team cognition. Adaptive stimulus duration moderated the relationships between communication, learning behavior, and team cognition with team adaptive performance, but not those for coordination, stimulus-specific actions, and plan formulation. Given these findings, our results should energize researchers to consider the type of changes teams face, and echo calls to attend to context in organizational behavior research (e.g., Heath & Sitkin, 2001; Johns, 2006). Further, our study is the first to empirically examine the inputs and mechanisms that lead to effective team adaptation in different situations.

4.1. Theoretical implications

Perhaps most importantly, our results suggest that context—the nature of the stimuli—moderates the relationship between team processes and emergent states with team adaptive performance. Our findings suggest an answer for why certain processes or emergent states are reported as highly effective for team performance in some studies, yet less beneficial in others. We theorized and found that in general, team processes and emergent states were more effective in helping teams “deal with” changes in their external environment, versus changes in their internal environment. We also theorized and found that learning behavior was more effective in sustained adaptive contexts, compared to temporary adaptive contexts.

This research helps to both support and extend previous theorizing in this area. Our integrated conceptual model combines seminal IMOI research (Ilgen et al., 2005) with more recent theorizing concerning the team adaptation process (Maynard et al., 2015; Rosen et al., 2011). We provide additional support for adaptation as an unfolding process where *adaptability* (i.e., inputs) influences *adaptive mechanisms* (i.e., team processes and emergent states), which in turn affect *team adaptive performance*. Yet, thus far, models of team adaptation have not differentiated by context, and our contextual moderators—stimulus origin and duration—provide an important extension to these models. For example, Burke et al.'s (2006) model of the adaptive cycle and adaptive team performance assumes that teams experience a series of unfolding phases over time, integrating inputs, processes, and emergent states. Yet, the model does not take into account the context in which the adaptation occurs. Our theorizing—and empirical results—suggest that the adaptive stimulus is a valuable moderator. Thus, these findings should be integrated into future team adaptation theory-building, such that the type of stimulus faced by the team is viewed as an important moderator of the process-performance relationship.

Using this model, researchers will see new boundaries for inferences that can be drawn from their findings based on the context and nature of the stimulus. According to Johns (2006, p. 388), “if we do not understand situations, we will not understand person-situation interactions,” and thus, the current work represents an important “next step” in theory-building for the team adaptation literature.

We also relied on previous theory (e.g., Burke et al., 2006; Ilgen et al., 2005; Kozlowski et al., 1999) to quantitatively summarize and compare the predictors of team adaptive performance in general. This is a significant step forward, because thus far our understanding of which factors are theoretically relevant for team performance under non-routine circumstances has been limited. In doing so, we move the literature forward by empirically demonstrating the importance of adaptive mechanisms. We found that team processes—especially stimulus-specific actions, coordination, and learning behavior—are particularly important for success when teams face non-routine circumstances. We also found that team cognition, particularly transactive memory, represents another key factor in effective team adaptive performance.

In general, we found support for the idea that distal antecedents (e.g., inputs) influenced performance more weakly than proximal mechanisms (e.g., team processes and emergent states). Our findings differ from many studies of routine performance, where input variables such as personality (e.g., Bell, 2007) and teamwork competencies demonstrate strong relations with criteria (e.g., Cooke et al., 2003; Stevens & Campion, 1999). Thus, our results indicate that certain inputs may operate differently under non-routine circumstances than they do under routine situations. For example, both our bivariate analyses and path model suggest that in adaptive situations, cognitive ability may explain more variance than conscientiousness; whereas in routine teamwork situations, conscientiousness remains a strong predictor (e.g., Bell, 2007). These findings lend further support to the idea that conscientiousness—or certain aspects of it (e.g., dependability; LePine, 2003; LePine et al., 2000)—may not be beneficial for performance in adaptive contexts, as it tends to prohibit flexibility and exploration. Future team adaptation research may benefit from a more targeted approach towards investigating conscientious, as perhaps the sub-facets of achievement-striving and dependability (see LePine, 2003; Randall, 2008) may provide greater insight than examining overall conscientiousness.

Additionally, an important issue within the team adaptation literature involves conceptualizing adaptation as a process versus as an outcome, which has typically caused some confusion in identifying when teams have "adapted." We attempt to provide a movement towards consensus about whether the most important concern is the *process* by which a team adapts (i.e., adaptive behaviors; e.g., Waller, 1999) or *how successfully* it does so (i.e., team adaptive performance; e.g., Marks et al., 2000). Researchers in the past have tended to choose between these two based on their particular research question rather than advocate for a methodological paradigm. Theoretically, we have taken the stance that while adaptive behaviors are a crucial piece of the puzzle, the ultimate criterion of success—by which most teams are judged—are outcomes, which we have termed *team adaptive performance*. The results of our meta-analysis suggest that team processes and emergent states are importantly related to team adaptive performance, lending support to our theoretical conceptualization. However, we acknowledge that there is room for debate in this area, and suggest that the debate is more than just an epistemological concern about the nature of what adaptation is; the way we measure adaptation will significantly influence what we find.

The results of our supplemental analysis also highlight a potentially important distinction in the *type* of communication employed during and in response to an adaptive stimulus. Our examination of one-way information transfer or sharing versus information elaboration found that information elaboration is a stronger predictor of team adaptive performance. This finding suggests that elaboration and information integration is more valuable than one-way information transfer within an adaptive context, possibly because it encompasses the exchange, analysis, and application of information (e.g., Resick, Murase, Randall, & DeChurch, 2014; van Knippenberg, De Dreu, & Homan, 2004), as opposed to general requests or information sharing. Thus, it is likely that the elaboration process is a key factor that allows for a successful adaptive response, and simple communication exchanges may not be sufficient. However, more research is needed in this area, as despite finding stronger effects for information elaboration processes, the two communications categories were not significantly different from one another in predicting adaptive team performance. This may be due to real differences, or due to difficulties inherent in coding and analyzing communications data (Cooke, Gorman, & Winner, 2007).

4.2. Practical implications

The results of our meta-analysis also have some important implications for practitioners. Most directly, managers interested in developing adaptive teams can build them through selecting team members high in cognitive ability. Organizations with specific interest in adaptive performance (e.g., fire departments, crisis management firms, public relations firms), may wish to emphasize cognitive ability over personality when making selection decisions. Managers can also encourage the development of team processes and emergent states through team interaction training and leader briefings (e.g., Lewis et al., 2007; Marks et al., 2000; Vashdi et al., 2013), and developing empowered teams (e.g., Randall et al., 2011; Stokes et al., 2010). Further, teams can be encouraged to develop transactive memory structures through role identification behaviors (Pearsall, Ellis, & Bell, 2010) and having members observe the behaviors and indicators of expertise of their teammates (Peltokorpi, 2012; Zajac et al., 2014).

Our results can help guide managers and leaders in understanding which factors to cultivate and encourage when changes occur. Leaders can now differentiate between the most and least effective team processes in a given change context. Leaders may choose to emphasize the importance of learning behaviors, for example, when a sustained change occurs in their team; or can emphasize the importance of using workaround solutions when a change is temporary. Further, when a disruption is internal, leaders can expect to see—and attempt to manage—the resulting decrements in communication and coordination, but when it is external, they may choose to empower their team to use established interactional and coordinated routines as they adapt together as a unit. Our model can also be used to help "frame" the type of the adaptive stimulus to the team. Our results suggest, for example, that a manager who is introducing a new product line, or a new production process, should emphasize team learning behaviors first and foremost. Or, sometimes teams face a series of predictable temporary changes (e.g., consulting teams that have members who travel regularly). If managers want a team to take a long-term approach to a short-term stimulus (rather than create temporary work-arounds), he or she can emphasize that the temporary change could have the potential to become more permanent, or that the temporary change is to be expected to occur frequently.

