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# COGNITIVE TEAM DIVERSITY AND INDIVIDUAL TEAM MEMBER CREATIVITY: A CROSS-LEVEL INTERACTION

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**We theorized and tested the conditions under which cognitive team diversity is positively related to individual team member creativity. Hierarchical linear modeling results using 316 employees on 68 teams from Chinese companies indicated that a team member's creative self-efficacy moderated the relationship between cognitive team diversity and individual creativity: this relationship was positive only when creative self-efficacy was high. Further, "transformational leadership" moderated the relationship in such a way that cognitive team diversity was positively related to individual creativity only when transformational leadership was high.**

Creativity and innovation are critical for organization performance and survival in rapidly changing and highly competitive environments (Lopez-Cabrales, Pérez-Luño, & Cabrera, 2009). Furthermore, teams are widely used in workplaces, and workforces are becoming more diverse than ever before, so the need to examine the relationships between team diversity and creativity is especially important (Jackson, Joshi, & Erhardt, 2003; Williams & O'Reilly, 1998).

We note that although researchers have accumulated knowledge on how team diversity relates to team creativity (e.g., Kearney & Gebert, 2009; Shin & Zhou, 2007), little research has been done to explore the relationship between team diversity and individual creativity. However, because team members may respond differently to the same context, it is not appropriate to assume that team diversity has a similar effect on individual creativity as it does on team-level creativity. Thus, in this study, answering Jackson and colleagues' (2003) call for the examination of the individual-level outcomes of team diversity, we aimed to examine how team diversity influences individual creativity. Among the team diversity dimensions, we focused on cognitive team diversity—perceived differences in thinking styles, knowledge, skills, values, and beliefs among individual team members (Dahlin, Weingart, & Hinds, 2005) because not all effects of diversity are equal (Joshi & Roh, 2009; Williams & O'Reilly, 1998), and creativity involves cognitive processes.

One important area of diversity and creativity research concerns the conditions that can enhance or mitigate the effects of team diversity on creativity. The interactional approach of creativity research suggests that scholars need to look at followers' characteristics to fully understand the relationship between contexts and individual creativity (Oldham & Cummings, 1996; Woodman, Sawyer, & Griffin, 1993). Nevertheless, diversity and creativity researchers have rarely studied individual differences as moderators of the relationship between team diversity and creativity, although each individual may react to team diversity differently. Bandura (1991) suggested that self-efficacy is one of the most critical cognitive and motivational factors in workplaces. In particular, *creative self-efficacy*, which is the extent to which employees

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believe they are capable of being creative (Tierney & Farmer, 2002), has been studied as a key variable positively affecting workplace creativity (Redmond, Mumford, & Teach, 1993; Tierney & Farmer, 2002). The literature suggests that creative self-efficacy may influence individuals' responses to contexts, such as cognitive team diversity, and their subsequent creative behavior (cf. Drazin, Glynn, & Kazanjian, 1999; Ford, 1996). In particular, to make sense of engaging in creative behavior when exposed to cognitive team diversity, individuals should possess the belief that "I can be creative, so I can utilize the cognitive resources to be creative." Thus, given that creativity is a result of cognitive and motivational processes (Mumford & Gustafson, 1988), we argue that creative self-efficacy is one of the most important individual differences that moderate the relationship between cognitive team diversity and creativity.

To further understand the conditions under which cognitive team diversity exerts a positive influence on individual creativity, one should also consider team-level moderators. Team-level factors such as leadership have been studied as moderators of the relationship between team diversity and team creativity (Shin & Zhou, 2007; Somech, 2006). Given the influence of leadership, especially "transformational leadership" (Bass, 1985), on employees' creative behavior in their workplace (Redmond et al., 1993; Scott & Bruce, 1994; Shin & Zhou, 2003), we examined the moderating role of transformational leadership in the relationship between cognitive team diversity and individual team member creativity.

Thus, our study contributes to the diversity and creativity literature in several ways. First, we develop a theory addressing the interplay between cognitive team diversity and individual team members' creativity. Given that the creativity of individual team members provides the basis for a team's creative processes, understanding how team diversity influences individual creativity becomes salient. Second, by investigating the effects of the cross-level interaction between cognitive team diversity and team members' creative self-efficacy on individual creativity, we offer a perspective complementary to the previous single-level (i.e., team-level) studies on the relationship between team diversity and creativity. Third, we explore the contextual boundary conditions of cognitive team diversity's effect on individual creativity. Specifically, we theorize and test the way in which transformational leadership and cognitive team diversity interact to influence individual creativity. Finally, as Zhou and Shalley (2008) suggested, one of the gaps to fill in the creativity-at-work literature is to expand the research to the international arena to seek cross-national generalizability, because organizations continue to become interconnected globally. In particular, Chinese employees tend to place high value on collectivism (Hofstede, 1980; Oyserman, Coon, & Kemmelmeier, 2002), so the pressure for conformity in collectivistic cultures (Goncalo & Staw, 2006) might offset the effects of cognitive diversity on creativity. Even though existing cognitive diversity and creativity theory is not explicitly culture bound, cognitive diversity might have different effects on individual creativity in China. Therefore, this research may contribute to the creativity literature by examining diversity and creativity issues in the Chinese context.

## THEORY DEVELOPMENT

### Team Diversity and Creativity

In line with previous studies (Zhou & Shalley, 2003), we define creativity as the production of novel and useful ideas concerning products, services, processes, and procedures by an employee. These ideas can be completely new anywhere or new only to a focal team or organization. Creativity requires the ability to think divergently, see things from different perspectives, and combine previously unrelated processes, products, or materials into something new and better (Amabile, 1996). The generation of creative ideas is a result of cognitive and motivational processes within individuals, although sometimes the interactions within teams foster it (Mumford & Gustafson, 1988). Indeed, taking a "sensemaking" perspective, Drazin et al. argued that creativity is the process of engagement in creative acts that occur in an iterative fashion between individuals and teams: "The iterative, interactive nature of group creativity requires that individuals first choose to engage in individual-level creativity" (1999: 291).

