2012

Facet Personality and Surface-Level Diversity as Team Mental ModelAntecedents: Implications for Implicit Coordination

David M. Fisher, *DePaul University*
Suzanne T. Bell, *DePaul University*
James A. Belohlav, *DePaul University*
Erich C. Dierdorff,, *DePaul University*

Journal of Applied Psychology

Facet Personality and Surface-Level Diversity as Team Mental Model Antecedents: Implications for Implicit Coordination

David M. Fisher, Suzanne T. Bell, Erich C. Dierdorff, and James A. Belohlav

Facet Personality and Surface-Level Diversity as Team Mental Model Antecedents: Implications for Implicit Coordination

David M. Fisher, Suzanne T. Bell, Erich C. Dierdorff, and James A. Belohlav
DePaul University

Team mental models (TMMs) have received much attention as important drivers of effective team processes and performance. Less is known about the factors that give rise to these shared cognitive structures. We examined potential antecedents of TMMs, with a specific focus on team composition variables, including various facets of personality and surface-level diversity. Further, we examined implicit coordination as an important outcome of TMMs. Results suggest that team composition in terms of the cooperation facet of agreeableness and racial diversity were significantly related to team-focused TMM similarity. TMM similarity was also positively predictive of implicit coordination, which mediated the relationship between TMM similarity and team performance. Post hoc analyses revealed a significant interaction between the trust facet of agreeableness and racial diversity in predicting TMM similarity. Results are discussed in terms of facilitating the emergence of TMMs and corresponding implications for team-related human resource practices.

Keywords: team mental models, team cognition, shared cognition, team composition, implicit coordination

In the face of mounting economic and technological demands, many organizations are turning to teams to handle complex tasks that require the effort of more than one individual. Many authors have noted the rapid increase in the use of teams by organizations (e.g., Barrick, Stewart, Neubert, & Mount, 1998; Hollenbeck, DeRue, & Guzzo, 2004; Sundstrom, De Meuse, & Futrell, 1990) and the corresponding proliferation of research on the topic of team effectiveness (cf. Cohen & Bailey, 1997; Kozlowski & Bell, 2003; Mathieu, Maynard, Rapp, & Gilson, 2008). Given the interdependent nature of teamwork, an inherent challenge in the functioning of teams is the need to integrate individual attributes through interaction among team members to achieve a combined team outcome (Guzzo & Dickson, 1996; Hackman, 1987).

A growing body of conceptual and empirical work suggests the importance of team members "being on the same page" in order to achieve the coordinated interaction required to produce the desired team outcome. Team members who conceptualize various aspects of the team context in a similar manner, such as task requirements or expected team interaction patterns, are likely able to integrate their behaviors more effectively, allowing for improved coordination and performance (Cannon-Bowers, Salas, & Converse, 1993; Klimoski & Mohammed, 1994; Rentsch & Hall, 1994). This

phenomenon of being on the same page is often referenced with the existence of a team mental model (TMM), which is said to occur when each individual team member's conceptualization, or mental model, is shared or compatible with that of other team members (Mohammed, Ferzandi, & Hamilton, 2010; Rentsch, Small, & Hanges, 2008). Indeed, there is much empirical evidence to suggest that TMMs are positively related to coordination processes and ultimately the performance of teams (e.g., DeChurch & Mesmer-Magnus, 2010; Marks, Sabella, Burke, & Zaccaro, 2002; Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000).

With the apparent benefit of TMMs in regard to positive outcomes for teams, it is similarly important to consider factors that promote or facilitate their emergence. Yet much less is known about TMM antecedents, leading many authors to suggest this as an important area for future research (e.g., DeChurch & Mesmer-Magnus, 2010; Lim & Klein, 2006; Marks, Zaccaro, & Mathieu, 2000; Mohammed et al., 2010; Pearsall, Ellis, & Bell, 2010). This absence of information in the literature leaves organizations and human resource practitioners with little information regarding how to foster TMMs in order to improve the performance of their teams. Therefore, our purpose in the current research was to examine potential antecedents of TMMs, with a specific focus on team composition. As suggested by Mathieu et al. (2000), "If individual differences can be tied consistently with the development and use of particular mental models, then teams might be composed so as to enhance members' sharedness" (p. 281). Underlying this assertion is the idea that if team composition variables can be linked to TMMs, organizations can strategically target the implicated variables via human resource initiatives (e.g., selection, training, leadership intervention), in turn allowing for highly coordinated teams.

The remainder of this introduction is organized as follows. First, the topic of mental models in teams is reviewed. Second, available

David M. Fisher and Suzanne T. Bell, Department of Psychology, DePaul University; Erich C. Dierdorff and James A. Belohlav, Driehaus College of Business, DePaul University.

Correspondence concerning this article should be addressed to David M. Fisher, Department of Psychology, DePaul University, 2219 North Kenmore Avenue, Chicago, IL 60614. E-mail: dfisher1@depaul.edu

literature on antecedents of TMMs is discussed. Third, specific hypotheses are presented regarding various facets of personality and surface-level diversity as potential antecedents of TMMs, given the influence such deep- and surface-level composition variables can have on team functioning (Bell, 2007; Driskell, Goodwin, Salas, & O'Shea, 2006; Williams & O'Reilly, 1998). Finally, in order to validate the importance of TMMs in the current sample, we also examine the relationship between TMMs and implicit coordination. In doing so, we aim to contribute to the extant literature regarding teams and mental models by extending the nascent body of empirical work that suggests the importance of team composition for TMMs (Edwards, Day, Arthur, & Bell, 2006; Rentsch & Klimoski, 2001; Resick, Dickson, Mitchelson, Allison, & Clark, 2010). For example, by focusing on facet levels of compositional attributes, we present a more nuanced examination of compositional antecedents than that of previous research. In addition, a primary tenet behind the notion of TMMs is that they allow for *implicit* coordination among team members (Cannon-Bowers et al., 1993; Mohammed et al., 2010). To our knowledge, however, no empirical investigations have examined the relationship between TMMs and implicit coordination in particular, as compared to unspecified forms of coordination or that which includes explicit elements (cf. Rico, Sánchez-Manzanares, Gil, & Gibson, 2008; e.g., Marks et al., 2002; Mathieu et al., 2000). Thus, we strive to extend and refine the nomological network surrounding the construct of TMMs, in addition to informing team-relevant human resource practices. A summary of proposed relationships and hypotheses is presented in Figure 1.

Mental Models in Teams

The concept of a mental model as an organized mental representation is well established in the cognitive psychology literature (Rouse & Morris, 1986). Individuals construct such mental representations in order to understand, describe, and predict the world around them (Johnson-Laird, 1983). With respect to work teams, each team member is said to have an organized mental represen-

tation, or mental model, related to various aspects of the team context, which in turn allows the individual to describe, explain, and predict events that occur in the team environment (Cannon-Bowers et al., 1993). When a team member's mental model is shared or compatible with that of other members, the resulting team-level phenomenon of being on the same page is referred to as a TMM. In other words, TMMs allow all team members to interpret relevant information in a similar manner, share expectations regarding future events, and develop similar explanations for situations faced by the team (Mohammed et al., 2010; Rouse, Cannon-Bowers, & Salas, 1992). Thus, they afford the capacity to synchronize behaviors and coordinate efforts.

There are various aspects of the team context that can serve as the content of TMMs. Theory regarding the evolution and maturation of teams suggests that teams separately develop both taskwork and teamwork competencies (Morgan, Salas, & Glickman, 1993), leading researchers to focus on the two content domains of taskwork and teamwork in the treatment of TMMs (Mathieu et al., 2000). In addition, there are various potential properties of TMMs that may be of interest. The most common property of interest is the amount of similarity or convergence between the mental models of all team members (Mohammed et al., 2010; Rentsch et al., 2008). However, researchers have also begun to examine the accuracy of TMMs, based on the idea that a shared conceptualization of the team context is not necessarily a correct conceptualization (Edwards et al., 2006; Marks et al., 2000). Both taskwork-focused and teamwork-focused TMMs, operationalized with indices of both similarity and accuracy, have been empirically linked to important outcomes in teams, such as coordination processes and task performance (DeChurch & Mesmer-Magnus, 2010; Edwards et al., 2006; Lim & Klein, 2006; Marks et al., 2000, 2002; Mathieu et al., 2000).

As a result of the various combinations of content and properties that can be used to examine and operationalize TMMs, it is important to specifically reference the TMM content and property under investigation (Mohammed et al., 2010). Although both task-
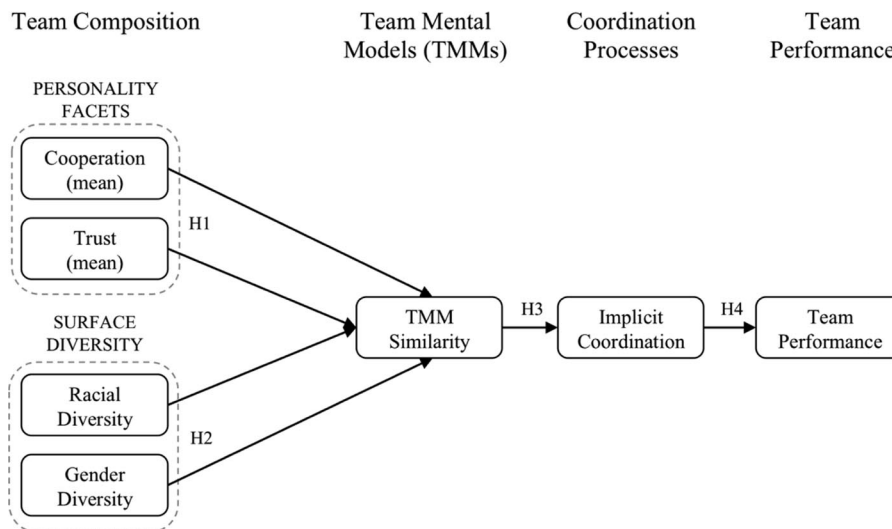

Figure 1. Summary of proposed relationships and hypotheses (H).

and team-focused TMMs appear important for team functioning, team-focused models are more predictive of team processes, whereas task-focused models are more predictive of specific performance outcomes (DeChurch & Mesmer-Magnus, 2010; Edwards et al., 2006; Lim & Klein, 2006; Mathieu, Heffner, Goodwin, Cannon-Bowers, & Salas, 2005; Mathieu et al., 2000). A major premise of the current investigation is that TMMs are a driving mechanism of coordinated effort in teams, which implicates team processes as the focal outcome. Further, findings related to team-focused TMMs may be more generalizable, as generic teamwork occurs in all teams (Cannon-Bowers, Tannenbaum, Salas, & Volpe, 1995; Guzzo & Dickson, 1996; Rentsch & Klimoski, 2001; Stevens & Campion, 1994), whereas task-focused models are inherently contingent upon particular tasks performed by specific teams. Considering the importance of transportable teamwork skills (Cannon-Bowers et al., 1995), we chose to investigate team-focused TMMs.