4.3. Future research directions

Stemming from our focus on temporary versus sustained changes, future studies should incorporate models of time and team development into research on adaptation. Our review indicated that more longitudinal research studying real teams in adaptive contexts is needed. Examining teams over time will help research to uncover adaptive responses that are effective long-term, but may have short-term performance costs. For example, a team that responds to changes in the environment or in competition may need to invest considerable time and effort in external scouting (Ancona and Caldwell, 1990, 1992, 2007), learning new skills and abilities, or recruiting and training new members. Although these adaptive responses may pay off in the long run, in the short-term they may be viewed with bias as counterproductive, and thus less likely to be implemented. Similarly, a team that responds to competitor innovation by increasing internal efficiencies may see a short-term boost in performance but ultimately fail because their adaptive response was incorrect.

Moreover, in terms of team development, different processes may be relevant along different points over time. For instance, research by Edmondson, Bohmer, and Pisano (2001) examines technology implementation and changing routines in hospitals and points to the important role of time. In addition, Kozlowski et al.'s (1999) team compilation model suggests that teams possess different capacities early versus late in their development. Therefore, it is important for researchers to acknowledge the stage of development of the team of interest when designing models of team adaptation. For instance, mutual performance monitoring (see Kozlowski et al., 1999) is a likely predictor of successful adaptation for teams at a later stage of development, but not for teams in an early stage. Members in teams at an early stage may not be able to fully understand the roles of their teammates, and performance monitoring may actually lead to *more* errors.

Further, researchers should investigate how teams working in multi-team systems adapt, perhaps drawing on the findings of Ancona and Caldwell (e.g., Ancona & Caldwell, 1990). Most team adaptation researchers have not explored the boundaries beyond an individual team in adaptation, although teams do not work in a vacuum and often coordinate with other teams in order to accomplish their work. For instance, researchers have long recognized that new product teams must obtain information and resources from outside of their team, and then transmit the information directly to the team (e.g., Allen, 1984; Ebadi & Dilts, 1986; Tushman, 1979). Do interactions with other teams help or hinder the ability of a focal team to successfully adapt? What factors help to "transfer" adaptive mechanisms from one team to another?

Future research should also further investigate the differences that we found among team processes in field and laboratory studies. These differences may simply be due to measurement differences between lab and organizational settings, or real differences between behaviors and their effectiveness may exist. Future work may also benefit from a greater understanding of the differences in the process-performance relationships for teams low versus high in authority and skill differentiation. Researchers may also wish to investigate how teams successfully adapt when faced with multiple stimuli. For instance, a team may experience the temporary loss of a member while in the midst of adapting to a long-term task change. In such instances, the timing of adaptive behaviors (see Waller, 1999) may be particularly important. Or, the loss of a member may propel teams to quickly abandon old routines and mental models and "start from scratch," positively impacting team adaptive performance.

Finally, future studies should examine teams that adapt even when they should stay the course. Even the most effective teams that collectively engage in a textbook assessment of the situation and develop a thoughtful problem solving response may make changes that result in poor outcomes. Sometimes, staying the course may be the best solution, while attempting to adapt may worsen the situation. For example, in the case of the Mann-Gulch disaster, Weick (1993) describes a team of smokejumpers trapped on a hillside. Many of the smokejumpers adapted by running from the fire, climbing up the hillside to escape. However, because fire burns upward, the choice to climb resulted in disaster. The more effective strategy would have been to stay the course and lie down in an already-burned portion of the field. In many situations, teams may mistakenly assess a situation as one requiring adaptation and mistakenly diverge from a winning strategy. Similarly, a team may have successfully responded to a stimulus but not realize it, and continue to make adaptations past the point that they are beneficial.

4.4. Limitations

Our study has a few important limitations. First, some of our results are based on moderately small sample sizes (i.e., k). We were unable to test some of our proposed hypotheses because few or no studies have investigated the relationship; for instance, we were unable to test the moderating effect of adaptive stimulus origin on learning behavior effectiveness. Additionally, we found relatively little research on input factors and team leader behavior, or on predictors of emergent states in adaptive contexts. As the number of adaptation studies increases, researchers may be able to update our model to include a larger number of input and situational factors. For example, team regulatory focus plays an important role in team performance under routine conditions (e.g., Lanaj, Chang, & Johnson, 2012) and theoretical work and review papers have suggested the importance of regulatory focus for adaptive contexts (Johnson & Wallace, 2011; Kozlowski & Ilgen, 2006). Also, regarding the communications data, we were limited in terms of the primary studies' decisions in reporting exactly *what* information was communicated; when data was provided, it was often task-specific, making generalizations across studies difficult.

Although the low k for certain factors represent a limitation, comparisons based on low k are not uncommon in meta-analyses of team-level phenomena (e.g., Bell, 2007; De Dreu & Weingart, 2003; D'Innocenzo, Mathieu, & Kukenberger, 2014; Hülsheger, Anderson, & Salgado, 2009). However, we acknowledge that the computations based on low k could be subject to second-order sampling error (Hunter & Schmidt, 2004). Despite this, we presented these estimates in order to be comprehensive and because second-order sampling error tends to have lesser effects on meta-analytic estimates of relationships among means when compared to those of variance (Mesmer-Magnus & DeChurch, 2009). Further, the fail-safe k values were generally large ($M = 199$), and according to Dalton et al. (2012), the file drawer problem has little impact on the validity of meta-analytic estimates.

Further, while we focused on origin and duration, there are other ways to classify adaptive stimuli. For example, Baard et al. (2014) discuss the distinction made by Wood (1986) in terms of task complexity. Wood (1986) classified task changes as either component complexity (changes in discrete cues and actions), coordinative complexity (changes in linkages among cues and their sequencing), and dynamic complexity (the degree of flux inherent in component and coordinative complexity).[13] This, and other classification schemes, may be able to provide an even more nuanced conceptualization of adaptive stimuli in the future.

4.5. Conclusion

Team processes and cognition are important predictors of team adaptive performance. However, the context—or adaptive stimulus—appears to matter in terms of which processes and emergent states will be most effective, and when. Our examination of the origin and duration of a stimulus have helped to shed light on how team processes are differentially effective across adaptive contexts. Our hope is not only for researchers to recognize and deeply consider the important differences that exist among the various types of adaptation found in the literature, but to specifically incorporate the nature of the stimuli when developing theory and empirical studies.

Acknowledgement

We would like to acknowledge Aleksander P.J. Ellis for his helpful comments on the manuscript, and Jake West for his help with construct coding.

[13] We also coded and analyzed adaptive stimuli using this typology. Results are available from the first author upon request.

Appendix A . Studies used in meta-analysis and constructs coded from each study

Study	Origin	Duration	Adaptive task or process	Team type	Team size	N_t	Predictor construct labels	Predictor constructs highest order	Criterion construct label	Criterion construct highest order
Beersma et al. (2009)	Internal	Sustained	Structural adaptation; change in reward structure	Action	4	75	Coordination	Team process	Performance	Team adaptive performance
							Team role discussion	Team process		
Beersma et al. (2016)	External	Sustained	Non-routine events	Action	4	22	Information processing	Team process	Team performance	Team adaptive performance
							Coordination	Team process		
Burtscher et al. (2010)	External	Temporary	Non-routine events	Action	2–4	22	Task management	Team process	Team performance	Team adaptive performance
Burtscher et al. (2011)	External	Temporary	Critical, non-routine events	Action	2	15	Information management	Team process	Decision latency	Team adaptive performance
							Task management	Team process	Execution latency	Team adaptive performance
Chandler and Lyon (2009)	Internal	Sustained	Membership change	Management	N/R	124	Vicarious search and notice learning	Training	Venture performance	Team adaptive performance
Chen (2005)	Internal	Sustained	Membership change	Project	8	65	Initial team performance (T1)	Prior performance	Subsequent team performance (T4)	Team adaptive performance
Chen et al. (2005)	External	Sustained	Task environment change	Action	2	78	Team knowledge	Team characteristics	Team adaptive performance	Team adaptive performance
							Action processes	Team process		
							Transition processes	Team process		
							Team skill	Prior performance		
Christian et al. (2014)	Internal	Sustained	Member loss	Action	4	78	Transactive memory systems	Team cognition	Team performance	Team adaptive performance
							Plan formulation	Team process		
							Prior performance	Prior performance		
de Jong and de Ruyter (2004)	External	Temporary	Service recovery	Service	20	61	Team size	Team characteristics	Loyalty intentions	Team adaptive performance
							Tenure	Team characteristics	Recovery satisfaction	Team adaptive performance
							Customer complaint management	Feedback	Service revenues	Team adaptive performance
							Intrateam support	Team process	Share of customer	Team adaptive performance
							Proactive recovery behavior	Team process		
							Adaptive recovery behavior	Team process		