On the other hand, diversity is defined as "the distribution of differences among the members of a unit with respect to a common attribute such as tenure, ethnicity" (Harrison & Klein, 2007: 1200). The diversity literature suggests that the value of team diversity resides in the increased range of knowledge, skills, and perspectives available within a team (Pelled, Eisenhardt, & Xin, 1999; see Williams and O'Reilly [1998] for a review), which can be very valuable sources of workplace creativity (Amabile, 1996). Teams can be hotbeds of individual creativity that allow team members to combine information and perspectives from individuals with different knowledge, skills, thinking styles, and perspectives (Lipman-Blumen & Leavitt, 1999).

However, despite the potentially positive influence of diversity on creativity, studies of diversity have yielded mixed results on the relationship between team diversity and cognitive performance measured as problem solving, idea generation, and decision making (Jackson et al., 2003; van Knippenberg, De Dreu, & Homan, 2004; Williams & O'Reilly, 1998). These mixed results suggest that researchers need to pay closer attention to at least two issues to better understand the relationship between team diversity and creativity. First, they need to choose the diversity variable that is appropriate in terms of its conceptual relevance to the outcome variables. This is because the effects of diversity variables are not all equal (Harrison & Klein, 2007; Horwitz & Horwitz, 2007; Joshi & Roh, 2009). Second, they need to examine the conditions under which diversity delivers the intended benefits to employee creativity (Mannix & Neale, 2005; Williams & O'Reilly, 1998). In this study, we address these calls by investigating the effects of cognitive team diversity on individual creativity and by examining individual-level as well as team-level moderators of the relationship between cognitive team diversity and individual creativity.

### Cognitive Team Diversity and Individual Team Member Creativity

The two main arguments about the effects of diversity on creativity have been differentiated in the literature as "similarity attraction" and "value in diversity" (Williams & O'Reilly, 1998). According to the similarity attraction argument (Pfeffer, 1983), similarity induces individuals to appreciate one another's positive attributes, and dissimilarity provokes unfavorable treatment and less acceptance of another's strengths because of social categorization processes (i.e., an "us-them" distinction). Diversity may therefore relate negatively to individual creativity because of possible emotional and relational conflict resulting from being different (Jehn, Northcraft, & Neale, 1999; Mannix & Neale, 2005). If a team suffers from dysfunctional conflicts caused by diversity, the team members are less likely to engage in creative processes, such as building, experimenting, and elaborating ideas with one another. The value-in-diversity argument, on the other hand, highlights that exposure to differences may stimulate team members to generate innovative ideas (Perry-Smith & Shalley, 2003) and motivate them to combine and rearrange the different perspectives and ideas they encounter (Jehn et al., 1999). Team diversity may therefore relate positively to creativity because it is likely to provide team members with an increased range of knowledge and perspectives.

According to the literature, the similarity attraction argument is more relevant to demographic diversity, but the value in diversity argument is more relevant to cognitive diversity (Jehn et al., 1999). That is, whereas surface diversity, such as demographic diversity, is likely to cause social categorization processes, deep diversity, such as cognitive diversity, is likely to promote creativity processes (e.g., information processing, combining different ideas, building on others' ideas, and experimenting with the ideas of those with different perspectives) by providing team members with a wide range of ideas, perspectives, knowledge, and values (Harrison, Price, Gavin, & Florey, 2002; Horwitz & Horwitz, 2007; Jehn et al., 1999; Joshi & Roh, 2009; van Knippenberg et al., 2004). Although demographic diversity is likely to cause relational conflicts (i.e., interpersonal emotional clashes), cognitive diversity is likely to boost task conflicts (i.e., disagreement on job-related issues) toward creative solutions (Pelled et al., 1999). Thus, when a context requires creativity, cognitive team diversity, which conceptually relates more closely to creativity than demographic diversity does, is likely to provide individual members with more benefits than disadvantages, because team members are more likely to recognize the various ideas, knowledge, and perspectives among team members as creativity processes than to engage in social categorization processes (Harrison & Klein, 2007; van Knippenberg et al., 2004). Indeed, previous studies suggest that cognitive diversity (often resulting from functional diversity) is positively related to creative performance (Jackson et al., 2003; Kurtzberg & Amabile, 2001; Perry-Smith & Shalley, 2003).

Furthermore, compared with team creativity, which requires team convergence processes, individual creativity is likely to take advantage of the different perspectives and approaches of other team members without a further need for high-quality interpersonal interactions. For team creativity to be realized, once the individual members of a team have generated an idea, the team has to process each member's creative ideas critically and drop those that appear less useful. This may cause team "process losses," such as limiting choices (Gigone & Hastie, 1993), conflicts (Carnevale & Probst, 1998), conformity (Larey & Paulus, 1999), "social loafing" (Price, Harrison, & Gavin, 2006), and other production-blocking factors (Diehl & Stroebe, 1991) that may be especially strong in diverse groups (Webber & Donahue, 2001). In other words, individual creativity can take advantage of cognitive resources by being less vulnerable to social categorization processes than team creativity

processes. Thus, being exposed to cognitive team diversity, whether purposefully or not, individual team members are more able to combine and build on different ideas and to experiment with these ideas from different perspectives. That is, with the abundant cognitive resources from cognitive team diversity, individual team members are likely to exploit the various ideas and perspectives of other team members to generate creative ideas in a context requiring creativity.

To summarize, we argue that cognitive team diversity is significantly related to individual team members' creativity because it is likely to be associated with creativity processes rather than with social categorization processes. Thus, we predict the following:

*Hypothesis 1. Cognitive team diversity positively relates to individual team member creativity.*

### The Moderating Role of Creative Self-Efficacy

Creativity researchers readily acknowledge that individual differences can affect creativity, yet Drazin et al. found that creativity researchers assume "the homogeneity of higher-level (or situational) effects on individuals" (1999: 289). However, individual team members respond to situations intentionally (Weick, 1979), and many studies have emphasized the importance of a focal individual's characteristics (e.g., Drazin et al., 1999; Ford, 1996; Shin & Zhou, 2003), so the assumption of homogeneity should be questioned (Drazin et al., 1999; Klein, Dansereau, & Hall, 1994). Thus, we argue that team diversity may have different influences on individual creativity depending on individual differences. In particular, individuals are likely to show creative behavior in a given situation if they think undertaking the creative endeavor makes sense or if they believe their creativity competencies are sufficient to bring success (Drazin et al., 1999; Ford, 1996). Ford (1996) argued that individuals continuously engage in sensemaking processes to decide between creative and routine behavioral options. For instance, if individual team members believe that they can be creative, this belief is likely to move their sensemaking processes toward creative behavioral options. Thus, to improve their work creatively, when exposed to cognitive team diversity, individuals should not only be motivated, but should also cognitively choose to exploit cognitive resources (Taylor & Greve, 2006).