With respect to the TMM property of interest, there are many different ways for teamwork to manifest (Taggar & Brown, 2001), but for coordinated effort to occur, a similar conceptualization among team members is necessary. Accuracy of TMMs, on the other hand, may be more relevant for task-focused models, where there is a single effective way or limited number of effective ways to compete the task (Edwards et al., 2006; Mohammed et al., 2010). It is important to note, however, that accuracy has also been shown to be important for team-focused TMMs (Smith-Jentsch, Cannon-Bowers, Tannenbaum, & Salas, 2008). Yet the findings regarding the role of accuracy in team-focused TMMs have been inconsistent. For example, Mathieu et al. (2005) found that similarity was beneficial only to the extent that the TMMs were also similar to predefined expert (i.e., accurate) models. On the other hand, Lim and Klein (2006) did not find such an interaction and found an independent contribution of TMM similarity to team effectiveness. We examined similarity as the property of interest with respect to team-focused TMMs, based on the idea that there are multiple ways for teamwork to manifest and the fact that similar conceptualizations of teamwork are likely a prerequisite for coordinated effort.

Antecedents of TMMs

In the broader context and nomological network of team-related constructs, TMMs have been characterized as a form of team cognition. They have been referred to as emergent states, which are defined as "properties of the team that are typically dynamic in nature and vary as a function of team context, inputs, processes, and outcomes" (Marks, Mathieu, & Zaccaro, 2001, p. 357). As such, TMMs represent emergent phenomena that are rooted in the individual characteristics and cognitions of team members that subsequently manifest as collective team-level phenomena when the individual cognitions are shared or compatible (Kozlowski & Klein, 2000). Such characterizations suggest that TMMs can be influenced by individual member inputs and team processes or, more generally, that some form of initial interaction among team members is necessary to calibrate individual cognitions to form an emergent team-level phenomenon.

The importance of initial team interaction for the emergence of TMMs is consistent with theory regarding team development and the functioning of teams. Kozlowski, Gully, Nason, and Smith (1999) presented a theory of team compilation that describes the process whereby teams form and develop from separate individuals to become distinct collective units. As this formation occurs, team members actively engage in interactions with other team members in order to understand their teammates' roles and capacities (Pearsall et al., 2010) and further understand the team situation (Dierdorff, Bell, & Belohlav, 2011). It is during this initial interaction that team members acquire vital knowledge relevant to social, task, and role aspects of the team context, which ultimately allows for an understanding of how the skills and capacities of all members fit together in a network of team activity (Kozlowski et al., 1999). This acquired knowledge and understanding exhibits substantial conceptual overlap with the content of TMMs (Cannon-Bowers et al., 1993; Rentsch et al., 2008). Thus, the initial team interaction that occurs during team compilation likely represents the means by which individual team member cognitions combine and calibrate to emerge as a collective phenomenon, or TMM.

Corresponding to the above reasoning, there is growing empirical evidence to support the importance of early interaction for the development of TMMs. For example, Pearsall et al. (2010) found that early team interaction in the form of role identification behaviors was positively related to multiple forms of team-level cognition, including TMM accuracy and transactive memory systems. Further, Stout, Cannon-Bowers, Salas, and Milanovich (1999) found that early team interaction in the form of planning was positively related to TMM similarity. Finally, additional evidence comes from the use of training focused on improving interaction among team members as a means of inducing TMM similarity. Marks and her colleagues (Marks et al., 2000, 2002) found that team-interaction training and cross-training were positively related to TMM similarity.

Taken together, the above conceptual arguments and empirical evidence suggest that some initial form of interaction among team members is necessary for calibrating individual cognitions to allow for the emergence of a collective understanding in the form of a TMM. It follows that important antecedents of TMMs may be team composition variables that implicate effective or ineffective interaction with others, thus influencing this emergence. Drawing on additional evidence below, we present hypotheses regarding specific composition variables that may serve as antecedents of TMMs, including various facets of personality and surface-level diversity.

Personality Facet Composition

Given the interdependent and social nature of teams, it is not surprising that team effectiveness is in part influenced by the individual attributes of each member (Guzzo & Dickson, 1996; Hackman, 1987). Personality refers to the enduring characteristics of an individual that guide the way the individual thinks and acts in a variety of situations (Costa & McCrae, 1985; Hough & Furnham, 2003; John, 1990; Shaffer, Harrison, Gregersen, Black, & Ferzandi, 2006). Accordingly, personality is often used in organizational settings to explain and predict attitudes, behaviors, and outcomes (Ones, Dilchert, Viswesvaran, & Judge, 2007). Many authors have further suggested the importance of personality for the behavior of individuals within teams and the corresponding

functioning of the teams (e.g., Bell, 2007; Driskell et al., 2006; Driskell, Hogan, & Salas, 1987).

Given the importance of some form of initial interaction between team members for the development of TMMs, it may be prudent to examine personality traits that impact interaction within a team. In particular, the five-factor model (John, 1990) trait of agreeableness should be especially important for interpersonal interaction. Agreeable individuals are often described as appreciative, kind, or accommodating and are characterized by a tendency to be friendly and cooperative (McCrae & John, 1992). Therefore, teams composed of highly agreeable members should exhibit positive interpersonal interactions that allow for effective team functioning. Conversely, less agreeable individuals who are typically argumentative, inflexible, and uncompromising (Barrick, Mount, & Judge, 2001) should severely inhibit team processes and interaction.

The importance of agreeableness with respect to interpersonal interaction and team functioning has found strong support. Mount, Barrick, and Stewart (1998) examined the role of personality in jobs that involve interpersonal interaction. Agreeableness emerged as the best predictor of supervisor ratings regarding interactions with others, specifically for jobs characterized by interdependence with coworkers. Agreeableness is also positively related to information sharing (Matzler, Renzl, Muller, Herting, & Mooradian, 2008), which is vital in team contexts (Mesmer-Magnus & DeChurch, 2009). Finally, aggregate levels of agreeableness have been positively linked to team-level functioning and performance (Barrick et al., 1998; Bell, 2007). Thus, the personality trait of agreeableness appears to be a key ingredient for effective interactions within a team setting.

With respect to TMMs in particular, teams composed of highly agreeable individuals should be more successful at achieving a TMM characterized by a high degree of similarity, as a result of amicable interactions and increased information sharing that allow for the alignment of individual cognitions. Indeed, there is already some support for this contention, as Resick et al. (2010) found mean levels of agreeableness to be positively related to task-focused TMM similarity. We augment and extend the work of Resick et al. (2010) in several ways. Namely, we focus on agreeableness with respect to team-focused TMMs, as compared to task-focused TMMs. In addition, we examine a sample of student decision-making teams engaged in a 5-week business simulation, as opposed to a comparatively shorter computer-simulated military task. Such distinctions are important given the differential relationships of task- and team-focused TMMs with outcomes such as processes and performance (DeChurch & Mesmer-Magnus, 2010; Edwards et al., 2006; Lim & Klein, 2006; Mathieu et al., 2000, 2005), suggesting the potential for differential relationships with antecedents. Further, the vast majority of research regarding TMMs has been conducted on action-oriented teams in the context of computer simulation and military training (Mohammed et al., 2010; Rentsch et al., 2008). However, some authors have noted the need to examine TMMs with regard to decision-making teams in industry (Mohammed et al., 2010), given their increased prevalence in organizations (Pearsall et al., 2010; Sundstrom, 1999).

As another extension of Resick et al.'s (2010) work, we focus on specific facets of agreeableness that are conceptually linked to positive interpersonal interactions, as opposed to the omnibus trait. Although the five-factor model provides a parsimonious frame-work by organizing personality around five traits, each of these broad traits is multidimensional in nature and comprises various facets (Goldberg, 1999). For example, the facets of agreeableness include altruism, cooperation, modesty, morality, sympathy, and trust (Costa & McCrae, 1985; Driskell et al., 2006). Although agreeableness is related to positive interpersonal interaction, it is rarely specified which facets are driving this relationship. Whereas it is conceivable that the facet of cooperation is related to interpersonal interaction and team performance, it is less likely that the facet of morality has an impact on these criteria. Indeed, the importance of separately considering the facets of broad personality traits is becoming more widely acknowledged (Barrick & Mount, 2005; Barrick et al., 2001; Driskell et al., 2006; Tett & Christiansen, 2007). In the case of agreeableness, it has been suggested that the driving forces of relationships with team-relevant criteria are the facets of cooperation and trust (Driskell et al., 2006).

Cooperation as an individual difference variable can be defined as a tendency toward collaboration that maximizes outcomes for both the self and others, as opposed to competition in which outcomes are maximized for the self relative to others (Costa & McCrae, 1985; Driskell et al., 2006). The desire to maximize outcomes for the entire group, rather than just one's self, represents a prosocial orientation in which a high value is placed on reciprocity (Van Lange, 1999). In turn, a prosocial orientation and focus on reciprocity should be related to the positive interpersonal interactions and information sharing needed for individual cognitions to successfully emerge as a collective phenomenon. Competition, on the other hand, will likely be counterproductive, as individual interests are considered to be more important than mutual team interests (i.e., individual interests hinder interpersonal relations during formative periods and subsequently harm the development of a TMM). Therefore, team composition with respect to cooperation should be positively related to the development of team-focused TMM similarity.

Trust as an individual difference variable can be defined as a dispositional tendency to believe that others are honest and well intentioned (Costa & McCrae, 1985; Driskell et al., 2006). Those who are low in trust typically are suspicious and doubt the motives, intentions, and sincerity of others. Dirks (1999) examined the importance of interpersonal trust in work groups and found that trust was necessary for groups to convert individual actions into effective collaborative efforts. For high-trust groups, higher levels of motivation were associated with higher levels of coordination, as individual efforts were combined and integrated. Conversely, for low-trust groups, higher levels of motivation were associated with lower levels of coordination, as lack of trust prevented the integration of individual efforts. Thus, low levels of trust are likely to constrain the integrative interactions and information sharing required to successfully develop a shared conceptualization of the team context among all members. On the other hand, high levels of trust should be associated with positive collaboration and interaction, allowing for the successful emergence of a TMM. Therefore, team composition with respect to the trust facet of agreeableness should also be positively related to the development of team-focused TMM similarity. Based on the above discussion, the following are hypothesized:

Hypothesis 1a: Team composition in terms of the cooperation facet of agreeableness (mean levels) will be positively related to team-focused TMM similarity.

Hypothesis 1b: Team composition in terms of the trust facet of agreeableness (mean levels) will be positively related to team-focused TMM similarity.