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Appendix A (*continued*)

Study	Origin	Duration	Adaptive task or process	Team type	Team size	N_t	Predictor construct labels	Predictor constructs highest order	Criterion construct label	Criterion construct highest order
DeRue et al. (2008)	Internal	Sustained	Structural adaptation (downsizing)	Action	5	71	Emotional stability	Personality	T2 performance	Team adaptive performance
							Extraversion	Personality		
							T1 qualitative behaviors	Team process		
							T1 quantitative behaviors	Team process		
							T2 qualitative behaviors	Team process		
							T2 quantitative behaviors	Team process		
							T1 performance	Prior performance		
de Snoo and van Wezel (2014)	External	Sustained	Non-routine events	Project	3	42	Group decision-making coordination	Team process	Rescheduling performance	Team adaptive performance
Ellis et al. (2003)	External	Sustained	Task environment change	Action	4	109	Cognitive ability	Cognitive ability	Team performance	Team adaptive performance
							Agreeableness	Personality		
							Openness	Personality		
							Team learning	Team process		
Entin and Serfaty (1999)	External	Temporary	Non-routine events	Action	5	4–6	TACT (training)	Training	Team performance	Team adaptive performance
Gorman et al. (2010)	External	Sustained	Task environment change	Action	3	26	Perturbation training	Training	Team performance	Team adaptive performance
							Feedback	Feedback		
Grote et al. (2010)	External	Temporary	Non-routine events	Action	N/R	42	Explicit coordination	Team process	Performance	Team adaptive performance
Han and Williams (2008)	Internal and External	Temporary	Non-routine events	Action	3	37	Continuous learning activity	Team goal orientation	Team adaptive performance	Team adaptive performance
							Team learning climate	Team goal orientation		
							Individual adaptive performance	Team process		
Johnson et al. (2006)	Internal	Sustained	Reward structure	Action	4	80	T1 accuracy	Prior performance	T2 accuracy	Team adaptive performance
							T1 speed	Prior performance	T2 speed	Team adaptive performance
							T1 information sharing	Team process		
							T2 information sharing	Team process		

Appendix A (*continued*)

Study	Origin	Duration	Adaptive task or process	Team type	Team size	N_t	Predictor construct labels	Predictor constructs highest order	Criterion construct label	Criterion construct highest order
Johnson et al. (2013)	Internal	Sustained	Personnel change, process change, and structural change	Action	4	78	Diagnostic list	Training	T2 task performance	Team adaptive performance
							Structural alignment feedback	Feedback		
							Structural change-plan	Team process		
							T1 OCB	Team process		
							T2 OCB	Team process		
							T1 task performance	Prior performance		
Jundt et al. (2005)	Internal	Sustained	Structural adaptation	Action	4	64	Extraversion	Personality	Performance (Time 2)	Team adaptive performance
							Emotional stability	Personality		
							Performance (Time 1)	Prior performance		
Kaplan et al. (2013)	External	Temporary	Non-routine events	Action	4	21	Tenure	Team characteristics	Team effectiveness	Team adaptive performance
Konradt et al. (2015)	External	Sustained	Non-routine events	Project	3	98	Feedback	Feedback	Performance improvement	Team adaptive performance
							Team mental models	Team cognition		
							Task mental models	Team cognition		
							Reflection	Team process		
							Adaptation	Team process		
Lei et al. (2015)	External	Temporary	Non-routine events	Action	2	11	S3 planning	Team process	S5 performance	Team adaptive performance
LePine (1998)	Internal	Temporary	Communication breakdown	Action	3	141	Quality of feedback	Feedback	Post-change decision-making performance	Team adaptive performance
LePine (2003)	Internal	Temporary	Communication breakdown	Action	3	73	Cognitive ability	Cognitive ability	Decision-making accuracy	Team adaptive performance
							Achievement	Personality		
							Dependability	Personality		
							Openness	Personality		
							Role structure adaptation (objective)	Team process		
							Role structure adaptation (rated)	Team process		

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Appendix A (*continued*)

Study	Origin	Duration	Adaptive task or process	Team type	Team size	N_t	Predictor construct labels	Predictor constructs highest order	Criterion construct label	Criterion construct highest order
LePine (2005)	Internal	Temporary	Communication breakdown	Action	3	64	Cognitive ability	Cognitive ability	Post-change decision-making performance	Team adaptive performance
							Learning orientation	Team goal orientation		
							Performance orientation	Team goal orientation		
							Number of adapted trials	Team process		
							Pre-change decision-making performance	Prior performance		
Lewis et al. (2007)	Internal	Sustained	Membership change	Production	3	30–90	Expertise structure stability	Team cognition	Operational performance	Team adaptive performance
							TMS structure stability	Team cognition		
							Intervention (oldtimer flexibility)	Training		
Magni et al. (2013)	External	Temporary/sustained	Non-routine events	Project	4.57	71	Team size	Team characteristics	Effectiveness	Team adaptive performance
							Improvisation	Team process		
Marks et al. (2000)	External	Sustained	Task environment change	Action	3	59–78	Mental model similarity (T2)	Team cognition	Coordinated team performance (T2)	Team adaptive performance
							Mental model accuracy (T2)	Team cognition		
							Communication processes (T2)	Team process		
Marques-Quinteiro et al. (2013)	External	Temporary	Non-routine events	Action	6.87	42	Team size	Team characteristics	Team performance	Team adaptive performance
							Team tenure	Team characteristics		
							Transactive memory systems	Team cognition		
							Team adaptive behavior	Team process		
							Team implicit coordination	Team process		
Marques-Quinteiro et al. (2015)	External	Sustained	Non-routine events	Project	4.67	175	Team size	Team characteristics	Team adaptive performance	Team adaptive performance
							Task experience	Team characteristics		

Appendix A (*continued*)

Study	Origin	Duration	Adaptive task or process	Team type	Team size	N_t	Predictor construct labels	Predictor constructs highest order	Criterion construct label	Criterion construct highest order
Moon et al. (2004)	Internal	Sustained	Structural adaptation	Action	4	63	Cognitive ability	Cognitive ability	Performance stage 2	Team adaptive performance
							Average support	Team process		
							Average communication	Team process		
							Performance stage 1	Prior performance		
Okhuysen (2001)	Internal	Temporary	Attentional switches	Project	4	40	Formal intervention	Training	Team performance	Team adaptive performance
Porter et al. (2003)	External	Temporary	Task change (workload imbalance)	Action	4	71	Provider agreeableness	Personality	Overall defensive score	Team adaptive performance
							Provider conscientiousness	Personality	Overall offensive score	Team adaptive performance
							Provider emotional stability	Personality		
							Provider extraversion	Personality		
							Recipient agreeableness	Personality		
							Recipient conscientiousness	Personality		
							Recipient emotional stability	Personality		
							Recipient extraversion	Personality		
							Backing up behaviors	Team process		
Porter et al. (2010)							Learning orientation	Team goal orientation	T2 performance	Team adaptive performance
							Performance orientation	Team goal orientation		
							T1 performance	Prior performance		
Randall (2008)	External	Sustained	Task environment change	Project	3	74	Achievement striving (conscientiousness)	Personality	Pop-24 months	Team adaptive performance
Randall et al. (2011)	External	Sustained	Task environment change	Project	3	74	Cognitive ability	Cognitive ability	Decision effectiveness	Team adaptive performance
							MM-accuracy	Team cognition		
							MM-similarity	Team cognition		
							Information sharing	Team process		
							Reactive strategy adaptation	Team process		
							City 1 decision effectiveness	Prior performance		