Self-efficacy beliefs are among the most powerful determinants of behavioral change because they determine the initial decision to engage in a behavior, the effort expended, and the persistence demonstrated in the face of adversity (Bandura, 1991). To predict individual creativity, an efficacy measure specific to creativity is much more effective and necessary than a general measure of general beliefs (Gibson, Randel, & Earley, 2000). Creative self-efficacy is defined as individuals' beliefs in their ability to produce creative ideas (Tierney & Farmer, 2002), and this kind of self-efficacy has been suggested as a sensemaking frame (Ford, 1996).

Drawing on the sensemaking framework, we propose that creative self-efficacy may frame individuals' sensemaking processes so that they perceive cognitive team diversity as a favorable situation facilitating creative behavior. Team members with high creative self-efficacy may believe that they can effectively interpret and integrate different ideas and perspectives because they are more focused on creativity tasks and less distracted by psychological anxiety (Bandura, 1997). In other words, individuals with strong creative self-efficacy are likely to see cognitive team diversity as a valuable resource that is personally advantageous for their creative performance, so they will actively look for ways to capitalize on it. In addition, as discussed earlier, individuals with high creative self-efficacy are more willing to engage in creative acts because creative behavioral options make more sense: they will more likely take risks in creating new things from combining different perspectives and ideas because they feel confident of their ability to integrate these (Drazin et al., 1999). With boosted motivation resulting from sensemaking, they will want to create novel ideas from the different information, knowledge, and perspectives their group has. On the other hand, individual team members with low creative self-efficacy may doubt their abilities. With their low confidence and weak sensemaking of creative behavioral options, they are unlikely to seek and integrate different ideas or engage in creative behavior. They will even discount the benefits of team diversity. Furthermore, they may interpret the different ideas and information in a manner consistent with their own views (Swann, 1987), which will result in an absence of synergy with the ideas of others.

In addition, several studies suggest that self-efficacy beliefs facilitate the integration and use of new information (Brown, Ganesan, & Challagalla, 2001), as well as increase a positive learning attitude and an awareness of development needs (Noe & Wilk, 1993). With high creative self-efficacy, individuals may regard differences in opinions and ideas as opportunities for their work, whereas with low creative self-efficacy, they may perceive these differ-

ences as threats (Staw, Sandelands, & Dutton, 1981). To summarize, team members with high levels of creative self-efficacy are more likely to manifest the benefits of cognitive diversity than those with low levels of creative self-efficacy. Hence, we predict the following:

*Hypothesis 2. The relationship between cognitive team diversity and individual team member creativity is moderated by a team member's creative self-efficacy in such a way that cognitive team diversity is more positively related to individual creativity when the team member's creative self-efficacy is high than when it is low.*

### The Moderating Role of Transformational Leadership

To understand under what conditions individual team members better use the potential benefits of cognitive team diversity for their creativity, one should also contemplate team-level factors. Among the team contextual factors, leadership plays the dominant role in workplaces (Redmond et al., 1993) and has been studied as a moderator of the relationship between team diversity and team creativity. Leadership may minimize the negative influence (e.g., social categorization processes) and maximize the positive influence (e.g., providing various ideas, knowledge and perspectives) of team diversity on team creativity (Kearney & Gebert, 2009; Shin & Zhou, 2007; Somech, 2006). In particular, transformational leadership has been suggested to boost team members' motivation and to encourage them to be open to different ideas and to value unique needs and perspectives (Bass, 1985; Shin & Zhou, 2003). Thus, we argue that transformational leadership is likely to help individuals capitalize on the cognitive resources from cognitive team diversity.

*Transformational leadership* behavior includes "inspirational motivation" (articulating a common compelling vision), "idealized influence" (serving as a role model to energize), intellectual stimulation (stimulating imagination, intellectual curiosity, and novel approaches), and "individualized consideration" (paying attention to followers' needs and appreciating individuals' initiatives and viewpoints) (Bass, 1985). Each of these behaviors may affect the relationship between cognitive diversity and individual creativity. For example, by providing inspirational motivation, these leaders tend to decrease their team members' negative reactions toward and behaviors in relation to diversity (i.e., being different) via increasing these members' awareness of team identification (i.e., "we are a team") so that the individual team members are more willing to capitalize on the wide range of ideas and perspectives coming from their cognitively diverse team (van Knippenberg, 1999). Moreover, the enhanced motivation resulting from transformational leaders' idealized influence can drive the individuals to search for the different ideas provided by the cognitive diversity of their team and to integrate these actively so that they may perform better in creative tasks. With exposure to different ideas, perspectives, and knowledge and with the enhanced motivation, team members are likely to exploit the advantage of cognitive resources.

Second, by intellectually stimulating their team members, transformational leaders can guide them to search for and to be open to different ideas and perspectives (Gong, Huang, & Farh, 2009). Their intellectual stimulation directs the attention of team members toward discovering new and better ideas and urges these members to explore and experiment with new approaches (Shin & Zhou, 2003), making them more readily appreciate and adopt one another's different perspectives to be creative. In other words, intellectual stimulation may help them explore the cognitive resources from cognitive team diversity. In addition, the individualized consideration of transformational leaders assures the team members that individuality and unique perspectives are valued (Bass, 1985). As such, transformational leaders motivate team members to seek creative ideas without the fear of being penalized (Kahai, Sosik, & Avolio, 2003). Consequently, the team members are less likely to fear ostracism and are more likely to feel comfortable in discussing and exploring their ideas with other members. With a high level of psychological safety, team members are more likely to utilize the different ideas and perspectives of the cognitively diverse team members (Edmondson, 1999). Taking these points together, we predict the following:

*Hypothesis 3. The relationship between cognitive team diversity and individual team member creativity is moderated by transformational leadership in such a way that cognitive team diversity is more positively related to individual creativity when transformational leadership is high than when it is low.*

## METHODS

### Participants and Procedures

Data were collected from subordinates and their supervisors from 68 teams in three large organizations located in the northern part of the Republic of

China. These organizations include a grocery store, a design company, and an electronics company that had different tasks and team types. Within each organization, the team types and the levels of task complexity were very similar (i.e., shop clerks for the grocery company, design teams for the design company, and technical and administrative support for the electronic company). In our study, we defined a work team as a group of personnel that (1) formed the smallest functional unit in the organization, (2) reported directly to the same supervisor, and (3) worked together on a permanent basis. All the work teams were well delineated: the members identified themselves with the teams, and the management identified the members with the teams. Invariably, team members interacted at least once a day in team meetings and/or in their tasks. All members of the teams that actually participated in the study also participated in the survey. The average team size was 4.7 members (ranging from 3 to 10), and members' average team tenure was about five years. In general, the team members had a moderate level of task interdependence (scoring 3.4 on a seven-point scale with 7 equal to "to a very large extent") with the other team members. Participation was voluntary, and the respondents were assured of the anonymity of their responses. All were assigned precoded questionnaires to facilitate the matching of the subordinate-supervisor surveys. The surveys were collected during work hours in the presence of one of the research assistants. Employees evaluated their own levels of creative self-efficacy, cognitive team diversity, and their supervisors' transformational leadership, and supervisors assessed their subordinates' individual creativity. All respondents were provided with a financial incentive in the form of cash payment to encourage participation in the study.

A total of 433 matched employee-supervisor questionnaires were returned (a 78.7 percent response rate, ranging from 73 to 95 percent by organization). Because of missing data and a small team (i.e., fewer than three members ), the final sample used in the analyses comprised 316 employee-supervisor matched questionnaires and 68 teams. Their demographic data are as follows: 34.2 percent of the employees were female; their average age was 31.7 years; and their average organizational tenure was 5.3 years. Of the supervisors, 43 percent were female; their average age was 36.7 years; and their average organizational tenure was 9.0 years.

## Measures

The surveys were initially written in English and then translated into Chinese using the back-translation procedure (Brislin, 1986). Specifically, all translators were blind to the study's hypotheses, and two bilingual individuals independently translated the survey from English to Chinese. There was 90 percent agreement between the translators regarding word choice and expression. A third bilingual translated the survey back to English. During this procedure, ten words or phrases in the Chinese version that did not exactly match those in the English version were corrected, in accordance with the recommendation of Brislin (1986).

***Creative self-efficacy.*** To assess the subordinates' creative self-efficacy, we used Carmeli and Schaubroeck's (2007) eight-item scale. The subordinates were asked to assess their belief with regard to their ability to perform creative behavior successfully (1 = "strongly disagree"; 7 = "strongly agree"). Sample items include "I will be able to achieve most of the goals I have set for myself in a creative way" and "When facing difficult tasks, I am certain I will accomplish them creatively" ($\alpha$ = .86).

***Transformational leadership.*** To assess the supervisors' transformational leadership, we used the Multifactor Leadership Questionnaire (MLQ) Form 5X (Avolio, Bass, & Jung, 1999). The MLQ contains measures of charismatic attributes and behavior, inspiration, individual consideration, and intellectual stimulation. The subordinates were asked to assess their supervisors' leadership behavior on the five dimensions on a five-point Likert-type scale (0 = "not at all"; 4 = "frequently, if not always"). We aggregated the individual responses to compute group-level transformational leadership (individual-level $\alpha$ = .92).

***Cognitive team diversity.*** We measured the teams' cognitive diversity using Van der Vegt's and Janssen's (2003) four-item measure. The subordinates were asked to indicate the extent to which the members of their team differ in their way of thinking, in their knowledge and skills, in how they see the world, and in their beliefs about what is right or wrong (1 = "to a very small extent"; 7 = "to a very large extent"). We aggregated the individual responses to compute group-level cognitive diversity (individual-level $\alpha$ = .76).

***Individual creativity.*** The supervisors assessed their subordinates' creativity using the scales employed by Zhou and George (2001) (1 = "not at all characteristic"; 5 = "very characteristic"). Sample items include "Suggests new ways to achieve goals or objectives" and "Comes up with new and practical ideas to improve performance" ($\alpha$ = .91).

***Control variables.*** We included several control variables in the statistical analyses. First, at the individual level, following other researchers (e.g.,

Amabile, 1996; Mumford & Gustafson, 1988; Shin & Zhou, 2003), we controlled for education level because it might be associated with creativity through task domain expertise. In addition, we controlled for preference for active divergence—divergent thinking attitudes that accompanied improvements in creative performance—because it could affect individual creativity within a team (Basadur, Pringle, & Kirkland, 2002). We measured the preference for active divergence using Basadur et al.'s six-item measure (1 = "strongly disagree" to 5 = "strongly agree"). A sample item was "I feel that people at work ought to be encouraged to share all their ideas because you never know when a crazy-sounding one might turn out to be the best" ($\alpha = .73$). We also controlled for openness to experience because it might influence individual creativity. We measured it with a brief version of Saucier's (1994) "minimarker" measure of the "big five personality markers." Finally, we controlled for the task interdependence of each individual team member with other team members, which might have significant influence on creative processes (Van der Vegt & Janssen, 2003). We measured interdependence with three items adopted from Campion, Medsker, and Higgs (1993). A sample item was "I cannot accomplish my tasks without information or materials from other members of my team" ($\alpha = .76$).

Following other researchers, we controlled for team size, average team tenure, organizational tenure diversity, and gender diversity at the team level to partial out their potential influences on the relationships (e.g., Harrison et al., 2002; Jackson et al., 2003). Some scholars have argued that demographic diversity implies cognitive diversity (McGrath, Berdahl, & Arrow, 1995), and others have suggested that demographic characteristics do not even correlate with cognitive diversity (Kilduff, Angelmar, & Mehra, 2000). Given the existing mixed findings on type of diversity and creativity, we included forms of demographic diversity to control their influences on the results. We used Blau's index to measure gender diversity and used the standard deviation for organizational tenure diversity. Finally, we controlled for company-level effects using two dummy variables. This was to prevent any possible confounding effects on the results coming from the company-level factors.