Surface-Level Diversity Composition

The antecedents of TMMs hypothesized above represent deep-level composition variables (Bell, 2007). However, surface-level or readily observable compositional characteristics can also impact the functioning of teams (S. E. Jackson et al., 1991; Jehn, North-craft, & Neale, 1999; Pelled, Eisenhardt, & Xin, 1999; Zenger & Lawrence, 1989). Accordingly, we examined surface-level diversity as another antecedent of TMMs, with a specific focus on racial and gender diversity, as these characteristics represent salient and observable social cues that can influence attitudes toward target individuals or the team as a whole (Riordan & Shore, 1997; Stangor, Lynch, Duan, & Glass, 1992). Overall, the diversity literature has espoused two primary but contradictory explanations for the effects of diversity in groups (Williams & O'Reilly, 1998). According to the social categorization perspective, the differences between group members are used as a means of categorization, where individuals are attracted to similar others, in turn creating a distinction between in-groups and out-groups (Byrne, 1971; Tajfel & Turner, 1986). This perspective suggests that increasingly diverse groups allow for more categorizations, in turn preventing social integration and negatively impacting group functioning (O'Reilly, Caldwell, & Barnett, 1989). The information/decision-making perspective, on the other hand, suggests that differences between group members can positively impact group functioning, as diverse groups have access to a greater range of past experiences and unique perspectives that can be drawn upon to improve group processes and performance (Bantel & Jackson, 1989).

These different perspectives might be reconciled by considering the complex and multifaceted nature of diversity. Not all forms of diversity have the same effect (Bell, Villado, Lukasik, Belau, & Briggs, 2011; Horwitz & Horwitz, 2007; Milliken & Martins, 1996; Tyran & Gibson, 2008), and the impact of diversity may further be contingent on the passage of time (Harrison, Price, & Bell, 1998; Harrison, Price, Gavin, & Florey, 2002). Namely, during early phases of team interaction, it is the readily observable surface-level characteristics that impact team functioning, as team members have not had the opportunity to learn about the deep-level compositional characteristics of other members. As time passes, however, the effects of such surface-level demographics weaken, as deep-level differences or similarities become apparent. Thus, deep-level differences regarding life experiences and task-relevant perspectives have the potential to improve team outcomes via increased elaboration of task-relevant information, but only to the extent that other differences do not result in a crippling categorization process (van Knippenberg, De Dreu, & Homan, 2004; van Knippenberg & Schippers, 2007).

The role of diversity in the development of TMMs has already found conceptual and empirical support in the literature. For example, Rentsch and Hall (1994) stated, "The organizational demography literature offers a rationale in support of finding a relationship between similarity in demographic characteristics and team-related schema similarity" (p. 247). Further, Rentsch and Klimoski (2001) found positive relationships for both education and job-level homogeneity with TMM similarity. Given the implicated importance of early team interactions for the development of TMMs, it is also likely that surface-level differences among team members influence the development of TMMs. Indeed, surface-level diversity has been shown to negatively impact commitment to one's work group, task commitment, and cohesion (Gist, Locke, & Taylor, 1987; Riordan & Shore, 1997). In the absence of other pertinent information regarding the deeper compositional characteristics of team members afforded by time spent together, such superficial differences have the potential to elicit a similarity-attraction phenomenon during early team interactions (Byrne, 1971; Harrison et al., 1998, 2002). In turn, the corresponding categorization of team members will hinder social integration (O'Reilly et al., 1989; Tajfel & Turner, 1986), thus compromising the successful emergence of a shared conceptualization of the team context. Therefore, team composition with respect to racial and gender diversity should be negatively related to the development of team-focused TMM similarity. Based on the above discussion, the following are hypothesized:

Hypothesis 2a: Team composition in terms of racial diversity will be negatively related to team-focused TMM similarity.

Hypothesis 2b: Team composition in terms of gender diversity will be negatively related to team-focused TMM similarity.

Implicit Coordination

We also thought it necessary to validate the importance of TMMs in our current sample by demonstrating a relationship with a valued criterion. When team members are actively engaged in task-directed behavior, a similar conceptualization of the team context should allow them to better anticipate each other's actions, in turn affording the ability to effectively integrate and coordinate individual behaviors (Cannon-Bowers et al., 1993; Klimoski & Mohammed, 1994; Rentsch & Hall, 1994). Consistent with this, TMMs have been shown to be predictive of coordination processes in teams (e.g., Marks et al., 2002; Mathieu et al., 2000). However, there are multiple ways to conceptualize the process of coordination.

Rico et al. (2008) clearly delineated a distinction between explicit and implicit forms of coordination. Explicit coordination refers to activities undertaken with the specific intention of managing and orchestrating task-directed behavior, such as planning or strategizing. In other words, explicit coordination "requires that team members communicate in order to articulate plans, define responsibilities, negotiate deadlines, and seek information to undertake common tasks" (Rico et al., 2008, p. 165). In contrast, implicit coordination refers to the fluid adaptation, dynamic adjustment, and integration of individual team member behaviors during task completion, without the need for overt communication regarding the coordination of individual actions. This is not meant to imply that implicit coordination does not involve verbal exchanges among team members. Rather, the verbal exchanges are based on an implicit understanding of what is needed to complete the task, as opposed to a means of overtly orchestrating planned action. Rico et al. (2008) suggested that key indicators of implicit

coordination include providing task-relevant information to other team members without an explicit request, proactively sharing workload and helping other team members, monitoring other team members' activities and performance, and adapting behaviors in anticipation of others' actions.

Although both forms of coordination are likely important for team functioning, explicit coordination is more conceptually aligned with the formative team processes and interactions, such as planning, that give rise to a shared conceptualization of the team context (Stout et al., 1999). This is consistent with the idea that various forms of coordination can occur in both transition and action phases of task completion (Marks et al., 2001). Implicit coordination, on the other hand, is more indicative of the fluid capacity for behavioral integration afforded by a well-established TMM. As Mohammed et al. (2010) suggested, "The notion of a team mental model (TMM) was introduced as a way to capture the *implicit* [emphasis added] coordination frequently observed in effective teams" (p. 876). To our knowledge, however, no empirical investigations have examined the relationship between TMMs and implicit coordination in particular, as compared to unspecified forms of coordination or that which includes explicit elements (e.g., Marks et al., 2002; Mathieu et al., 2000). Nonetheless, TMMs allow all team members to similarly interpret team-relevant information and share expectations regarding the team context (Mohammed et al., 2010; Rouse et al., 1992), in turn promoting the fluid adaptation and integration of behaviors that characterize implicit coordination. Thus, drawing on the work of Rico et al. (2008), we focus specifically on team members' reports of implicit coordination within their teams. Based on the above discussion, the following is hypothesized:

> *Hypothesis 3:* Team-focused TMM similarity will be positively related to the team process of implicit coordination.

Finally, given the benefits of coordination, teams that exhibit a high degree of implicit coordination are likely to perform more effectively. For example, there is evidence that coordination processes are positively predictive of team performance (LePine, Piccolo, Jackson, Mathieu, & Saul, 2008). In addition, coordination processes have been found to mediate the relationship between TMMs and team performance (Mathieu et al., 2000). One reason for such mediation is that TMM similarity facilitates more fluid and easier coordination among team members, which ultimately promotes more effective team functioning (Mohammed et al., 2010). Consistent with this previous research and theory, the following are hypothesized:

> *Hypothesis 4a:* The team process of implicit coordination will be positively related to team performance.

> *Hypothesis 4b:* The team process of implicit coordination will mediate the relationship between team-focused TMM similarity and team performance.

Method

Research Participants

Participants ($N = 186$) were undergraduate- and graduate-level students enrolled in a capstone business course at a large midwestern university. The participants were members of 32 teams, with two to eight individuals on each team ($M = 5.81$, $SD = 1.77$). In terms of racial-ethnic background, participants described themselves as 50% Caucasian/White, 30.1% Asian/Pacific Islander, 9.7% Hispanic, 1.6% African American/Black, 1.6% Biracial/Multiracial, and 0.5% American Indian/Alaska Native, with the remaining 6.5% describing themselves as Other or not indicating their race. With respect to gender, 49.5% of participants described themselves as male and 47.8% of participants described themselves as female; the remaining 2.7% did not indicate their gender. Participants ranged in age from 20 years to 46 years, with a mean age of 24.15 ($SD = 4.58$). Participants did not receive any incentives to participate in this research.

The Business Simulation

The business simulation (Smith, 2009) was a central component of the capstone course for both graduate and undergraduate sections. As part of the simulation, each team acted as a top management team in charge of an electronic sensor manufacturing company. The teams were responsible for developing a coordinated business strategy across all functional areas of their respective fictitious organizations, including research and development, marketing, production, human resources, and finance. In doing so, each team was required to make strategic decisions with respect to the activities of their organization, with the ultimate goal of maximizing organizational performance. Each team made eight strategic operational decisions, representing 8 fiscal years in the simulated marketplace. Example content for each decision includes the determination of production levels, product positioning, and product pricing. Following each decision point, teams received feedback from the simulation software regarding the effects of each decision in the form of reports that indexed the organization's performance. Example indices of organizational performance include profit, stock price, return on assets, and return on sales. This simulation has been used in previous research and has been referred to as "an ongoing hands-on experience for [students]" (Mathieu & Schulze, 2006, p. 609). Further, the simulation software is designed to reflect a dynamic marketplace that includes changing technology, customer values, and competitive pressures. Thus, the simulation provided a high-fidelity experience reflecting the ambiguity and challenges faced by real-world decision-making teams. Team performance on the simulation accounted for 24% of participants' individual grades in the course, and all teams were provided developmental feedback, based on the measures collected, following the conclusion of the simulation.

Procedure

The teams consisted of individuals from a variety of different business majors and/or concentrations so as to accurately reflect the cross-functional nature of real-world organizational decision-making teams. This also ensured the need for coordination and information sharing among team members so that individual skills and competencies could be successfully integrated to allow for optimal decision making and corresponding organizational performance. Prior to the business simulation, each participant was provided a 36-page student guide as well as access to an online tutorial and practice simulation. The actual simulation lasted a total

of 5 weeks. During the first 2 weeks of the simulation, one strategic decision was made per week to allow participants to become familiar with the simulation process. For the remaining 3 weeks, two strategic decisions were made per week, for a total of eight decisions throughout the simulation.

Prior to beginning the simulation, participants were surveyed regarding their personality and demographic background, in addition to within-team familiarity, via a web-based survey. At the end of the third week of the simulation, after the fourth strategic decision, participants were surveyed to elicit information used to operationalize TMM similarity. This allowed sufficient time for team members to develop and solidify their own mental conceptualizations of the team context. Finally, following the sixth strategic decision, at the end of the fourth week of the simulation, participants were surveyed regarding their perceptions of implicit coordination among team members. For all surveys, there was a 5-day time frame for completion to ensure temporal separation of variables related to team composition, TMMs, and the process of coordination. The overall averaged within-team survey response rate was 86%.