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Appendix A (*continued*)

Study	Origin	Duration	Adaptive task or process	Team type	Team size	N_t	Predictor construct labels	Predictor constructs highest order	Criterion construct label	Criterion construct highest order
Resick et al. (2010)	External	Temporary	Critical and disruptive events	Project	4	40	MM-quality-importance ratings	Team cognition	Decision effectiveness	Team adaptive performance
							MM-quality-priority rankings	Team cognition		
							MM-quality-structural networks	Team cognition		
							MM-similarity-importance ratings	Team cognition		
							MM-similarity-priority rankings	Team cognition		
							MM-similarity-structural networks	Team cognition		
							Team adaptation	Team process		
							Pre-disaster decision effectiveness	Prior performance		
Resick et al. (2014)	External	Sustained	Non-routine events	Project	4	68	Information elaboration	Team process	Team performance	Team adaptive performance
Santos et al. (2015)	External	Sustained	Non-routine events	Project	4.76	68	Team size	Team characteristics	Team performance	Team adaptive performance
							Task experience	Team characteristics		
							Temporal mental model similarity	Team cognition		
							Temporal mental model accuracy	Team cognition		
							Team learning	Team process		
							Team adaptation	Team process		
Stachowski et al. (2009)	External	Temporary	Crisis event	Action	4.36	14	Crew tenure	Team characteristics	Performance ratings	Team adaptive performance
							Anticipation ratio	Team process		
Stokes et al. (2010)	Internal and external	Temporary	Communication breakdown and task change	Action	5	132	Cognitive ability	Cognitive ability	Adaptive performance (objective)	Team adaptive performance
							Conscientiousness	Personality		
							Neuroticism	Personality		
							Openness	Personality		
							Adaptive performance (subjective)	Team process		

Appendix A (*continued*)

Study	Origin	Duration	Adaptive task or process	Team type	Team size	N_t	Predictor construct labels	Predictor constructs highest order	Criterion construct label	Criterion construct highest order
Summers et al. (2012)	Internal	Sustained	Structural adaptation (change in membership)	Project	4	108	Leaving member cognitive ability	Cognitive ability	Task performance (T3)	Team adaptive performance
							New member cognitive ability	Cognitive ability		
							Flux in coordination	Team process		
							Information transfer	Team process		
							Task performance (T2)	Prior performance		
Tajeddin (2014)	External	Sustained	Non-routine events	Project	3	56	Team coordination	Team process	Team performance	Team adaptive performance
Uitdewilligen et al. (2013)	External	Sustained	Task environment change	Action	3	46	Game experience	Team characteristics	Post-change performance	Team adaptive performance
							MM-accuracy	Team cognition		
							MM-similarity	Team cognition		
							MM-absolute change	Team process		
							Patterns after change	Team process		
							Wind centrality after change	Team process		
							Pre-change performance	Prior performance		
Unger-Aviram and Erez (2016)	External	Sustained	Non-routine events	Project	3	40	Learning goal orientation	Team goal orientation	Performance Phase 2	Team adaptive performance
							High learning values	Training		
							Performance Phase 1	Prior performance		
Vashdi et al. (2013)	External	Temporary	Non-routine events	Action	5	217	Team size	Team characteristics	Relative duration of surgery	Team adaptive performance
							Action team learning	Team process		
							Team workload sharing	Team process		
							Team helping	Team process		

(*continued on next page*)

Appendix A (*continued*)

Study	Origin	Duration	Adaptive task or process	Team type	Team size	N_t	Predictor construct labels	Predictor constructs highest order	Criterion construct label	Criterion construct highest order
Waller (1999)	External	Temporary	Non-routine events	Action	3	10	Average time for task distribution	Team process	Performance	Team adaptive performance
							Average time for task prioritization	Team process		
							Information collection and transfer	Team process		
							Non-routine event verbalization	Team process		
							Task prioritization	Team process		
Waller et al. (2004)	External	Temporary	Non-routine events	Action	5	14	Crew size	Team characteristics	Performance	Team adaptive performance
							Face-to-face communication	Team process		
Wiedow and Konradt (2011)	External	Sustained	Task adaptation	Project, service, and production	4.2	50	Coordination success (supervisor-rated)	Team process	Team performance (supervisor-rated)	Team adaptive performance
							Coordination success (team-rated)	Team process	Team performance (team-rated)	Team adaptive performance
							Team adaptation	Team process		
							Team reflection	Team process		
Woolley (2009)	Internal/external	Sustained	Membership change and loss of materials	Project	3	40–90	Process-focus	Team goal orientation	Final score	Team adaptive performance
							Outcome-focus	Team goal orientation		
							Action identification	Team process		
							Problem adaptation	Team process		
							Process adaptation	Team process		
Woolley et al. (2013)	External	Sustained	Non-routine events	Action	3	92	Process focus	Team goal orientation	Decision 2% correct	Team performance
							Breadth of info search (T2)	Team process		
							Decision 1% correct	Prior performance		
Zellmer-Bruhn (2003)	Internal/external	Temporary	Non-routine events	Service	10	90	Team exist	Team characteristics		
							Team size	Team characteristics		

References

References marked with an asterisk (*) indicate studies that contributed data to the meta-analysis

Allen, T. J. (1984). *Managing the flow of technology: Technology transfer and the dissemination of technological information within the R&D organization*. Cambridge, MA: MIT Press.

Ancona, D. G., & Caldwell, D. F. (1990). Beyond boundary spanning: Managing external dependence in product development teams. *The Journal of High Technology Management Research, 1*, 119–135.

Ancona, D. G., & Caldwell, D. F. (1992). Bridging the boundary: External activity and performance in organizational teams. *Administrative Science Quarterly, 37*, 634–665.

Ancona, D. G., & Caldwell, D. F. (2007). Improving the performance of new product teams. *Research Technology Management, 50*, 37–43.

Arrow, H., & McGrath, J. E. (1993). Membership matters: How member change and continuity affect small group structure, process, and performance. *Small Group Research, 24*, 334–361.

Austin, J. R. (2003). Transactive memory in organizational groups: The effects of content, consensus, specialization, and accuracy on group performance. *Journal of Applied Psychology, 88*, 866–878.

Baard, S. K., Rench, T. A., & Kozlowski, S. W. J. (2014). Performance adaptation: A theoretical integration and review. *Journal of Management, 40*, 48–99.

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

Beal, D. J., Cohen, R. R., Burke, M. J., & McLendon, C. L. (2003). Cohesion and performance in groups: A meta-analytic clarification of construct relations. *Journal of Applied Psychology, 88*, 989–1004.

*Beersma, B., Greer, L. L., Dalenberg, S., & De Dreu, C. K. W. (2016). Need for structure as asset and liability in dynamic team decision-making. *Group Dynamics: Theory, Research, and Practice, 20*, 16–23.

*Beersma, B., Hollenbeck, J. R., Conlon, D. E., Humphrey, S. E., Moon, H., & Ilgen, D. R. (2009). Cutthroat cooperation: The effects of team role decisions on adaptation to alternative reward structures. *Organizational Behavior and Human Decision Processes, 108*, 131–142.