## RESULTS

### Psychometric Characteristics of the Measures

We performed confirmatory factor analysis on the four individual-level variables (openness to experience, creative self-efficacy, preference for active divergence, and individual creativity) to establish their discriminant validity using AMOS 18.0. The four-factor model provided a generally good fit to the data ($\chi^2[480] = 788.01$, $p < .01$, comparative fit index (CFI) = .92, root-mean-square error of approximation (RMSEA) = .05, and a Tucker-Lewis index (TLI) = .91). According to the chi-square difference tests, the four-factor model fit the data significantly better than the three-factor models (i.e., combining creative self-efficacy and preference for active divergence) ($\chi^2[481] = 853.75$, $p < .01$, CFI = .90, RMSEA = .05, and TLI = .89), the two-factor model (i.e., combining openness to experience, creative self-efficacy, and preference for active divergence) ($\chi^2(483) = 950.00$, $p < .01$, CFI = .88, RMSEA = .06, and TLI = .87), and the one-factor model ($\chi^2(486) = 968.06$, $p < .01$, CFI = .87, RMSEA = .06, and TLI = .86), which supports the variables' discriminant validity.

We tested the within-team agreement for team cognitive diversity and transformational leadership by computing $r_{wg}$, obtaining median values of .84 and .91, respectively. The interclass correlation (ICC1) estimate was .12 for team cognitive diversity and .25 for transformational leadership. Meanwhile, the ICC2 estimate was .40 for team cognitive diversity and .61 for transformational leadership. Overall, these results met or exceeded the levels of reliability and agreement found in previous research that dealt with aggregation issues (e.g., Campion et al., 1993). Thus, aggregating the responses to the team level was appropriate.

### Descriptive Statistics

Table 1 provides the means, standard deviations, reliabilities, and correlations of the measures and variables used in the study. The statistics in the upper portion of the table pertain to the individual level of analysis. The data in the lower portion pertain to the correlations among team-level variables.

### HLM Results

Table 2 summarizes the results from hierarchical linear modeling (HLM) analyses. Our hypotheses imply that the significant variance in team member creativity can be explained at both team and individual levels. To test our hypotheses, we first had to ensure that significant team variance in team member creativity existed. Otherwise, there was no point in moving to the team level and conducting further cross-level analyses. Thus, we first estimated a null model in which team member creativity was a linear function of three parameters: the

**TABLE 1**
**Descriptive Statistics and Correlations[a]**

| (a) Individual (Level 1) Variables | Mean | s.d. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Creativity | 3.52 | 0.68 | (.91) | | | | | | | | |
| 2. Gender | 0.66 | 0.48 | −.16** | | | | | | | | |
| 3. Organizational tenure | 5.32 | 7.10 | .02 | −.25** | | | | | | | |
| 4. Preference for active divergence | 5.23 | 1.37 | .13* | .00 | −.04 | (.73) | | | | | |
| 5. Openness to experience | 4.80 | 0.86 | .21** | −.10 | −.00 | .35** | | | | | |
| 6. High school | 0.17 | 0.38 | −.19** | .03 | −.09 | −.13* | −.15** | | | | |
| 7. College | 0.66 | 0.48 | .10 | .06 | .04 | −.02 | −.03 | −.63** | | | |
| 8. Task interdependence | 3.34 | 0.72 | .11 | −.13* | .10 | .24** | .05 | −.05 | −.03 | (.76) | |
| 9. Creative self-efficacy | 5.13 | 0.88 | .16** | −.03 | .05 | .34** | .46** | −.03 | −.03 | .18** | (.86) |

| (b) Team (Level 2) Variables | Mean | s.d. | ICC1 | ICC2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Creativity team average | 3.58 | 0.53 | .45 | .80 | (.91/.88) | | | | | | | | |
| 2. Company A | 0.10 | 0.31 | | | −.08 | | | | | | | | |
| 3. Company B | 0.19 | 0.40 | | | .23 | −.16 | | | | | | | |
| 4. Team size | 4.65 | 1.84 | | | −.31* | .36** | −.25* | | | | | | |
| 5. Organizational tenure diversity | 6.52 | 3.42 | | | .00 | .58** | .23 | .03 | | | | | |
| 6. Average tenure of a team | 4.97 | 5.24 | | | .08 | .70** | .11 | .17 | .80** | | | | |
| 7. Gender diversity | 0.17 | 0.20 | | | −.14 | .11 | −.11 | .18 | .22 | .24 | | | |
| 8. Cognitive team diversity | 5.14 | 0.56 | .12 | .40 | .05 | .32** | .00 | .02 | .08 | .07 | −.12 | (.76/.84) | |
| 9. Transformational Leadership | 3.42 | 0.52 | .25 | .61 | .12 | .16 | .38** | .08 | .23* | .16 | −.04 | .08* | (.92/.91) |

[a] $n = 316$ for level 1 variables and 68 for level 2 variables. Values in parentheses in the upper portion and the first number in parentheses in the lower portion are alpha coefficients. The second numbers in the lower part's parentheses are average interrater reliability ($r_{wg}$'s).

* $p < .05$

** $p < .01$

Two-tailed tests.

grand mean of the population of individuals, the random effect due to individuals, and the random effect due to teams. We found significant between-team variability ($\tau_{00} = .21$, $p < .001$). Calculating ICC values indicated that 46 percent of the variance in team member creativity was between teams, and about 54 percent was within teams.

Model 1 (Table 2) shows the HLM results from regressing team member creativity on individual-level predictors only. In addition to measuring fixed effects (represented as regression coefficients), as in OLS regression, HLM measures the random effects of the intercepts and slopes in a model. The random effects are listed in parentheses in the second column under each model.

Model 2 of Table 2 includes all the individual-level predictors, team-level control variables, and cognitive diversity. This model was employed to test Hypothesis 1, which suggests that cognitive team diversity is positively related to individual team member creativity. The results show that only tenure diversity was significantly but negatively related to team member creativity. There was an insignificant association between cognitive team diversity and team member creativity ($\hat{\gamma} = .03$, n.s.). Thus, Hypothesis 1 was not supported.