Measures

Personality facets of cooperation and trust. The cooperation and trust facets of agreeableness were operationalized with five-factor model facet scales from the International Personality Item Pool (Goldberg, 1999). Each scale had 10 items, and participants were asked to rate the degree to which they felt the items described themselves on a 5-point scale ranging from 1 (*extremely inaccurate*) to 5 (*extremely accurate*). A complete list of the items is presented in the Appendix. Where appropriate, items were reverse-coded so that stronger endorsements indicated higher levels of the respective trait. There were adequate levels of reliability for both the cooperation ($\alpha = .73$) and trust ($\alpha = .87$) scales (Nunnally & Bernstein, 1994). Within-team means were used to operationalize team-level composition for cooperation and trust. This represents an additive composition model, in which individual team member attributes are combined to represent a configural property of the team as a whole, without concern for similarity among team members, as differences in personality are expected (Chan, 1998; Kozlowski & Klein, 2000). Team mean levels are considered a robust indicator of team composition with respect to the distribution of particular team member attributes (Barrick et al., 1998; Bell, 2007; Resick et al., 2010).

Racial and gender diversity. Participants were asked to self-report their race and gender in order to operationalize racial and gender diversity. Racial and gender diversity were conceptualized in terms of variety, as such differences among team members represent qualitative categorical differences, as opposed to hierarchical differences (i.e., disparity) or differences along a continuum (i.e., separation; Harrison & Klein, 2007). Diversity in terms of variety suggests that diversity increases as the number of unique racial or gender categories within a team increases. This conceptualization of diversity is consistent with the arguments presented herein, as more categories allow for increased heterogeneity and corresponding opportunity for the categorization process that is purposed to disrupt early team interactions, in turn hindering TMM emergence (Byrne, 1971; O'Reilly et al., 1989; Rentsch and Hall, 1994; Riordan & Shore, 1997; Tajfel & Turner, 1986). Blau's

(1977) index of heterogeneity, an appropriate indicator of diversity conceptualized as variety (Harrison & Klein, 2007), was used to operationalize both racial and gender diversity. According to Blau's index, diversity is defined by the following formula, where P_k is the proportion of each category in the team of interest:

$$\text{Racial/gender diversity} = 1 - \Sigma P_k^2$$

Our sample included teams that ranged from fully homogenous to heterogeneous with respect to race and gender. In the upper quartile of homogeneity for race, 75% of teams were all or majority Caucasian/White, and 25% were all or majority Asian/Pacific Islander, mirroring the composition of the overall sample. In the upper quartile of homogeneity for gender, 50% of teams were all or majority male, and the other 50% were all or majority female.

Team-focused TMM similarity. The similarity of team-focused TMMs was operationalized with Pathfinder (www.interlinkinc.net). A structural assessment program commonly used to examine TMMs (e.g., Lim & Klein, 2006; Marks et al., 2002), Pathfinder captures both the content and the structure of knowledge organization (Mohammed et al., 2010; Rentsch et al., 2008). To elicit the content of individual team members' mental models, we asked participants to make paired-comparison ratings of the relatedness among 10 concepts regarding teamwork, adapted from the teamwork concepts used by Lim and Klein (2006). A complete list of the concepts is presented in the Appendix. The 10 teamwork concepts necessitated a total of 45 paired-comparisons, with ratings of relatedness done on a 9-point scale ranging from −4 (*unrelated*) to 4 (*related*). Pathfinder was used to generate networks for each team member based on the paired-comparison ratings, representing his or her individual structured conceptualization or mental model regarding teamwork. Following the generation of individual networks, Pathfinder was further used to generate a similarity index between the networks of all members on a team. Team-focused TMM similarity was operationalized by comparing each team member's network to the network of every other team member and averaging similarity indices across all within-team comparisons.

Implicit coordination. Implicit coordination was operationalized with four items based on the work of Rico et al. (2008). Namely, key indicators of implicit coordination include (a) providing task-relevant information to other team members without an explicit request, (b) proactively sharing workload and helping other team members, (c) monitoring other team members' activities and performance, and (d) adapting behaviors in anticipation of others' actions. Items were specifically written to reflect these indicators, and participants were asked to rate the degree to which they felt the items described their team on a 5-point scale ranging from 1 (*extremely inaccurate*) to 5 (*extremely accurate*). A complete list of the items is presented in the Appendix. The implicit coordination scale exhibited an adequate level of reliability ($\alpha = .85$; Nunnally & Bernstein, 1994). With respect to aggregation, within-team means were used to operationalize implicit coordination at the team level. In this case, a referent-shift consensus model of composition was evoked, as individual team members were rating a property of the team referent, and a requisite amount of agreement is needed to justify aggregation to the team-level of analyses (Chan, 1998; Kozlowski & Klein, 2000). There were adequate levels of within-team agreement regarding implicit coordination (mean $r_{wg} = .75$), in addition to a medium grouping

effect (ICC[1] = .08, ICC[2] = .34; LeBreton & Senter, 2007). Although this measure was developed for the current study, several factors support its validity. First, the items were specifically written to reflect the commonly identified indicators of implicit coordination (cf. Rico et al., 2008). Second, an exploratory factor analysis using principal-axis factoring suggested the extraction of a single factor. Third, the scale was compared against an additional measure of team coordination (Mathieu & Marks, 2006) for evidence of convergent construct-related validity, and it exhibited convergence ($r = .61$, $p < .01$).

Team performance.   Team performance was operationalized with the simulation-generated indices of stock price, return on assets, and return on sales from the final week of the simulation. These were standardized and then combined to form a composite index of team performance ($\alpha = .93$).

Control variables.   Participants were students in either an undergraduate- or a graduate-level equivalent of the management capstone course. Several factors supported combing these courses in the present study. The undergraduate- and graduate-level courses had similar content focusing on strategic decision making in organizations, the business simulation itself was the same across both courses, and all course sessions comprising the current sample were taught by the same instructor. Nonetheless, as a precaution, a dummy variable was created representing the undergraduate–graduate distinction (undergraduate teams = 0; graduate teams = 1) and used as a control variable. Familiarity among team members prior to the task was also assessed. Participants were asked, "Overall, how well did you know your team members before this class?" and ratings were made on a to 5-point scale ranging from 1 (*not at all*) to 5 (*very well*). Mean levels within teams were used to operationalize aggregate familiarity prior to the task and used as a control variable. Finally, team size was used as a control variable.[1]

Results

Because several of the main study variables were measured with self-report scales (i.e., cooperation, trust, implicit coordination), a confirmatory factor analysis was conducted to determine if the expected factor structure fit the data well. Racial diversity, gender diversity, and team-focused TMM similarity were not included in this analysis due to their qualitatively distinct methods of operationalization (i.e., Blau's index of heterogeneity, Pathfinder network analysis). Results of the confirmatory factor analysis suggested that the expected three-factor structure for trust, cooperation, and implicit coordination fit the data well (comparative fit index = .91; Tucker–Lewis index = .89; root-mean-square error of approximation [RMSEA] = .06; RMSEA 90% confidence interval = [.05, .07]; standardized root-mean-square residual = .07). Further, an examination of an alternative model, in which cooperation and trust were treated as a single latent variable, suggested significantly worse fit, $\Delta\chi^2(1) = 78.30$, $p < .01$. Table 1 presents descriptive statistics and correlations for all study variables.

With regard to antecedents of TMMs, Hypotheses 1a and 1b proposed that team composition in terms of the personality facets of cooperation and trust, respectively, would be positively related to team-focused TMM similarity. Further, Hypotheses 2a and 2b proposed that team composition in terms of racial diversity and

gender diversity, respectively, would be negatively related to team-focused TMM similarity. To test these hypotheses, we conducted a hierarchical regression analysis predicting team-focused TMM similarity, with the control variables entered in the first block and the hypothesized antecedents entered in the second block. As shown in Table 2, both the personality facet of cooperation ($\beta = .38$, $p < .05$) and racial diversity ($\beta = -.73$, $p < .01$) were significantly related to team-focused TMM similarity, in the expected directions. However, the personality facet of trust ($\beta = -.07$, $p = .34$) and gender diversity ($\beta = -.21$, $p = .17$) both exhibited nonsignificant relationships with team-focused TMM similarity. Therefore, Hypotheses 1a and 2a were supported, whereas Hypotheses 1b and 2b were not supported.

With regard to the consequences of TMMs, Hypothesis 3 proposed that team-focused TMM similarity would be positively related to the team process of implicit coordination. To test this hypothesis, we conducted another hierarchical regression analysis predicting implicit coordination, with the control variables entered in the first block and team-focused TMM similarity entered in the second block. As shown in Table 3, team-focused TMM similarity was positively related to implicit coordination ($\beta = .34$, $p < .05$), supporting Hypothesis 3. In addition, Hypothesis 4a proposed that the team process of implicit coordination would be positively related to team performance. To test this hypothesis, we conducted a third hierarchical regression analysis predicting team performance, with the control variables entered in the first block and implicit coordination entered in the second block. As shown in Table 4, implicit coordination was positively related to team performance ($\beta = .40$, $p < .05$), supporting Hypothesis 4a.

Finally, Hypothesis 4b proposed that implicit coordination would mediate the relationship between team-focused TMM similarity and team performance. In order to test for mediation, we followed the procedure outlined by Preacher and Hayes (2008), who advocated a bootstrapping approach for assessing indirect effects and corresponding confidence intervals. This approach is superior to the traditional causal step approach (cf. Baron & Kenny, 1986) in terms of statistical power and control of Type I error rate (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; MacKinnon, Lockwood, & Williams, 2004) and further does not assume normality of the sampling distribution (Preacher & Hayes, 2008). The bootstrap results (5,000 iterations) indicated a significant indirect effect for TMM similarity, as the bias-corrected confidence interval did not include zero, 95% CI [0.09, 14.51]. The procedure outlined by Preacher and Hayes (2008) also allows for a formal p value corresponding to a "normal theory" (p. 886) point estimate of the indirect effect. The point estimate for the indirect effect was nonsignificant (point estimate = 2.95, $SE = 1.95$, $Z = 1.51$). However, this normal theory test assumes that the sampling distribution of the indirect effect is normal, which is often an unrealistic assumption (Preacher & Hayes, 2008; Taylor, MacKinnon, & Tein, 2008). The bootstrapping approach, on the other hand, does not rely on this assumption for valid inferences and thus

---

[1] There was a single team with two individuals and a single other team with eight individuals. The remaining teams ranged in size from three to seven individuals. A reanalysis of all study data excluding these two teams did not affect the statistical significance of any findings or alter any conclusions.