Bell, S. T. (2007). Deep-level composition variables as predictors of team performance: A meta-analysis. *Journal of Applied Psychology, 92*, 595–615.

Bell, S. T., Villado, A. J., Lukasik, M. A., Belau, L., & Briggs, A. L. (2011). Getting specific about demographic diversity variable and team performance relationships: A meta-analysis. *Journal of Management, 37*, 709–743.

Bosco, F. A., Aguinis, H., Singh, K., Field, J. G., & Pierce, C. A. (2014). Correlational effect size benchmarks. *Journal of Applied Psychology, 100*, 431–449.

Bouton, M. E. (2002). Context, ambiguity, and unlearning: Sources of relapse after behavioral extinction. *Biological Psychiatry, 52*, 976–986.

Bowers, C. A., Pharmer, J. A., & Salas, E. (2000). When member homogeneity is needed in work teams: A meta-analysis. *Small Group Research, 31*, 305–327.

Brannick, M. T., Roach, R. M., & Salas, E. (1993). Understanding team performance: A multimethod study. *Human Performance, 6*, 287–308.

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Newbury Park, CA: Sage.

Bunderson, J. S., & Sutcliffe, K. M. (2003). Management team learning orientation and business unit performance. *Journal of Applied Psychology, 88*, 552–560.

Burke, M. J., Borrero, S., Beal, D. J., & Christian, M. S. (2016). *RBNL meta-analysis program. New Orleans, LA*.

Burke, M. J., & Landis, R. S. (2003). Methodological and conceptual challenges in conducting and interpreting meta-analyses. In K. R. Murphy (Ed.), *Validity generalization: A critical review* (pp. 287–309). Mahwah, NJ: Erlbaum.

Burke, C., Stagl, K., Salas, E., Pierce, L., & Kendall, D. (2006). Understanding team adaptation: A conceptual analysis and model. *Journal of Applied Psychology, 91*, 1189–1207.

*Burtscher, M. J., Manser, T., Kolbe, M., Grote, G., Grande, B., Spahn, D. R., et al. (2011). Adaptation in anaesthesia team coordination in response to a simulated critical event and its relationship to clinical performance. *British Journal of Anaesthesia, 106*, 801–806.

*Burtscher, M. J., Wacker, J., Grote, G., & Manswer, T. (2010). Managing nonroutine events in anesthesia: The role of adaptive coordination. *The Journal of the Human Factors and Ergonomics Society, 52*, 282–294.

Button, S. B., Mathieu, J. E., & Zajac, D. M. (1996). The development and psychometric evaluation of measures of learning goal and performance goal orientation. *Organizational Behavior and Human Decision Processes, 67*, 26–48.

Campbell, J. P., McCloy, R. A., Oppler, S. H., & Sager, C. E. (1993). A theory of performance. In N. Schmitt & W. C. Borman (Eds.), *New developments in selection and placement* (pp. 35–70). San Francisco, CA: Jossey-Bass.

Cancel, A. E., Cameron, G. T., Sallot, L. M., & Mitrook, M. A. (1997). It depends: A contingency theory of accommodation in public relations. *Journal of Public Relations Research, 9*, 31–63.

Cannon-Bowers, J. A., Salas, E., & Converse, S. A. (1993). Shared mental models in expert team decision making. In N. J. Castellan, Jr. (Ed.), *Individual and group decision making: Current issues* (pp. 221–246). Hillsdale, NJ: Erlbaum.

Cannon-Bowers, J. A., Tannenbaum, S. I., Salas, E., & Volpe, C. E. (1995). Defining team competencies and establishing team training requirements. In R. A. Guzzo & E. Salas (Eds.), *Team effectiveness and decision making in organizations* (pp. 333–380). San Francisco, CA: Jossey-Bass.

*Chandler, G. N., & Lyon, D. W. (2009). Involvement in knowledge-acquisition activities by venture team members and venture performance. *Entrepreneurship Theory and Practice, 33*, 571–592.

*Chen, G. (2005). Newcomer adaptation in teams: Multilevel antecedents and outcomes. *Academy of Management Journal, 48*, 101–116.

*Chen, G., Thomas, B., & Wallace, J. C. (2005). A multilevel examination of the relationships among training outcomes, mediating regulatory processes, and adaptive performance. *Journal of Applied Psychology, 90*, 827–840.

Christian, M. S., Bradley, J. C., Wallace, J. C., & Burke, M. J. (2009). Workplace safety: A meta-analysis of the roles of person and situation factors. *Journal of Applied Psychology, 94*, 1103–1127.

*Christian, J. S., Pearsall, M. J., Christian, M. S., & Ellis, A. P. J. (2014). Exploring the benefits and boundaries of transactive memory systems in adapting to team member loss. *Group Dynamics: Theory, Research, and Practice, 18*, 69–86.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Cooke, N. J., Gorman, J., & Winner, J. L. (2007). Team cognition. In F. T. Durso, R. S. Nickerson, S. T. Dumais, S. Lewandowsky, & T. J. Perfect (Eds.), *Handbook of applied cognition* (2nd ed., pp. 239–268). Hoboken, NJ: John Wiley.

Cooke, N. J., Kiekel, P. A., Salas, E., Stout, R., Bowers, C., & Cannon-Bowers, J. (2003). Measuring team knowledge: A window to the cognitive underpinnings of team performance. *Group Dynamics: Theory, Research, and Practice, 7*, 179–199.

Cooke, N. J., Salas, E., Kiekel, P. A., & Bell, B. (2004). Advances in measuring team cognition. In E. Salas & S. Fiore (Eds.), *Team cognition: Understanding the factors that drive process and performance* (pp. 83–107). Washington, DC: American Psychological Association.

Costa, P. T., Jr., & McCrae, R. R. (1985). *The NEO personality inventory manual*. Odessa, FL: Psychological Assessment Resources.

D'Innocenzo, L., Mathieu, J. E., & Kukenberger, M. R. (2014). A meta-analysis of different forms of shared leadership—Team performance relations. *Journal of Management, 20*, 1–28.

Dalton, D. R., Aguinis, H., Dalton, C. M., Bosco, F. A., & Pierce, C. A. (2012). Revisiting the file drawer problem in meta-analysis: An assessment of published and non-published correlation matrices. *Personnel Psychology, 65*, 221–245.

De Dreu, C. K., & Weingart, L. R. (2003). Task versus relationship conflict, team performance, and team member satisfaction: A meta-analysis. *Journal of Applied Psychology, 88*, 741–749.

*de Jong, A., & de Ruyter, K. (2004). Adaptive versus proactive behavior in service recovery: The role of self-managing teams. *Decision Sciences, 35*, 457–491.

*de Snoo, C., & van Wezel, W. (2014). Coordination and task interdependence during schedule adaptation. *Human Factors and Ergonomics in Manufacturing and Service Industries, 24*, 139–151.

*DeRue, D. S., Hollenbeck, J. R., Johnson, M. D., Ilgen, D. R., & Jundt, D. K. (2008). How different team downsizing approaches influence team-level adaptation and performance. *Academy of Management Journal, 51*, 182–196.

Devine, D., & Philips, J. (2001). Do smarter teams do better: A meta-analysis of cognitive ability and team performance. *Small Group Research, 32*, 507–532.

Diedrich, F. J., Freeman, J., Entin, E. E., Weil, S. A., & MacMillan, J. (2005). Modeling, measuring, and improving cognition at the team level. In *Proceedings from the first international conference on augmented cognition, Las Vegas, NV*.

Dunford, R., & Jones, D. (2000). Narrative in strategic change. *Human Relations, 53*(9), 1207–1226.

Ebadi, Y. M., & Dilts, D. A. (1986). The relation between R&D project performance and technical communication in a developing country: Afghanistan. *Management Science, 32*, 822–830.