Model 4 of Table 2 includes all the individual-level predictors, team-level predictors, and cross-level interaction terms. We used this regression to test Hypotheses 2 and 3 because they predict cross-level and level 2 interactions after all individual- and team-level predictors have been controlled for. Hypothesis 2 states that an individual team member's creative self-efficacy moderates the relationship between cognitive team diversity and individual creativity. The interaction term between creative self-efficacy and cognitive team diversity was significant and positive, the expected direction ($\hat{\gamma} = .22$, $p < .01$), supporting Hypothesis 2.

Hypothesis 3 suggests that transformational leadership may have a moderating effect on the relationship between cognitive diversity and team member creativity. The HLM results supported this hypothesis, as the interaction term between the two variables was positive and significant ($\hat{\gamma} = .57$, $p < .01$).

## Simple Slopes and Graphical Depiction of the Moderating Effects

The pattern of the significant moderating effect of creative self-efficacy on the relationship between cognitive team diversity and individual creativity is illustrated in Figure 1. Since HLM produces a variance and covariance matrix of regression coefficients (gammas), using this matrix, we ran simple slope tests following the procedure recommended by Preacher, Curran, and

**TABLE 2**
**Results of Hierarchical Linear Modeling[a]**

| Variables | Model 1: Adding Level 1 Predictors | Model 2: Testing Main Effect of Cognitive Diversity | Model 3: Adding All Other Level 2 Predictors | Model 4: Adding Cross-Level Interaction Effects |
|---|---|---|---|---|
| Level 1 | | | | |
| Intercept | 3.63*** (.21***) | 3.61*** (.19***) | 3.61*** (.18***) | 3.61*** (.18***) |
| Gender | −0.18** | −0.17** | −0.17** | −0.17** |
| Organizational tenure | −0.00 (.00) | −0.00 (.00) | −0.00 (.00) | −0.00 (.00) |
| Preference for active divergence | 0.06 (.04) | 0.06 (.04) | 0.06 (.04) | 0.04 (.05) |
| Openness to experience | 0.03 (.01) | 0.04 (.01) | 0.04 (.01) | 0.04 (.01) |
| High school | −0.04 | −0.00 | 0.00 | 0.00 |
| College | 0.10 | 0.11 | 0.11 | 0.13 |
| Task interdependence | 0.01 (.01) | 0.02 (.01) | 0.01 (.01) | 0.03 (.00) |
| Creativity self-efficacy | 0.03 (.02) | 0.03 (.02) | 0.03 (.01) | 0.03 (.01) |
| Level 2 | | | | |
| Company 2 | | −0.16 | −0.22 | −0.26 |
| Company 3 | | 0.13 | 0.05 | 0.04 |
| Team size | | −0.08** | −0.09** | −0.09*** |
| Average tenure of a team | | 0.05** | 0.05** | 0.05** |
| Organizational tenure diversity | | −0.06* | −0.06* | −0.06* |
| Gender diversity | | −0.37 | −0.39 | −0.39 |
| Cognitive diversity | | 0.03 | 0.05 | 0.07 |
| Transformational leadership | | | 0.14 | 0.14 |
| Transformational leadership × cognitive diversity | | | 0.57** | 0.57** |
| Transformational leadership × tenure diversity | | | −0.04 | −0.05 |
| Transformational leadership × gender diversity | | | 0.26 | 0.29 |
| Level 1 × level 2 (cross-level) | | | | |
| Cognitive diversity × creativity self-efficacy | | | | 0.22** |
| Org. tenure diversity × creativity self-efficacy | | | | −0.01 |
| Gender diversity × creativity self-efficacy | | | | 0.00 |
| Within-team residual variance | 0.20 | 0.20 | 0.20 | 0.20 |
| $\Delta R^2_{\text{within-team}}$[b] | .20 | .00 | .00 | .02 |
| $\Delta R^2_{\text{between-teams}}$[b] | .01 | .09 | .05 | .00 |
| Deviance | 580.8 | 592.4 | 593.4 | 596.0 |

[a] Numbers in parentheses are variance components.
[b] Difference compared to previous model. Model 1 was compared with the null model.
* $p < .05$
** $p < .01$
*** $p < .001$
Two-tailed tests.

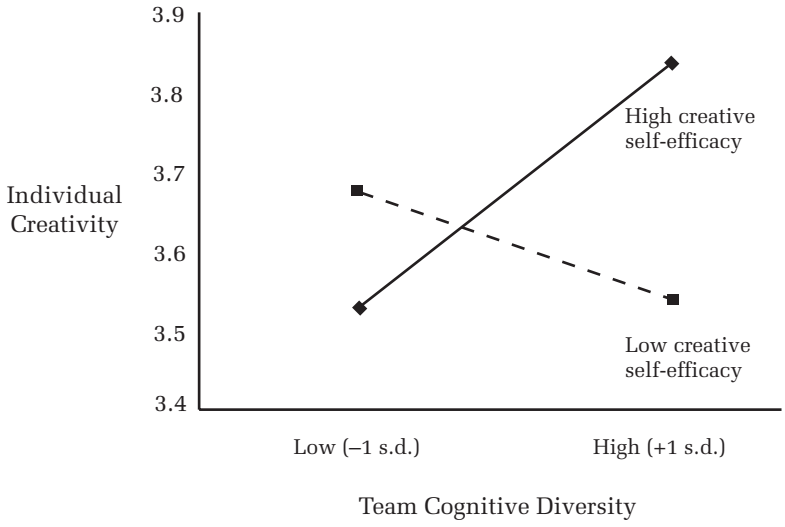
Bauer (2006). When an individual team member had high creative self-efficacy, cognitive team diversity was positively related to team member creativity with statistical significance ($\gamma = .27$, $z = 2.43$, $p < .05$). However, when a team member had low creative self-efficacy, cognitive team diversity was insignificantly related to team member creativity ($\gamma = -.13$, $z = -0.93$, $p = .34$). The figure suggests that cognitive team diversity alone does not have a positive relationship with individual creativity, but it does have such a positive relationship for individuals with high self-efficacy, which is consistent with Hypothesis 2.