Table 1

Descriptive Statistics and Correlations for All Study Variables

Variable	N	M	SD	1	2	3	4	5	6	7	8	9
1. TMM similarity	30	0.32	0.05	—								
2. Cooperation (mean)	32	3.51	0.21	.24	—							
3. Trust (mean)	32	3.61	0.24	.03	.23	—						
4. Racial diversity	32	0.44	0.24	−.41*	−.12	−.13	—					
5. Gender diversity	32	0.37	0.18	−.02	−.04	−.26	.47**	—				
6. Implicit coordination	32	3.85	0.50	.33*	.13	−.03	.00	−.14	—			
7. Team performance	32	0.00	0.94	−.10	.12	−.03	−.02	−.07	.38*	—		
8. Class level	32	0.25	0.44	−.04	−.08	.15	−.67**	−.51**	−.07	.07	—	
9. Familiarity	32	1.75	0.56	.00	−.06	.27	.15	.03	−.03	.11	−.21	—
10. Team size	32	5.81	1.77	.07	−.09	−.14	.70**	.62**	.03	−.04	−.93**	.27

Note. TMM = team mental model.
* $p < .05$, one-tailed.   ** $p < .01$, one-tailed.

represents a more appropriate test of mediation (Preacher & Hayes, 2008). Accordingly, based on the bootstrap results, Hypothesis 4b was supported.[2]

Discussion

Although many authors have noted that little is known about the antecedents of TMMs, an increasingly coherent picture appears to be developing and implicates the importance of team composition (Edwards et al., 2006; Rentsch & Klimoski, 2001; Resick et al., 2010). TMMs ultimately reside in the individual cognitions of team members (Kozlowski & Klein, 2000), and it is likely through early interaction among the members that such cognitions emerge as a collective phenomenon (Kozlowski et al., 1999; Marks et al., 2001; Pearsall et al., 2010; Stout et al., 1999). By examining both deep-level (i.e., personality) and surface-level (i.e., diversity) composition variables that implicate effective and ineffective early team interactions, we explained 45% of variance in team-focused TMM similarity in our sample (see Table 2). In turn, teams that were able to achieve a TMM characterized by a high degree of similarity had improved implicit coordination and performance.

With respect to personality composition as an antecedent, the cooperation facet of agreeableness was positively related to team-focused TMM similarity. This finding augments and extends the work of Resick et al. (2010) in several ways. The positive relationship between cooperation composition and TMM similarity represents a substantive replication regarding the importance of personality variables for TMM emergence. This finding extends the work of Resick et al. by focusing on facet-level personality and considering team-focused TMMs, as compared to task-focused TMMs, in addition to employing a qualitatively distinct sample. It was interesting, however, that trust exhibited a nonsignificant negative relationship with TMM similarity. As a potential explanation, it is conceivable that dispositional trust actually has a negative impact on TMM emergence, a subtle effect that merely did not reach significance in our sample. Low trust individuals are suspicious and doubt the intentions of others (Costa & McCrae, 1985; Driskell et al., 2006), and they may be more motivated to actively engage with team members to ascertain and substantiate their intentions. Conversely, high trust individuals may merely assume positive intentions in others, negating the need to engage one's teammates to confirm their intentions. Thus, team members who automatically trust others may not exert as much individual

effort during formative times in a team's development, when such individual efforts are vital for the team to successfully coalesce from a separate group of individuals into a collective entity (Kozlowski et al., 1999), in turn hindering the emergence of TMMs. This possibility is further explored below.

With respect to surface-level diversity as an antecedent, racial diversity was negatively related to team-focused TMM similarity. This finding provides support for the contention made by Rentsch and Hall (1994) that similarity in demographic characteristics should be related to team-relevant schema similarity. Gender diversity, on the other hand, failed to exhibit a significant negative relationship with TMM similarity. Indeed, our findings are consistent with those of Rentsch and Klimoski (2001), who also did not observe a significant relationship between gender diversity and team member schema agreement. With respect to such findings, it is again important to acknowledge that not all forms of diversity have the same effect (Bell et al., 2011; Horwitz & Horwitz, 2007; Milliken & Martins, 1996; Tyran & Gibson, 2008) and that surface-level diversity will influence team functioning only to the extent that such differences are salient to team members (Riordan & Shore, 1997; van Knippenberg et al., 2004). Consistent with research that indicates racial diversity has a stronger relationship than gender diversity with team member perceptions of similarity (Harrison et al., 2002; Zellmer-Bruhn, Maloney,

---

[2] We also examined the indirect effects of our composition variables on team performance via the sequential meditational chain of TMM similarity and implicit coordination (i.e., team composition → TMM similarity → implicit coordination → team performance). Although we found no prior empirical evidence to support this particular meditational chain, we explored these effects as they are consistent with the temporal measurement of our study variables and the relationships displayed in Figure 1. In order to explore the possibility of such sequential meditational chains, we followed procedures outlined by Taylor et al. (2008), who extended methods used for two-path mediation to the context of three-path mediation. Two three-path mediation models were tested, one for each statistically significant antecedent (i.e., cooperation, racial diversity). Results from both three-path models did not support indirect effects for the composition variables, as the bias-corrected bootstrap 95% confidence intervals contained zero in both models. These nonsignificant indirect effects may be a function of the temporal separation between the measurements of our study variables, spanning a total of 5 weeks, in turn attenuating the potency of the indirect effects.

Table 2

Hierarchical Regression Analysis Predicting TMM Similarity (Hypotheses 1–2)

Variable	Coefficient		Model statistics			
	β	t	R^2	F	ΔR^2	ΔF
Step 1			.01	0.11	—	—
Class level	0.22	0.43				
Familiarity	−0.03	−0.13				
Team size	0.28	0.53				
Step 2			.46	2.66*	.45	4.53**
Class level	0.72	1.36				
Familiarity	−0.14	−0.76				
Team size	1.34	2.35*				
Cooperation (mean)	0.38	1.93*				
Trust (mean)	−0.07	−0.41				
Racial diversity	−0.73	−3.47**				
Gender diversity	−0.21	−0.98				

Note. $N = 30$. TMM = team mental model.
* $p < .05$, one-tailed. ** $p < .01$, one-tailed.

Bhappu, & Salvador, 2008), race may have represented a more salient cue to participants in our sample.

Given the negative effect observed for racial diversity, we conducted post hoc analyses to explore potential variables that might mitigate this effect by examining interactions between racial diversity and the facets of agreeableness. This also afforded us the opportunity to further probe the possibility suggested above that high levels of dispositional trust may actually be maladaptive in teams. Namely, given that low trust individuals are suspicious and doubt the intentions of others, they may be more motivated to actively engage with team members to substantiate their intentions, whereas high trust individuals may merely assume positive intentions in others. Such an interpretation is consistent with recent findings regarding the reliance facet of psychological collectivism (Dierdorff et al., 2011). Further, this effect may be particularly pronounced in racially diverse teams, as racial diversity is negatively related to perceptions of similarity (Harrison et al., 2002; Zellmer-Bruhn et al., 2008). Following this logic, the negative relationship between racial diversity and TMM similarity is likely weaker for teams composed of members low in trust, as such individuals may be more motivated to ascertain the intentions of dissimilar others, where this motivation promotes the interaction required to align individual cognitions. The negative relationship between racial diversity and TMM similarity is also likely to be weaker for teams composed of members high in cooperation, as such individuals are predisposed to interact with others in a cooperative manner, allowing a team to overcome perceived differences.

In order to examine the above interactions, we created interaction terms and entered them as a third block to the hierarchical regression analysis presented in Table 2.[3] Results indicated a significant interaction between trust and racial diversity (β = −.57, p < .01). This interaction is depicted in Figure 2 and shows the negative relationship between racial diversity and TMM similarity was attenuated under conditions of low trust composition, as compared to high trust composition. The interaction between cooperation and racial diversity, on the other hand, did not reach significance (β = .25, p = .11). These findings suggest that personality composition has the potential to mitigate the observed negative effect of racial diversity on TMM similarity. Interestingly, this mitigating effect is achieved with low levels of dispositional trust, as opposed to high levels. As with the

reliance facet of psychological collectivism (cf. Dierdorff et al., 2011), low levels of dispositional trust may manifest as a healthy sense of skepticism that promotes interaction to validate the trustworthiness and dependability of teammates. Nonetheless, we urge caution in interpreting these findings, given that they were not based on a priori hypothesizing.

From a practical standpoint, the above findings have important implications for team-related human resource practices. First, our findings support the use of personality as a means of selecting individuals into teams, with the specific intention of facilitating the emergence of TMMs. Organizations would be wise to select individuals with a disposition for amicable interactions by focusing on the cooperation facet of agreeableness in particular. The current findings also highlight the potential benefits of adopting a nuanced approach that focuses on facet-level personality, as compared to broader traits. Although cooperation composition had a positive impact on TMM similarity, trust composition had a neutral main effect but a harmful interactive effect by exasperating the negative influence of racial diversity. This suggests that organizations should be cautious about solely focusing on broad personality traits (e.g., agreeableness), as this may capture facets of personality that potentially inhibit TMM similarity. However, replication of our post hoc finding regarding trust composition is necessary before any specific recommendation can be made.

There are also important practical implications of our findings regarding surface-level diversity. Namely, our results uncover a potential explanation for the negative relationship observed between racial diversity and team performance (Bell et al., 2011). However, despite this negative relationship, one would be hard pressed to advocate for less racially diverse teams considering the legal and social implications of doing so. As it is inappropriate to make team selection and composition decisions based on race, a better understanding of the mechanisms through which racial diversity impacts team performance is critical, so that organizations can attempt to mitigate this negative effect. Given the neg-

---

[3] Interaction terms were created by centering and subsequently multiplying the variables involved in the interaction (Aiken & West, 1991).

Table 3
Hierarchical Regression Analysis Predicting Implicit Coordination (Hypothesis 3)

	Coefficient		Model statistics			
Variable	β	t	R^2	F	ΔR^2	ΔF
Step 1			.02	0.24	—	—
Class level	−.35	−0.66				
Familiarity	−.09	−0.45				
Team size	−.30	−0.57				
Step 2			.14	1.05	.12	3.42[†]
Class level	−.42	−0.84				
Familiarity	−.08	−0.42				
Team size	−.40	−0.78				
TMM similarity	.34	1.85[*]				

Note. $N = 30$. TMM = team mental model.
[*] $p < .05$, one-tailed.   [†] $p < .10$.

ative relationship between racial diversity and TMM similarity, interventions focused on the development of shared mental models such as team-interaction training (Marks et al., 2000) and cross-training (Marks et al., 2002) might be used to promote the effective functioning of racially diverse teams. More broadly, research suggests that emphasizing the value of diversity (Homan, van Knippenberg, Van Kleef, & De Dreu, 2007) and transformational leadership (Kearney & Gebert, 2009) have the potential to mitigate the negative effects of diversity. Human resource initiatives based on these approaches (e.g., interaction training, diversity training, leadership intervention) have the potential to reduce the negative effects of diversity and simultaneously avoid the legal complications surrounding selection with respect to protected classes.