Edmondson, A. C., Bohmer, R. M., & Pisano, G. P. (2001). Disrupted routines: Team learning and new technology implementation in hospitals. *Administrative Science Quarterly, 46*, 685–716.

*Ellis, A. P. J., Hollenbeck, J. R., Ilgen, D. R., Porter, C. O. L. H., West, B. J., & Moon, H. (2003). Team learning: Collectively connecting the dots. *Journal of Applied Psychology, 88*, 821–835.

*Entin, E. E., & Serfaty, D. (1999). Adaptive team coordination. *The Journal of the Human Factors and Ergonomics Society, 41*, 312–325.

Erez, A., Bloom, M. C., & Wells, M. T. (1996). Using random rather than fixed effects models in meta-analysis: Implications for situational specificity and validity generalization. *Personnel Psychology, 49*, 275–306.

Finkelstein, S., & Hambrick, D. C. (1990). Top management team tenure and organizational outcomes: The moderating role of managerial discretion. *Administrative Science Quarterly, 35*, 484–503.

Gersick, C. J. G., & Hackman, J. R. (1990). Habitual routines in task-performing groups. *Organizational Behavior and Human Decision Processes, 47*, 65–97.

Gooding, R. Z., & Wagner, J. A. III., (1985). A meta-analytic review of the relationships between size and performance: The productivity and efficiency of organizations and their subunits. *Administrative Science Quarterly, 30*, 462–481.

*Gorman, J. C., Cooke, N. J., & Amazeen, P. G. (2010). Training adaptive teams. *The Journal of the Human Factors and Ergonomics Society, 52*, 295–307.

*Grote, G., Kolbe, M., Zala-Mezo, E., Bienefeld-Seall, N., & Kunzle, B. (2010). Adaptive coordination and heedfulness make better cockpit crews. *Ergonomics, 53*, 211–228.

Gully, S. M., Incalcaterra, K. A., Joshi, A., & Beaubien, J. M. (2002). A meta-analysis of team-efficacy, potency, and performance: Interdependence and level of analysis as moderators of observed relationships. *Journal of Applied Psychology, 87*, 819–832.

Hackman, J. R., & Walton, R. E. (1986). Leading groups in organizations. In P.S. Goodman & Associates (Ed.), *Designing effective work groups* (pp. 72–119). San Francisco, CA: Jossey-Bass.

Hambley, L. A., O'Neill, T. A., & Kline, T. J. B. (2007). Virtual team leadership: The effects of leadership style and communication medium on team interaction styles and outcomes. *Organizational Behavior and Human Decision Processes, 103*, 1–20.

*Han, T. Y., & Williams, K. J. (2008). Multilevel investigation of adaptive performance: Individual-and team-level relationships. *Group and Organization Management, 33*, 657–684.

Heath, C., & Sitkin, S. (2001). Big-B versus Big-O: What is organizational about organizational behavior? *Journal of Organizational Behavior, 22*, 43–58.

Hedges, L. V., & Olkin, I. (1985). *Statistical models for meta-analysis*. New York, NY: Academic Press.

Hemphill, J. F. (2003). Interpreting the magnitudes of correlation coefficients. *American Psychologist, 58*, 78–79.

Hollenbeck, J. R., Beersma, B., & Schouten, M. E. (2012). Beyond team types and taxonomies: A dimensional scaling conceptualization for team description. *Academy of Management Review, 37*, 82–106.

Hülsheger, U. R., Anderson, N., & Salgado, J. F. (2009). Team-level predictors of innovation at work: A comprehensive meta-analysis spanning three decades of research. *Journal of Applied Psychology, 94*, 1128–1145.

Hunter, J. E. (1986). Cognitive ability, cognitive aptitudes, job knowledge, and job performance. *Journal of Vocational Behavior, 29*, 340–362.

Hunter, J. E., & Hunter, R. F. (1984). Validity and utility of alternate predictors of job performance. *Psychological Bulletin, 96*, 72–98.

Hunter, J. E., & Schmidt, F. L. (2004). *Methods of meta-analysis: Correcting error and bias in research findings*. Newbury Park, CA: Sage.

Ilgen, D. R., Hollenbeck, J. R., Johnson, M., & Jundt, D. (2005). Teams in organizations: From input-process-output models to IMOI models. *Annual Review of Psychology, 56*, 517–543.

Jin, Y., & Cameron, G. T. (2007). The effects of threat type and duration on public relations practitioner's cognitive, affective, and conative responses in crisis situations. *Journal of Public Relations Research, 19*(3), 255–281.

Johns, G. (2006). The essential impact of context on organizational behavior. *Academy of Management Review, 31*, 386–408.

*Johnson, M. D., Hollenbeck, J. R., DeRue, D. S., Barnes, C. M., & Jundt, D. (2013). Functional versus dysfunctional team change: Problem diagnosis and structural feedback for self-managed teams. *Organizational Behavior and Human Decision Processes, 122*, 1–11.

*Johnson, M. D., Hollenbeck, J. R., Humphrey, S. E., Ilgen, D. R., Jundt, D. K., & Meyer, C. J. (2006). Cutthroat cooperation: Asymmetrical adaptation to changes in team reward structures. *Academy of Management Journal, 49*, 103–119.

Johnson, P., & Wallace, C. (2011). Increasing individual and team performance in an organizational setting through the situational adaptation of regulatory focus. *Consulting Psychology Journal: Practice and Research, 63*, 190–201.

*Jundt, D. K., Ilgen, D. R., Hollenbeck, J. R., Humphrey, S. E., Johnson, M. D., & Meyer, C. J. (2005). *The impact of hybrid team structures on performance and adaptation: Beyond mechanistic and organic prototypes*. Unpublished manuscript. East Lansing, MI: Department of Management, Michigan State University.

Kanfer, R. (1990). Motivation theory and industrial/organizational psychology. In M. D. Dunnette & L. M. Hough (Eds.). *Handbook of industrial and organizational psychology* (2nd ed., Vol. 1, pp. 75–170). Palo Alto, CA: Consulting Psychologists Press.

*Kaplan, S., Laport, K., & Waller, M. J. (2013). The role of positive affectivity in team effectiveness during crises. *Journal of Organizational Behavior, 34*, 473–491.

Katz, R. (1982). The effects of group longevity on project communication and performance. *Administrative Science Quarterly, 27*, 81–104.

Kirkman, B. L., & Rosen, B. (1999). Beyond self-management: Antecedents and consequences of team empowerment. *Academy of Management Journal, 42*, 58–74.

Klein, G., & Pierce, L. (2001). *Adaptive teams (draft technical report, purchase order H438556[A] for link simulation and training division/army prim contract no. DAAD17–00-A-5002)*. Fairborn, OH.

Klimoski, R., & Mohammed, S. (1994). Team mental model: Construct or metaphor? *Journal of Management, 20*, 403–437.

*Konradt, U., Schippers, M., Garbers, Y., & Steenfatt, C. (2015). Effects of guided reflexivity and team feedback on team performance improvement: The role of team regulatory processes and cognitive emergent states. *European Journal of Work and Organizational Psychology, 24*, 777–795.

Kozlowski, S. W. J., & Bell, B. S. (2003). Work groups and teams in organizations. In W. Borman, D. R. Ilgen, & R. Klimoski (Eds.). *Handbook of Psychology* (Vol. 12, pp. 333–375). Hoboken, NJ: Wiley.

Kozlowski, S. W. J., Gully, S. M., Nason, E. R., & Smith, E. M. (1999). Developing adaptive teams: A theory of compilation and performance across levels and time. In D. Ilgen & E. Pulakos (Eds.), *The changing nature of work performance: Implications for staffing, personnel actions, and development* (pp. 240–292). San Francisco: Jossey-Bass.