The pattern of the significant moderating effect of transformational leadership also shows a quite similar trend. Figure 2 depicts the relationship. When a team leader exhibited a high level of transformational leadership, cognitive team diversity was positively related to individual team member creativity, and the effect was statistically significant ($\gamma = .36$, $z = 2.41$, $p < .05$). However, cognitive team diversity was insignificantly related to team member creativity in teams in which the team leader exhibited a low level of transformational leadership ($\gamma = -.37$, $z = -1.46$, $p = .14$). The figure also suggests that the relationship between cognitive team diversity and individual team member creativity is contingent on leadership type.

## DISCUSSION

We theorized and found that a team member's creative self-efficacy moderated the relationship

**FIGURE 1**
**Cross-Level Interaction Plot**

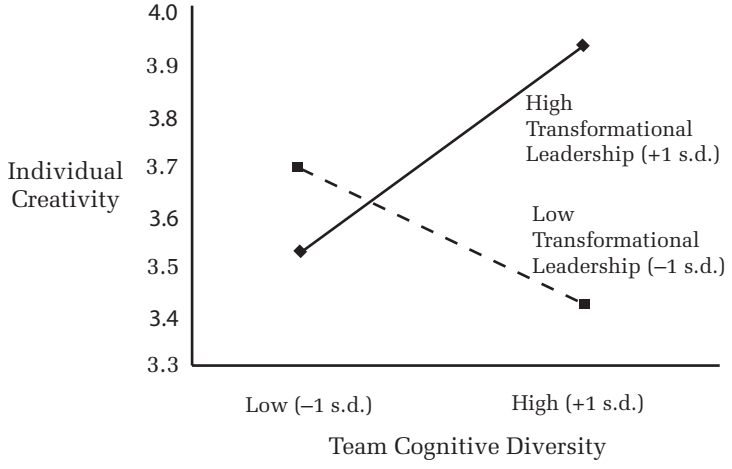



between cognitive team diversity and individual creativity in such a way that cognitive team diversity was positively related to individual team member creativity only when a team member's creative self-efficacy was high. In addition, transformational leadership influenced the relationship between cognitive team diversity and individual creativity: cognitive team diversity was positively related to individual creativity only when transformational leadership was high. These findings extend previous research on creativity and team diversity by looking into the conditions, at both the individual and team levels, under which cognitive team diversity positively relates to individual creativity. This study also investigated the cross-level interaction between team diversity and individual characteristics, which has been neglected in previous research.

### Theoretical Implications

This study makes several theoretical contributions to the creativity and diversity literatures. First, it provides insights into whether and when team diversity positively relates to individual creativity. Although individual team members are the ones who significantly influence team creativity processes (Gilson & Shalley, 2004; Janssen, van de Vliert, & West, 2004) and actually determine team creativity and innovation (Pirola-Merlo & Mann, 2004; West & Anderson, 1996), how team diversity affects individual creativity has rarely been stud-

**FIGURE 2**
**Level 2 Interaction Plot**



ied. Our study provides empirical evidence on the relationship between team diversity and team member creativity, which has never been examined except by Choi (2007), who found that functional diversity was significantly associated with individual creativity. However, in his study, the measure of creativity was self-reported by employees, and the findings differed depending on unit size, which compromises their generalizability.

Perhaps the most important implication of our findings is that individual differences and situational factors play important roles in helping individuals capitalize on the potential benefits of team diversity for their creativity. The present study not only theoretically developed the cross-level interaction effect on team member creativity by integrating research on efficacy, diversity, and creativity, but also empirically demonstrated the moderating role of creative self-efficacy on the relationship between cognitive team diversity and team member creativity with ongoing teams in different industries. In addition, our findings imply that transformational leadership may help team members explore and exploit the cognitive resources associated with cognitive team diversity. Although leadership plays a dominant role in employee creativity in their workplaces (Redmond et al., 1993; Scott & Bruce, 1994), and transformational leadership, in particular, has been found to have a positive relationship with creativity (Shin & Zhou, 2003), with a few exceptions (Shin & Zhou, 2007; Somech, 2006), the interaction effects between leadership and diversity on workplace creativity have rarely been studied. In fact, our study is the first to examine how transformational leadership influences the relationship between team diversity and individual creativity. Transformational leaders may help individual team members, if they are exposed to a high level of cognitive team diversity, to proactively utilize cognitive resources. Transformational leaders do so by encouraging their team members to search for new ideas and perspectives from other team members through intellectual stimulation; by boosting psychological safety for sharing and experimenting through individualized consideration; and by helping team members focus on the task (i.e., searching for the different knowledge, perspectives, and ideas of the diverse team members and integrating them) instead of on external issues through idealized influence and inspirational motivation. Although we did not test these possible mechanisms, our results support Tierney's (2008) proposition that examining the influence of leadership on employee creativity from a cognitive perspective is important.

In addition, we focused on cognitive team diversity as the main diversity variable in examining the relationship between team diversity and creativity. Prior research suggests choosing a diversity variable on the basis of its conceptual relevance to the outcomes of interest is important (Williams & O'Reilly, 1998). For creativity, which requires thinking divergently, seeing things from different perspectives, and combining previously unrelated processes, products, or materials into something new and better (Amabile, 1996; Mumford & Gustafson, 1988), cognitive team diversity may be the most relevant diversity variable because it provides the different perspectives, ideas, and thinking styles required for creative processes (Williams & O'Reilly, 1998). However, cognitive team diversity has been rarely studied in relation to creativity as an outcome, with a few exceptions (e.g., Van der Vegt & Janssen, 2003). Although we did not find a significant relationship between cognitive team diversity and individual creativity, cognitive team diversity turned out to be important for individual creativity because we identified significant moderating effects of creative self-efficacy and transformational leadership on the relationship between cognitive team diversity (not demographic team diversity) and individual creativity. As the diversity literature suggests, these results support previous findings suggesting that researchers should choose the proper diversity variable and consider moderators to obtain a clearer picture of the relationship between team diversity and creativity.