Finally, it is also important to consider several alternative explanations for the findings observed in our study. For example, we argue that effective early team interactions represent the explanation for why certain composition variables should influence TMM similarity. However, it is possible that homogenous teams achieve TMM similarity because members enter the team with similar preexisting conceptualizations of teamwork, as evidenced by the work of Smith-Jentsch, Campbell, Milanovich, and Reynolds (2001) regarding military rank. We explored this possibility with respect to personality homogeneity by operationalizing personality composition in terms of dispersion (i.e., within-team *SD*), but there

were no significant relationships with TMM similarity. We were unable to empirically examine this possibility with respect to demographic homogeneity, but beyond our hypotheses, the findings of our post hoc analyses were consistent with an interpretation that implicates early team member interactions. We also discuss this below as a direction for future research. In addition, it is possible that effective teams in our study were converging on a single correct conceptualization regarding teamwork in the simulation, thus confounding TMM similarity with TMM accuracy. However, an examination of the networks generated by Pathfinder for teams in the upper quartile of TMM similarity suggested that although there was convergence of networks within teams, such networks were qualitatively different across teams.

Limitations

The findings described above should be viewed in light of this study's limitations. As a first limitation, our sample size was relatively small, which limited the statistical power available to detect effects. This is a common problem faced by team researchers, given the difficulty of acquiring a large team-level sample size when each team itself comprises several individual participants. Post hoc power analyses regarding the ability to detect incremental variance beyond control variables indicated that observed statisti-

Table 4
Hierarchical Regression Analysis Predicting Team Performance (Hypothesis 4a)

	Coefficient		Model statistics			
Variable	β	t	R^2	F	ΔR^2	ΔF
Step 1			.03	0.26		
Class level	.28	0.54				
Familiarity	.12	0.59				
Team size	.20	0.37				
Step 2			.19	1.54	.16	5.29[*]
Class level	.42	0.86				
Familiarity	.13	0.69				
Team size	.31	0.63				
Implicit coordination	.40	2.30[*]				

Note. $N = 32$. TMM = team mental model.
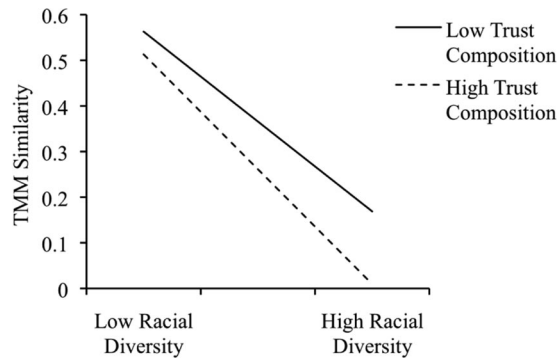[*] $p < .05$, one-tailed.

Figure 2. Relationship between racial diversity and team mental model (TMM) similarity as a function of trust.

cal power ranged from .51 to .96 across our regression analyses. Nonetheless, the majority of our hypotheses were supported, and we additionally observed a significant interaction in our post hoc analyses. Second, our sample was composed of students, which calls into question the generalizability of the findings to real-world decision-making teams. However, as previously suggested, the business simulation provided a high-fidelity experience that reflected the ambiguity and challenges faced by real-world decision-making teams. Namely, study participants worked together as decision-making teams to run a simulated business, with decision consequences that mirror those in real-world financial, labor, and product markets.

Another potential limitation of the current investigation is missing data at the individual level. In general, missing data at the individual level are likely to influence results when data are aggregated and analyzed at the team level (Allen, Stanley, Williams, & Ross, 2007; Timmerman, 2005). Although missing data are a cause for concern, the overall averaged within-team survey response rate was 86%. A moderate amount of missing data is a necessary trade-off for the increased ecological validity of findings afforded by examining such team-level phenomena outside of highly structured laboratory settings. Related to the above limitation, the data collection protocol was structured such that all measures where made available to participants for a 5-day time frame. Thus, team members may have taken the same measure as much as 4 days apart, in turn attenuating the amount of similarity or agreement among ratings. Although research suggests that TMMs are relatively stable over time (Edwards et al., 2006; Mathieu et al., 2000), empirical evidence regarding the temporal stability of implicit coordination is currently unavailable. Despite this limitation, the data collection protocol was structured to ensure temporal separation of variables related to team composition, TMMs, and team coordination.

A final limitation might be found in our operationalization of implicit coordination. We created this measure for the purposes of the current study. This was primarily a function of necessity, given that existing measures were not available for use. However, our analyses provide initial support for the adequacy of the measure. The scale exhibited a high level of reliability ($\alpha = .85$), and an exploratory factor analysis suggested the extraction of a single factor. Further, the scale exhibited a high degree of convergence with a separately developed scale intended to capture team coor-

dination and was also positively related to team performance. Finally, consistent with the recommendations of Rico et al. (2008), we felt the use of self-report ratings was appropriate because implicit coordination by definition may not be overtly observable to outside raters, given its manifestation as fluid adaptation and integration of behaviors. In particular, the indicators of implicit coordination may "easily go unnoticed because of their tacit nature" (Rico et al., 2008, p. 176).

Future Directions

The findings of our study also provide insight into potential directions for future research. First, a major argument presented herein is that team composition impacts TMMs through its influence on early team interactions, where such interactions allow for individual cognitions to integrate and emerge as a collective phenomenon. However, the role of early team interactions as the linking mechanism between team composition and TMMs has yet to be confirmed empirically. For example, it is unclear whether the team process of planning (Stout et al., 1999), other transition phase processes (Marks et al., 2001), early role identification behaviors (Pearsall et al., 2010), participative post-performance debriefings (Smith-Jentsch et al., 2008), or more generic indicators of quality interaction (e.g., team-member exchange; Dierdorff et al., 2011; Seers, 1989) serve as the primary conduit through which composition impacts TMMs. Future research might employ a pre-task measurement of mental models in order to help isolate the extent to which these mechanisms influence the convergence of individual mental models.

Another direction for future research is the exploration of additional deep-level composition variables as antecedents of TMMs. We focused specifically on the agreeableness facets of cooperation and trust because of evidence linking agreeableness more broadly and these facets in particular to amicable interactions in team settings (Barrick et al., 1998; Bell, 2007; Driskell et al., 2006; Matzler et al., 2008; Mount et al., 1998). However, it is certainly conceivable that other personality facets promote the emergence of high-quality TMMs. For example, facets of extraversion such as assertiveness and expressivity might be particularly important for information sharing that facilitates the integration of individual cognitions, given the importance of extraversion more broadly for information sharing (Matzler et al., 2008). Similarly, the dutifulness facet of conscientiousness might be particularly important for task-focused TMMs by promoting the development of an accurate and coherent individual conceptualization of the task. Other deep-level compositional characteristics that impact social and emotional perceptivity in the context of teams, such as psychological collectivism (C. L. Jackson, Colquitt, Wesson, & Zapata-Phelan, 2006) or emotional intelligence (Joseph & Newman, 2010; Mayer, Salovey, & Caruso, 2008), may also be important for TMM development. Last, we observed an interaction among composition variables in our post hoc analyses. Replication of such findings, in addition to the exploration of other possible interactions, represents a fruitful possibility for future research.

Exploring different operationalizations of surface-level diversity represents an additional direction for future research. We found a significant relationship between racial diversity and TMMs but no relationship between gender diversity and TMMs. Research on diversity faultlines (Lau & Murninghan, 1998) highlights the im-

portance of examining multiple forms of diversity in conjunction. The presence of faultlines within a team is likely to have a negative impact on TMMs, given the relationship between faultlines and information sharing (Homan et al., 2007). Further, research on relational demography (Riordan, 2000; Tsui, Egan, & O'Reilly, 1992; Tsui & O'Reilly, 1989) suggests the importance of considering an individual's demographic attributes in the context of other team members' attributes. Adopting such an individual-level perspective might provide useful insight into the development of individual team-relevant mental models that ultimately form the bases of TMMs.

In considering future research, it is useful to reiterate the importance of clearly specifying the TMM content of interest (cf. Mohammed et al., 2010; Rentsch et al., 2008). Namely, certain team composition variables may be differentially important for different TMM content. For example, general mental ability has been shown to positively predict task-focused TMM accuracy (Edwards et al., 2006; Resick et al., 2010), given the importance of intelligence for accurately comprehending a complex task domain. However, general mental ability may be less important for shared teamwork conceptualizations, given that there may not necessarily be one single correct conceptualization (Mohammed et al., 2010; Rentsch & Klimoski, 2001; Taggar & Brown, 2001). Rather, interpersonally oriented composition variables, such as facets of extraversion, agreeableness, or psychological collectivism, are likely more important for converging on a shared understanding of teamwork. This may similarly be true of formative interactions that allow for TMM emergence. For example, the process of planning might be specifically relevant for the development of task-focused TMMs (Stout et al., 1999), whereas guided self-correction focused on teamwork (Smith-Jentsch et al., 2008) or interpersonal processes (Marks et al., 2001) might be more useful in the development of team-focused TMMs.

As a final note regarding future research, it is also important to consider the roles of similarity and accuracy as properties of team-focused TMMs. The current investigation did not assess TMM accuracy, but teams in the upper quartile of similarity exhibited qualitatively different models. Although some research has found that similarity was important only to the extent that TMMs were accurate (Mathieu et al., 2005), other research has found independent positive effects for similarity (Lim & Klein, 2006). Such divergent findings may be a function of the degree to which the task in question allows for multiple effective teamwork configurations. Further, in situations where accuracy is important, team composition variables that implicate a desire for agreeable or conciliatory behavior may lead to premature consensus, resulting in similar mental models that may be inaccurate. Future research is needed to clarify these issues.

Conclusion

Team mental models represent important drivers of coordination and performance in teams. The current investigation examined potential antecedents of TMMs, with a specific focus on team composition variables that implicate effective and ineffective team interactions, thus influencing the emergence of TMMs. With an understanding of the effects of such variables, organizations can strategically target the implicated variables via human resource initiatives (e.g., selection, training, leadership intervention), in turn promoting highly coordinated and effective teams.

References

Aiken, L. A., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions.* Newbury Park, CA: Sage.