Kozlowski, S. W., & Ilgen, D. R. (2006). Enhancing the effectiveness of work groups and teams. *Psychological Science in the Public Interest, 7*, 77–124.

Krabberød, T. (2014). Task uncertainty and mission command in a naval context. *Small Group Research, 45*, 416–434.

Kristof-Brown, A., Barrick, M. R., & Stevens, C. K. (2005). When opposites attract: A multi-sample demonstration of complementary person-team fit on extraversion. *Journal of Personality, 73*, 935–958.

Lanaj, K., Chang, C. H., & Johnson, R. E. (2012). Regulatory focus and work-related outcomes: A review and meta-analysis. *Psychological Bulletin, 138*, 998–1034.

Langfred, C. W. (2000). The paradox of self-management: Individual and group autonomy in work groups. *Journal of Organizational Behavior, 21*, 563–585.

*Lei, Z., Waller, M. J., Hagen, J., & Kaplan, S. (2015). Team adaptiveness in dynamic contexts: Contextualizing the roles of interaction patterns and in-process planning. *Group & Organization Management*, 1–35.

*LePine, J. A. (1998). *An integrative model of team adaptation* PhD thesis. Michigan State University.

*LePine, J. A. (2003). Team adaptation and postchange performance: Effects of team composition in terms of members' cognitive ability and personality. *Journal of Applied Psychology, 88*, 27–39.

*LePine, J. A. (2005). Adaptation of teams in response to unforeseen change: Effects of goal difficulty and team composition in terms of cognitive ability and goal orientation. *Journal of Applied Psychology, 90*, 1153–1167.

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

LePine, J. A., Piccolo, R. F., Jackson, C. L., Mathieu, J. E., & Saul, J. R. (2008). A meta-analysis of teamwork processes: Tests of a multidimensional model and relationships with team effectiveness criteria. *Personnel Psychology, 61*, 273–307.

Lewis, K. (2004). Knowledge and performance in knowledge-worker teams: A longitudinal study of transactive memory systems. *Management Science, 50*, 1519–1533.

*Lewis, K., Belliveau, M., Herndon, B., & Keller, J. (2007). Group cognition, membership change, and performance: Investigating the benefits and detriments of collective knowledge. *Organizational Behavior and Human Decision Processes, 103*, 159–178.

Liu, S., Huang, J. L., & Wang, M. (2014). Effectiveness of job search interventions: A meta-analytic review. *Psychological Bulletin, 140*, 1009–1041.

*Magni, M., Maruping, L. M., Hoegl, M., & Proserpio, L. (2013). Managing the unexpected across space: Improvisation, dispersion, and performance in NPD teams. *Journal of Product Innovation Management, 30*, 1009–1026.

Majchrzak, A., Jarvenpaa, S. L., & Hollingshead, A. B. (2007). Coordinating expertise among emergent groups responding to disasters. *Organization Science, 18*, 147–161.

Marks, M. A., Mathieu, J. E., & Zaccaro, S. J. (2001). A temporally based framework and taxonomy of team processes. *Academy of Management Review, 26*, 356–376.

*Marks, M. A., Zaccaro, S. J., & Mathieu, J. E. (2000). Performance implications of leader briefings and team-interaction training for team adaptation to novel environments. *Journal of Applied Psychology, 85*, 971–986.

*Marques-Quinteiro, P., Curral, L., Passos, A. M., & Lewis, K. (2013). And now what do we do? The role of transactive memory systems and task coordination in action teams. *Group Dynamics: Theory, Research, and Practice, 17*, 194–206.

*Marques-Quinteiro, P., Ramos-Villagrasa, P. J., Passos, A. M., & Curral, L. (2015). Measuring adaptive performance in individuals and teams. *Team Performance Measurement, 21*, 339–360.

Mathieu, J. E., Gilson, L. L., & Ruddy, T. M. (2006). Empowerment and team effectiveness: An empirical test of an integrated model. *Journal of Applied Psychology, 91*, 97–108.

Mathieu, J. E., Heffner, T. S., Goodwin, G. F., Salas, E., & Cannon-Bowers, J. A. (2000). The influence of shared mental models on team process and performance. *Journal of Applied Psychology, 85*, 273–283.

Mathieu, J. E., Maynard, M., Rapp, T., & Gilson, L. (2008). Team effectiveness 1997–2007: A review of recent advancements and a glimpse into the future. *Journal of Management, 34*, 410–476.

Mathieu, J. E., & Schulze, W. (2006). The influence of team knowledge and formal plans on episodic team process-performance relationships. *Academy of Management Journal, 49*, 605–619.

Maynard, M. T., Kennedy, D. M., & Sommer, S. A. (2015). Team adaptation: A fifteen-year synthesis (1998–2013) and framework for how this literature needs to "adapt" going forward. *European Journal of Work and Organizational Psychology, 24*, 652–677.

Mesmer-Magnus, J., & DeChurch, L. A. (2009). Information sharing and team performance: A meta-analysis. *Journal of Applied Psychology, 94*, 535–546.

Mohammed, S., & Dumville, B. C. (2001). Team mental models in a team knowledge framework: Expanding theory and measurement across disciplinary boundaries. *Journal of Organizational Behavior, 22*, 89–106.

Montoya-Weiss, M. M., Massey, A. P., & Song, M. (2001). Getting it together: Temporal coordination and conflict management in global virtual teams. *Academy of Management Journal, 44*, 1251–1262.

*Moon, H., Hollenbeck, J. R., Humphrey, S. E., Ilgen, D. R., West, B. J., Ellis, A. P. J., et al. (2004). Asymmetric adaptability: Dynamic team structures as one-way streets. *Academy of Management Journal, 47*, 681–696.

Morgeson, F. P. (2005). The external leadership of self-managing teams: Intervening in the context of novel and disruptive events. *Journal of Applied Psychology, 90*, 497–508.

Morgeson, F. P., & Hofmann, D. A. (1999). The structure and function of collective constructs: Implications for multilevel theory development. *The Academy of Management Review, 24*, 249–265.

Neuman, G. A., & Wright, J. (1999). Team effectiveness: Beyond skills and cognitive ability. *Journal of Applied Psychology, 84*, 376–389.

*Okhuysen, G. A. (2001). Structuring change: Familiarity and formal interventions in problem solving groups. *Academy of Management Journal, 44*, 794–808.

Ones, D. S., Viswesvaran, C., & Schmidt, F. L. (1993). Comprehensive meta-analysis of integrity test validities: Findings and implications for personnel selection and theories of job performance. *Journal of Applied Psychology, 78*, 679–703.

Orasanu, J. (1990). *Shared mental models and crew decision making* (Tech. report no. 46). Princeton, NJ: Princeton University, Cognitive Sciences Laboratory.

Overton, R. C. (1998). A comparison of fixed-effects and mixed (random-effects) for meta-analysis tests of moderator variable effects. *Psychological Methods, 3*, 354–379.

Park, T., & Shaw, J. D. (2013). Turnover rates and organizational performance: A meta-analysis. *Journal of Applied Psychology, 98*, 268–309.

Pearsall, M. J., Christian, M. S., & Ellis, A. P. J. (2010). Motivating interdependent teams: Individual rewards, shared rewards, or something in between? *Journal of Applied Psychology, 95*, 183–191.

Pearsall, M. J., Ellis, A. P. J., & Bell, B. S. (2010). Building the infrastructure: The effects of role identification behavior on team cognition development and performance. *Journal of Applied Psychology, 95*, 192–200.

Peltokorpi, V. (2012). Organizational transactive memory systems: Review and extension. *European Psychologist, 17*, 11–20.

Porter, C. O. L. H. (2005). Goal orientation: Effects on backing up behavior, performance, efficacy, and commitment in teams. *Journal of Applied Psychology, 90*, 811–818.