Another noteworthy finding is that a nonsignificant relationship between creative self-efficacy and creativity (Table 2). This is an interesting finding given that previous studies have shown a positive relationship between these variables in samples from Western nations (e.g., Redmond et al., 1993; Tierney & Farmer, 2002). In social entities in which individualism is highly valued, creative self-efficacy might influence individual creativity, whereas in a collective society, collective creative efficacy might influence team creativity (James & Eisenberg, 2007). Indeed, culture has been shown to exert a significant effect on employee cognition, identity, and behavior (e.g., Earley, 1994). Our study's sample is from China, where individual belief in one's own creative potential may not automatically translate into creativity as is the case in the United States. This is because Chinese employees normally attend to their collective selves rather than to aspects of their personal selves, such as creative self-efficacy, in guiding their creative behavior, unless a specific situation primes or activates their personal selves (James & Eisenberg, 2007; Triandis, 1989). Future studies should investigate when cre-

ative self-efficacy is related closely to creativity in collectivistic societies.

### Limitations and Future Studies

Our study's cross-sectional design cannot determine the direction of causality unequivocally. For instance, people with previous success in creativity might prefer to join cognitively diverse teams. In addition, leaders who were more transformational might have attracted and selected more creative followers to join the teams they led. However, because our hypotheses were based on theories, and the employees were assigned to their teams by their organizations, we believe that the above-mentioned issues did not significantly affect the interpretation of the results. Still, future research that uses a longitudinal or experimental design is needed to demonstrate the direction of causality.

In addition, although we avoided potential common method biases by collecting the data from two different sources, which is the practice of most creativity studies (Zhou & Shalley, 2003), we did not have any objective measures of creativity. The teams in the sample were from different industries, so the collection of objective team creativity measures that would allow for a fair comparison across industries was not feasible. The creativity literature accepts the use of proxy measures such as supervisor ratings to measure creativity (Zhou & Shalley, 2003), but whether there was response bias in the supervisors' ratings of creativity remains a question. We tried to minimize this response bias by guaranteeing the confidentiality of the obtained data for the supervisors. However, future studies should still employ objective measures of creativity whenever possible to obtain a clearer picture of the relationships.

Another limitation was that we did not directly test how team diversity and the interactions among the moderators influenced team creativity. To get the whole picture, future studies should employ an innovative research design to test whether team member creativity mediates the effects of team diversity and the interactions among variables on team creativity. Sometimes, the creativity of individual team members may not contribute highly to team diversity because of team processes. Thus, future studies should also include possible mediators such as conflict (Jehn et al., 1999), external communication (Ancona & Caldwell, 1992), social integration (Harrison et al., 2002), and psychological safety (Edmondson, 1999) to better explain the mechanisms by which team diversity influences team member creativity and in turn, team creativity.

This study did not examine actual cognitive diversity among team members. Instead, we focused on perceived cognitive diversity. Perceived diversity has been frequently used in diversity research (e.g., Harrison et al., 2002; Jehn et al., 1999) and may explain individual behavior more strongly than actual diversity (Harrison & Klein, 2007). However, individuals may not accurately assess the cognitive diversity of the rest of their team members, and the assessment can be biased (Harrison & Klein, 2007). In this study, we did not ask the respondents to compare their teams with other teams to avoid any bias (e.g., overestimation of within-team diversity or similarity [cf. Harrison & Klein, 2007]). We also measured perceived diversity and creativity from different sources to avoid common method bias. However, future research should compare the strength of relationships between team member creativity and perceived and actual cognitive diversity, respectively.

Also, we did not include other plausible moderators of the relationship between team diversity and creativity, such as intrinsic motivation. As Amabile (1996) argued, intrinsic motivation may be one of the most critical factors for creativity. In the context of cognitive team diversity, if individuals have high levels of motivation, then they are likely to willingly search for and integrate different ideas, knowledge domains, and perspectives, which may strengthen the positive relationship between cognitive team diversity and creativity. Future studies should investigate this moderating relationship to understand why and how team diversity influences individual creativity.

Another potential concern can be found in the small effect size produced by our cross-level interactions (about 2%). However, our study used 21 control variables, including all the other interaction terms. Furthermore, the dependent variable and the independent variables were measured from different sources. Therefore, we believe that the interaction we observed was robust and meaningful. Finally, our data were collected in a single cultural context (i.e., China). It is possible that the collectivistic culture might have weakened the relationship between cognitive team diversity and creativity by pushing team members to conform to original ideas in the team. It is also possible that the moderating effects of creative self-efficacy and transformational leadership operate differently in different cultural contexts. To ensure the generalizability of the findings, our results should be replicated with samples from different cultures.

The limitations of this study are countered by several strengths. First, we collected the data from different sources to minimize potential common method biases. Second, as Jackson et al. (2003) suggested, by controlling for demographic team dif-

ferences such as gender and tenure, this study helped achieve a better understanding of the role of cognitive team diversity in team members' creativity. Third, the HLM analysis separated within- and between-team variance in creativity, so error terms were not biased systematically. As a result, the effect size estimates in our study can be considered more accurate. The HLM analysis also allowed us to conduct cross-level analysis. Fourth, the sample was relatively large (316 for level 1 and 68 for the level 2 variables), which might provide adequate variance and relatively stable results. The large sample also increased our confidence that the results were not simply based on the idiosyncratic characteristics of certain teams. Thus, the characteristics of our sample enhanced the generalizability of the results.

### Practical Implications

Our study also provides practical implications. As more organizations increase their diversity in an attempt to boost creativity, it would be important to inform managers that diversity alone does not guarantee creativity. Our findings suggest that for teams with a high level of cognitive team diversity, managers should ensure that members have high levels of creative self-efficacy. Without creative self-efficacy, individual creativity may even be negatively influenced by cognitive team diversity. By encouraging risk taking and by celebrating small successes, managers can increase their team members' creative self-efficacy. Managers should also apply other practices that can boost employees' beliefs in their ability to be creative. Furthermore, the results indicated that to take full advantage of diverse cognitive resources, managers should engage in transformational leadership behavior so that individual team members can focus on discovering new and better ideas, appreciate one another's different perspectives readily, and seek creative ideas when they are working with cognitively diverse team members. Consequently, team members are more likely to exploit the cognitive resources coming from cognitive team diversity to become more creative at their work.

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