Allen, H. J., Stanley, D. J., Williams, H. M., & Ross, S. J. (2007). Assessing the impact of nonresponse on work group diversity effects. *Organizational Research Methods, 10,* 262–286. doi:10.1177/1094428106/294731

Bantel, K. A., & Jackson, S. E. (1989). Top management and innovations in banking: Does the composition of the top team make a difference? *Strategic Management Journal, 10,* 107–124. doi:10.1002/smj.4250100709

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical consideration. *Journal of Personality and Social Psychology, 51,* 1173–1182. doi:10.1037/0022-3514.51.6.1173

Barrick, M. R., & Mount, M. K. (2005). Yes, personality matters: Moving on to more important matters. *Human Performance, 18,* 359–372. doi:10.1207/s15327043hup1804_3

Barrick, M. R., Mount, M. K., & Judge, T. A. (2001). Personality and performance at the beginning of the new millennium: What do we know and where do we go next? *International Journal of Selection and Assessment, 9,* 9–30. doi:10.1111/1468-2389.00160

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. doi:10.1037/0021-9010.83.3.377

Bell, S. T. (2007). Deep-level composition variables as predictors of team performance: A meta-analysis. *Journal of Applied Psychology, 92,* 595–615. doi:10.1037/0021-9010.92.3.595

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. doi:10.1177/0149206310365001

Blau, P. M. (1977). *Inequality and heterogeneity.* New York, NY: Free Press.

Byrne, D. (1971). *The attraction paradigm.* New York, NY: Academic Press.

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 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.

Chan, D. (1998). Functional relations among constructs in the same content domain at different levels of analysis: A typology of composition models. *Journal of Applied Psychology, 83,* 234–246. doi:10.1037/0021-9010.83.2.234

Cohen, S. G., & Bailey, D. E. (1997). What makes teams work: Group effectiveness research from the shop floor to the executive suite. *Journal of Management, 23,* 239–290. doi:10.1177/014920639702300303

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

DeChurch, L. A., & Mesmer-Magnus, J. R. (2010). The cognitive underpinnings of effective teamwork: A meta-analysis. *Journal of Applied Psychology, 95,* 32–53. doi:10.1037/a0017328

Dierdorff, E. C., Bell, S. T., & Belohlav, J. A. (2011). The power of "we": Effects of psychological collectivism on team performance over time. *Journal of Applied Psychology, 96,* 247–262. doi:10.1037/a0020929

Dirks, K. T. (1999). The effects of interpersonal trust on work group performance. *Journal of Applied Psychology, 84,* 445–455. doi:10.1037/0021-9010.84.3.445

Driskell, J. E., Goodwin, G. F., Salas, E., & O'Shea, P. G. (2006). What makes a good team player? Personality and team effectiveness. *Group Dynamics: Theory, Research, and Practice, 10,* 249–271. doi:10.1037/1089-2699.10.4.249

Driskell, J. E., Hogan, R., & Salas, E. (1987). Personality and group performance. In C. Hendrick (Ed.), *Group processes and intergroup relations: Review of personality and social psychology* (Vol. 9, pp. 91–112). Newbury Park, CA: Sage.

Edwards, B. D., Day, E. A., Arthur, W., Jr., & Bell, S. T. (2006). Relationships among team ability composition, team mental models, and team performance. *Journal of Applied Psychology, 91,* 727–736. doi:10.1037/0021-9010.91.3.727

Gist, M. E., Locke, E. A., & Taylor, M. S. (1987). Organizational behavior: Group structure, process, and effectiveness. *Journal of Management, 13,* 237–257. doi:10.1177/014920638701300204

Goldberg, L. R. (1999). A broad-bandwidth, public domain, personality inventory measuring the lower-level facets of several five-factor models. In I. Mervielde, I. Deary, F. De Fruyt, & F. Ostendorf (Eds.), *Personality psychology in Europe* (Vol. 7, pp. 7–28). Tilburg, the Netherlands: Tilburg University Press.

Guzzo, R. A., & Dickson, M. W. (1996). Teams in organizations: Research on performance and effectiveness. *Annual Review of Psychology, 47,* 307–338. doi:10.1146/annurev.psych.47.1.307

Hackman, J. R. (1987). The design of work teams. In J. Lorsch (Ed.), *Handbook of organizational behavior* (pp. 315–342). Englewood Cliffs, NJ: Prentice Hall.

Harrison, D. A., & Klein, K. J. (2007). What's the difference? Diversity constructs as separation, variety, or disparity in organizations. *Academy of Management Review, 32,* 1199–1228. doi:10.5465/AMR.2007.26586096

Harrison, D. A., Price, K. H., & Bell, M. P. (1998). Beyond relational demography: Time and the effects of surface- and deep-level diversity on work group cohesion. *Academy of Management Journal, 41,* 96–107. doi:10.2307/256901

Harrison, D. A., Price, K. H., Gavin, J. H., & Florey, A. T. (2002). Time, teams, and task performance: Changing effects of surface- and deep-level diversity on group functioning. *Academy of Management Journal, 45,* 1029–1045. doi:10.2307/3069328

Hollenbeck, J. R., DeRue, D. S., & Guzzo, R. (2004). Bridging the gap between I/O research and HR practice: Improving team composition, team training, and team task design. *Human Resource Management, 43,* 353–366. doi:10.1002/hrm.20029

Homan, A. C., van Knippenberg, D., Van Kleef, G. A., & De Dreu, C. K. W. (2007). Bridging faultlines by valuing diversity: Diversity beliefs, information elaboration, and performance in diverse work groups. *Journal of Applied Psychology, 92,* 1189–1199. doi:10.1037/0021-9010.92.5.1189

Horwitz, S. K., & Horwitz, I. B. (2007). The effects of team diversity on team outcomes: A meta-analytic review of team demography. *Journal of Management, 33,* 987–1015. doi:10.1177/0149206307308587

Hough, L. M., & Furnham, A. (2003). Use of personality variables in work settings. In W. C. Borman, D. R. Ilgen, & R. J. Klimoski (Eds.), *Handbook of psychology: Industrial and organizational psychology* (pp. 131–169). Hoboken, NJ: Wiley.

Jackson, C. L., Colquitt, J. A., Wesson, M. J., & Zapata-Phelan, C. P. (2006). Psychological collectivism: A measurement validation and linkage to group member performance. *Journal of Applied Psychology, 91,* 884–899. doi:10.1037/0021-9010.91.4.884

Jackson, S. E., Brett, J. F., Sessa, V. I., Cooper, D. M., Julin, J. A., & Peyronnin, K. (1991). Some differences make a difference: Individual dissimilarity and group heterogeneity as correlates of recruitment, promotion, and turnover. *Journal of Applied Psychology, 76,* 675–689. doi:10.1037/0021-9010.76.5.675

Jehn, K. A., Northcraft, G. B., & Neale, M. A. (1999). Why differences make a difference: A field study of diversity, conflict, and performance in workgroups. *Administrative Science Quarterly, 44,* 741–763. doi:10.2307/2667054

John, O. P. (1990). The "Big Five" factor taxonomy: Dimensions of personality in the natural language and in questionnaires. In L. Pervin (Ed.), *Handbook of personality theory and research* (pp. 66–100). New York, NY: Guilford Press.

Johnson-Laird, P. N. (1983). *Mental models.* Cambridge, MA: Harvard University Press.

Joseph, D. L., & Newman, D. A. (2010). Emotional intelligence: An integrative meta-analysis and cascading model. *Journal of Applied Psychology, 95,* 54–78. doi:10.1037/a0017286

Kearney, E., & Gebert, D. (2009). Managing diversity and enhancing team outcomes: The promise of transformational leadership. *Journal of Applied Psychology, 94,* 77–89. doi:10.1037/a0013077

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

Kozlowski, S. W. J., & Bell, B. S. (2003). Work groups and teams in organizations. In W. C. Borman, D. R. Ilgen, & R. J. Klimoski (Eds.), *Handbook of psychology: Industrial and organizational psychology* (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. R. Ilgen & E. D. Pulakos (Eds.), *The changing nature of performance: Implications for staffing, motivation, and development* (pp. 240–292). San Francisco, CA: Jossey-Bass.

Kozlowski, S. W. J., & Klein, K. J. (2000). A multilevel approach to theory and research in organizations: Contextual, temporal, and emergent processes. In K. J. Klein & S. W. J. Kozlowski (Eds.), *Multilevel theory, research, and methods in organizations* (pp. 3–90). San Francisco, CA: Jossey-Bass.

Lau, D., & Murnighan, J. K. (1998). Demographic diversity and faultlines: The compositional dynamics of organizational groups. *Academy of Management Review, 23,* 325–340.

LeBreton, J. M., & Senter, J. L. (2007). Answers to 20 questions about interrater reliability and interrater agreement. *Organizational Research Methods, 11,* 815–852. doi:10.1177/1094428106296642

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. doi:10.1111/j.1744-6570.2008.00114.x

Lim, B., & Klein, K. J. (2006). Team mental models and performance: A field study of the effects of team mental model similarity and accuracy. *Journal of Organizational Behavior, 27,* 403–418. doi:10.1002/job.387

MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods, 7,* 83–104. doi:10.1037/1082-989X.7.1.83

MacKinnon, D. P., Lockwood, C. M., & Williams, J. (2004). Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivariate Behavioral Research, 39,* 99–128. doi:10.1207/s15327906mbr3901_4

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

Marks, M. A., Sabella, M. J., Burke, C. S., & Zaccaro, S. J. (2002). The impact of cross-training on team effectiveness. *Journal of Applied Psychology, 87,* 3–13. doi:10.1037/0021-9010.87.1.3

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. doi:10.1037/0021-9010.85.6.971

Mathieu, J. E., Heffner, T. S., Goodwin, G. F., Cannon-Bowers, J. A., & Salas, E. (2005). Scaling the quality of teammates' mental models: Equifinality and normative comparisons. *Journal of Organizational Behavior, 26,* 37–56. doi:10.1002/job.296

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. doi:10.1037/0021-9010.85.2.273

Mathieu, J. E., & Marks, M. A. (2006). *Team process items.* Unpublished.

Mathieu, J. E., Maynard, M. T., 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. doi:10.1177/0149206308316061

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. doi:10.5465/AMJ.2006.21794678

Matzler, K., Renzl, B., Muller, J., Herting, S., & Mooradian, T. A. (2008). Personality traits and knowledge sharing. *Journal of Economic Psychology, 29,* 301–313. doi:10.1016/j.joep.2007.06.004

Mayer, J. D., Salovey, P., & Caruso, D. R. (2008). Emotional intelligence: New ability of eclectic train. *American Psychologist, 63,* 503–517. doi:10.1037/0003-066X.63.6.503

McCrae, R. R., & John, O. P. (1992). An introduction to the five-factor model and its applications. *Journal of Personality, 60,* 175–215. doi:10.1111/j.1467-6494.1992.tb00970.x

Mesmer-Magnus, J. R., & DeChurch, L. A. (2009). Information sharing and team performance: A meta-analysis. *Journal of Applied Psychology, 94,* 535–546. doi:10.1037/a0013773

Milliken, F. J., & Martins, L. L. (1996). Searching for common threads: Understanding the multiple effects of diversity in organizational groups. *Academy of Management Review, 21,* 402–433.