*Porter, C. O. L. H., Hollenbeck, J. R., Ilgen, D. R., Ellis, A. P. J., West, B. J., & Moon, H. (2003). Backing up behaviors in teams: The role of personality and legitimacy of need. *Journal of Applied Psychology, 88*, 391–403.

*Porter, C. O. L. H., Webb, J. W., & Gogus, C. I. (2010). When goal orientations collide: Effects of learning and performance orientation on team adaptability in response to workload imbalance. *Journal of Applied Psychology, 95*, 935–943.

Raju, N., Burke, M., Normand, J., & Langlois, G. (1991). A new meta-analytic approach. *Journal of Applied Psychology, 76*, 432–446.

Randall, K. R. (2008). *Adaptation in knowledge-based teams: An examination of team composition, leader sensegiving, and cognitive, behavioral, and motivational mechanisms* PhD thesis. Florida International University.

*Randall, K. R., Resick, C. J., & DeChurch, L. A. (2011). Building team adaptive capacity: The roles of sensegiving and team composition. *Journal of Applied Psychology, 96*, 525–540.

*Resick, C. J., Murase, T., Bedwell, W. L., Sanz, E., Jiménez, M., & DeChurch, L. A. (2010). Mental model metrics and team adaptability: A multi-facet multi-method examination. *Group Dynamics: Theory, Research, and Practice, 14*, 332–349.

*Resick, C. J., Murase, T., Randall, K. R., & DeChurch, L. A. (2014). Information elaboration and team performance: Examining the psychological origins and environmental contingencies. *Organizational Behavior and Human Decision Processes, 124*, 165–176.

Rico, R., Sánchez-Manzanares, M., Gil, F., & Gibson, C. (2008). Team implicit coordination processes: A team knowledge–based approach. *Academy of Management Review, 33*, 163–184.

Rosen, M. A., Bedwell, W. L., Wildman, J. L., Fritzsche, B. A., Salas, E., & Burke, C. S. (2011). Managing adaptive performance in teams: Guiding principles and behavioral markers for measurement. *Human Resource Management Review, 21*, 107–122.

Rosenthal, R. (1979). The file drawer problem and tolerance for null results. *Psychological Bulletin, 86*, 638–641.

Rosenthal, U., & Kouzmin, A. (1997). Crises and crisis management: Toward comprehensive government decision making. *Journal of Public Administration Research and Theory, 7*, 277–304.

*Santos, C. M., Passos, A. M., & Uitdewilligen, S. (2015). When shared cognition leads to closed minds: Temporal mental models, team learning, adaptation and performance. *European Management Journal, 34*, 258–268.

Schmidt, F. L. (2002). The role of general cognitive ability and job performance: Why there cannot be a debate. *Human Performance, 15*, 187–210.

Smith, K. G., Smith, K. A., Olian, J. D., Sims, H. P., O'Bannon, D. P., & Scully, J. A. (1994). Top management team demography and process: The role of soci integration and communication. *Administrative Science Quarterly, 39*, 412–438.

*Stachowski, A. A., Kaplan, S. A., & Waller, M. J. (2009). The benefits of flexible team interaction during crises. *Journal of Applied Psychology, 94*, 1536–1543.

Steel, P. D., & Kammeyer-Mueller, J. (2008). Bayesian variance estimation for meta-analysis quantifying our uncertainty. *Organizational Research Methods, 11*, 54–78.

Steel, P., Kammeyer-Mueller, J., & Paterson, T. A. (2015). Improving the meta-analytic assessment of effect size variance with an Informed Bayesian Prior. *Journal of Management, 41*, 718–743.

Stevens, M. J., & Campion, M. A. (1999). Staffing work teams: Development and validation of a selection test for teamwork settings. *Journal of Management, 25*, 207–228.

Stewart, G. L. (2006). A meta-analytic review of relationships between team design features and team performance. *Journal of Management, 32*, 29–55.

*Stokes, C. K., Schneider, T. R., & Lyons, J. B. (2010). Adaptive performance: A criterion problem. *Team Performance Management, 16*, 212–230.

*Summers, J. K., Humphrey, S. E., & Ferris, G. R. (2012). Team member change, flux in coordination, and performance: Effects of strategic core roles, information transfer, and cognitive ability. *Academy of Management Journal, 55*, 314–338.

*Tajeddin, G. (2014). *The timing of discrepant interruptions and its influence on team performance* PhD thesis. York University.

Tuckman, B. W. (1965). Development sequence in small groups. *Psychological Bulletin, 63*, 348–399.

Tushman, M. L. (1979). Impacts of perceived environmental variability on patterns of work related communication. *Academy of Management Journal, 22*, 482–500.

*Uitdewilligen, S., Waller, M. J., & Pitariu, A. H. (2013). Mental model updating and team adaptation. *Small Group Research, 44*, 127–158.

*Unger-Aviram, E., & Erez, M. (2016). The effects of situational goal orientation and cultural learning values on team performance and adaptation to change. *European Journal of Work and Organizational Psychology, 25*, 239–253.

van Knippenberg, D., De Dreu, C. K., & Homan, A. C. (2004). Work group diversity and group performance: An integrative model and research agenda. *Journal of Applied Psychology, 89*, 1008–1022.

*Vashdi, D. R., Bamberger, P. A., & Erez, M. (2013). Can surgical teams ever learn? The role of coordination, complexity, and transitivity in action team learning. *Academy of Management Journal, 56*, 945–971.

Viswesvaran, C., & Ones, D. S. (1995). Theory testing: Combining psychometric meta-analysis and structural equations modeling. *Personnel Psychology, 48*, 865–885.

Volberda, H. (1996). Toward the flexible form: How to remain vital in hypercompetitive environments. *Organization Science, 7*, 359–374.

*Waller, M. J. (1999). The timing of adaptive group responses to nonroutine events. *Academy of Management Journal, 42*, 127–137.

*Waller, M. J., Gupta, N., & Giambatista, R. C. (2004). Effects of adaptive behaviors and shared mental models on control crew performance. *Management Science, 50*, 1534–1544.

Wegner, D. M., Giuliano, T., & Hertel, P. T. (1985). Cognitive interdependence in close relationships. In W. Ickes (Ed.), *Compatible and incompatible relationships* (pp. 253–276). New York, NY: Springer-Verlag.

Weick, K. E. (1993). The collapse of sensemaking in organizations: The Mann Gulch disaster. *Administrative Science Quarterly, 38*, 628–652.

*Wiedow, A., & Konradt, U. (2011). Two-dimensional structure of team process improvement: Team reflection and team adaptation. *Small Group Research, 42*, 32–54.

Wood, R. E. (1986). Task complexity: Definition of the construct. *Organizational Behavior and Human Decision Processes, 37*, 60–82.

*Woolley, A. W. (2009). Means vs. ends: Implications of process and outcome focus for team adaptation and performance. *Organization Science, 20*, 500–515.

*Woolley, A. W., Bear, J. B., Chang, J. W., & DeConstanza, A. H. (2013). The effects of team strategic orientation on team process and information search. *Organizational Behavior and Human Decision Processes, 122*, 114–126.

Yoo, Y., & Alavi, M. (2004). Emergent leadership in virtual teams: What do emergent leaders do? *Information and Organization, 14*, 27–58.

Zaccaro, S. J., Rittman, A. L., & Marks, M. A. (2001). Team leadership. *The Leadership Quarterly, 12*, 451–483.

Zajac, S., Gregory, M. E., Bedwell, W. L., Kramer, W. S., & Salas, E. (2014). The cognitive underpinnings of adaptive team performance in ill-defined task situations: A closer look at team cognition. *Organizational Psychology Review, 4*, 49–73.

*Zellmer-Bruhn, M. E. (2003). Interruptive events and team knowledge acquisition. *Management Science, 4*, 514–528.