Mohammed, S., Ferzandi, L., & Hamilton, K. (2010). Metaphor no more: A 15-year review of the team mental model construct. *Journal of Management, 36,* 876–910. doi:10.1177/0149206309356804

Morgan, B. B., Jr., Salas, E., & Glickman, A. S. (1993). An analysis of team evolution and maturation. *Journal of General Psychology, 120,* 277–291. doi:10.1080/00221309.1993.9711148

Mount, M. K., Barrick, M. R., & Stewart, G. L. (1998). Five-factor model of personality and performance in jobs involving interpersonal interactions. *Human Performance, 11,* 145–165.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory.* New York, NY: McGraw-Hill.

Ones, D. S., Dilchert, S., Viswesvaran, C., & Judge, T. A. (2007). In support of personality assessment in organizational settings. *Personnel Psychology, 60,* 995–1027. doi:10.1111/j.1744-6570.2007.00099.x

O'Reilly, C. A., Caldwell, D. F., & Barnett, W. P. (1989). Work group demography, social integration, and turnover. *Administrative Science Quarterly, 34,* 21–37. doi:10.2307/2392984

Pearsall, M. J., Ellis, A. P. J., & Bell, B. S. (2010). Building the infrastructure. The effects of role identification behaviors on team cognition development and performance. *Journal of Applied Psychology, 95,* 192–200. doi:10.1037/a0017781

Pelled, L. H., Eisenhardt, K. M., & Xin, K. R. (1999). Exploring the black box: An analysis of work group diversity, conflict, and performance. *Administrative Science Quarterly, 44,* 1–28. doi:10.2307/2667029

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40,* 879–891. doi:10.3758/BRM.40.3.879

Rentsch, J. R., & Hall, R. J. (1994). Members of great teams think alike: A model of team effectiveness and schema similarity among team members. In M. M. Beyerlein & D. A. Johnson (Eds.), *Advances in interdisciplinary studies of work teams: Theories of self-managing work teams* (Vol. 1, pp. 223–261). Greenwich, CT: JAI Press

Rentsch, J. R., & Klimoski, R. J. (2001). Why do "great minds" think alike? Antecedents of team member schema agreement. *Journal of Organizational Behavior, 22,* 107–120. doi:10.1002/job.81

Rentsch, J. R., Small, E. E., & Hanges, P. J. (2008). Cognitions in organizations and teams: What is the meaning of cognitive similarity? In B. Smith (Ed.), *The people make the place: Exploring dynamic linkages between individuals and organizations* (pp. 127–155). Hillsdale, NJ: Erlbaum.

Resick, C. J., Dickson, M. W., Mitchelson, J. K., Allison, L. K., & Clark, M. A. (2010). Team composition, cognition, and effectiveness: Examining mental model similarity and accuracy. *Group Dynamics: Theory, Research, and Practice, 14,* 174–191. doi:10.1037/a0018444

Rico, R., Sánchez-Manzanares, M., Gil, F., & Gibson, C. (2008). Team implicit coordination processes: A team knowledge-based approach. *Academy of Management Journal, 33,* 163–184. doi:10.5465/AMR.2008.27751276

Riordan, C. M. (2000). Relational demography within groups: Past developments, contradictions, and new directions. *Research in Personnel and Human Resources Management, 19,* 131–173. doi:10.1016/S0742-7301(00)19005-X

Riordan, C. M., & Shore, L. M. (1997). Demographic diversity and employee attitudes: An empirical examination of relational demography within work units. *Journal of Applied Psychology, 82,* 342–358. doi:10.1037/0021-9010.82.3.342

Rouse, W. B., Cannon-Bowers, J. A., & Salas, E. (1992). The role of mental models in team performance in complex systems. *IEEE Transactions on Systems, Man, & Cybernetics, 22,* 1296–1308. doi:10.1109/21.199457

Rouse, W. B., & Morris, N. M. (1986). On looking into the black box: Prospects and limits in the search for mental models. *Psychological Bulletin, 100,* 349–363. doi:10.1037/0033-2909.100.3.349

Seers, A. (1989). Team-member exchange quality: A new construct for role-making research. *Organizational Behavior and Human Decision Processes, 43,* 118–135. doi:10.1016/0749-5978(89)90060-5

Shaffer, M. A., Harrison, D. A., Gregersen, H., Black, J. S., & Ferzandi, L. A. (2006). You can take it with you: Individual differences and expatriate effectiveness. *Journal of Applied Psychology, 91,* 109–125. doi:10.1037/0021-9010.91.1.109

Smith, D. (2009). *Capstone business simulation student guide.* Chicago, IL: Management Simulations.

Smith-Jentsch, K. A., Campbell, G. E., Milanovich, D. M., & Reynolds, A. M. (2001). Measuring teamwork mental models to support training needs assessment, development, and evaluation: Two empirical studies. *Journal of Organizational Behavior, 22,* 179–194. doi:10.1002/job.88

Smith-Jentsch, K. A., Cannon-Bowers, J. A., Tannenbaum, S. I., & Salas, E. (2008). Guided team self-correction: Impacts on team mental models, processes, and effectiveness. *Small Group Research, 39,* 303–327. doi:10.1177/1046496408317794

Stangor, C., Lynch, L., Duan, C., & Glass, B. (1992). Categorization of individuals on the basis of multiple social features. *Journal of Personality and Social Psychology, 62,* 207–218. doi:10.1037/0022-3514.62.2.207

Stevens, M. J., & Campion, M. A. (1994). The knowledge, skill, and ability requirements for teamwork: Implications for human resource management. *Journal of Management, 20,* 503–530.

Stout, R. J., Cannon-Bowers, J. A., Salas, E., & Milanovich, D. M. (1999). Planning, shared mental models, and coordinated performance: An empirical link is established. *Human Factors, 41,* 61–71. doi:10.1518/001872099779577273

Sundstrom, E. (1999). The challenges of supporting work team effective-

ness. In E. Sundstrom and Associates (Eds.), *Supporting work team effectiveness* (pp. 3–23). San Francisco, CA: Jossey-Bass.

Sundstrom, E., De Meuse, K. P., & Futrell, D. (1990). Work teams: Application and effectiveness. *American Psychologist, 45,* 120–133. doi:10.1037/0003-066X.45.2.120

Taggar, S., & Brown, T. C. (2001). Problem-solving team behaviors: Development and validation of BOS and a hierarchical factor structure. *Small Group Research, 32,* 698–726. doi:10.1177/104649640103200602

Tajfel, H., & Turner, J. (1986). The social identity of intergroup behavior. In W. A. S. Worchel (Ed.), *Psychology and intergroup relations* (pp. 7–24). Chicago, IL: Nelson-Hall.

Taylor, A. B., MacKinnon, D. P., & Tein, J. Y. (2008). Tests of the three-path mediated effect. *Organizational Research Methods, 11,* 241–269. doi:10.1177/1094428107300344

Tett, R. P., & Christiansen, N. D. (2007). Personality tests at the crossroads: A response to Morgeson, Campion, Dipboye, Hollenbeck, Murphy, and Schmitt (2007). *Personnel Psychology, 60,* 967–993. doi:10.1111/j.1744-6570.2007.00098.x

Timmerman, T. A. (2005). Missing persons in the study of groups. *Journal of Organizational Behavior, 26,* 21–36. doi:10.1002/job.306

Tsui, A. S., Egan, T. D., & O'Reilly, C. A. (1992). Being different: Relational demography and organizational attachment. *Administrative Science Quarterly, 37,* 549–579. doi:10.2307/2393472

Tsui, A. S., & O'Reilly, C. A. (1989). Beyond simple demographic effects: The importance of relational demography in superior–subordinate dyads. *Academy of Management Journal, 32,* 402–423. doi:10.2307/256368

Tyran, K. L., & Gibson, G. B. (2008). Is what you see, what you get? The relationship among surface level and deep level heterogeneity characteristics, group efficacy, and team reputation. *Group & Organization Management, 33,* 46–76. doi:10.1177/1059601106287111

van Knippenberg, D., De Dreu, C. K. W., & Homan, A. C. (2004). Work group diversity and group performance: An integrative model and research agenda. *Journal of Applied Psychology, 89,* 1008–1022. doi:10.1037/0021-9010.89.6.1008

van Knippenberg, D., & Schippers, M. C. (2007). Work group diversity. *Annual Review of Psychology, 58,* 515–541. doi:10.1146/annurev.psych.58.110405.085546

Van Lange, P. (1999). The pursuit of joint outcomes and equality in outcomes: An integrative model of social value orientation. *Journal of Personality and Social Psychology, 77,* 337–349. doi:10.1037/0022-3514.77.2.337

Williams, K. Y., & O'Reilly, C. A. (1998). Demography and diversity in organizations: A review of 40 years of research. *Research in Organizational Behavior, 20,* 53–71.

Zellmer-Bruhn, M. E., Maloney, M. M., Bhappu, A. D., & Salvador, R. (2008). When and how do differences matter? An exploration of perceived similarity in teams. *Organizational Behavior and Human Decision Processes, 107,* 41–59. doi:10.1016/j.obhdp.2008.01.004

Zenger, T. R., & Lawrence, B. S. (1989). Organizational demography: The differential effects of age and tenure distributions on technical communications. *Academy of Management Journal, 32,* 353–376. doi:10.2307/256366

(*Appendix follows*)

Appendix

Items Used to Operationalize Study Measures

Cooperation facet of personality:
   I contradict others
   I hate to seem pushy
   I insult people
   I love a good fight
   I am easy to satisfy
   I hold a grudge
   I have a sharp tongue
   I get back at others
   I yell at people
   I can't stand confrontations

Teamwork concepts for paired-comparison mental model elicitation:
   Working well together
   Often disagreeing with each other on issues faced by the team
   Trusting each other
   Communicating openly with each other
   Agreeing on decisions made in the team
   Backing each other up in carrying out team tasks
   Being similar to each other (for example in personality and ability)
   Being aware of other team members' abilities
   Treating each other as friends
   Being a highly effective team

Implicit coordination:
   Members of my team provide task-related information to other members without being asked
   My team proactively helps individual members when they need assistance
   My team monitors the progress of all members' performance
   Members of my team effectively adapt their behavior to the actions of other members

Trust facet of personality:
   I trust what people say
   I distrust people
   I believe that people are basically moral
   I believe that others have good intentions
   I suspect hidden motives in others
   I believe in human goodness
   I believe that people are essentially evil
   I trust others
   I am wary of others
   I think that all will be well

Note. Items concerning the personality facets of cooperation and trust are in the public domain and are available from http://ipip.ori.org/. Items concerning paired-comparison ratings of teamwork concepts are adapted from "Team Mental Models and Performance: A Field Study of the Effects of Team Mental Model Similarity and Accuracy," by B. Lim and K. J. Klein, 2006, *Journal of Organizational Behavior,* Vol. 27, pp. 403–418. Copyright 2006 by Wiley. Adapted with permission.