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Structuring for team success: The interactive effects of network structure and cultural diversity on team potency and performance

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ABSTRACT

This longitudinal study used data from 91 self-managed teams (456 individuals, 60 nationalities) to examine the interactive effects of a team's task ("workflow") network structure and its cultural diversity (as indexed by nationality) on the team's "potency" (i.e., the team's confidence in its ability to perform) and its performance (as rated by expert judges). We found that whereas the emergence of dense task networks enhanced team potency it was the emergence of (moderately) centralized task networks that facilitated team performance. These varied structural effects, moreover, were themselves contingent on team composition: the more culturally diverse a team, the more pronounced were the positive effects of network density on team potency and the higher the level of network centralization required for optimal team performance. The success of a team appears to hinge on the interplay between network structure and team composition.

Introduction

Work teams are a ubiquitous feature of organizational life—and this may be one reason why the determinants of team success have been the subject of such sustained scholarly interest. Among the many theories that have been employed over the years to understand variance in team success, one can broadly distinguish at least two types: compositional theories, which focus on the personal attributes of team members; and structural theories, which focus not on the personal attributes of team members but on the patterns of interactions (and sentiments) among them. The list of member attributes that compositional theories have examined is a long one. Given the increasing globalization of the workforce, however, there has been particular interest in understanding how observable markers—such as nationality, gender, and race—can shape team outcomes. This compositional line of work has been fruitful but has yielded mixed results. Although there is some support for the view that teams made up of demographically different individuals can leverage the potentially varied perspectives of their members to achieve superior performance there is also compelling evidence that teams composed of diverse individuals experience greater interpersonal conflict and lowered levels of coordination (e.g., Williams & O'Reilly, 1998; for recent meta-analytic evidence, see Stahl, Maznevski, Voigt, & Jonsen, 2010; van Dijk, van Engen, & van Knippenberg, 2012).

Whereas the compositional approach to team performance has focused on the attributes of a team's members, structurally oriented theories of team processes have built on the insight that interactions in teams—which are critical to the exchange of information and the coordination of team tasks—tend to be inherently patterned and structured in nature (e.g., Katz & Kahn, 1978; cf. Nadel, 1957). This emphasis on the patterned character of social interaction in teams notwithstanding, studies of team processes have frequently relied on team members' averaged perceptions to get at the underlying processes of interest (see the discussion in Crawford & Lepine, 2013, pp. 32–33). More recently, structurally oriented scholars have sought to reinvigorate a classic line of work that employed network theory and methods to understand and distinguish various configurations of structured team processes and their effects on team outcomes (Shaw, 1964; see Balkundi & Harrison, 2006). Rather than relying on averaged perceptions, the network approach focuses directly on the structure of patterned interactions among a team's members (see Wellman & Berkowitz, 1997). Networks can influence team performance because they facilitate (and constrain) the flow of resources (information, material) among a team's members, engender norms of trust and cooperation, and coordinate the actions of team members (e.g., Mehra, Smith, Dixon, & Robertson, 2006; Reagans &

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Zuckerman, 2001; cf. Podolny, 2005). Network-based approaches to team performance, of course, have a long history in organizational research (e.g., Roethlisberger & Dickson, 1939) but recent work has largely concentrated on the benefits that actors accrue by virtue of occupying favorable positions within the structure of a team's network (for a recent review, see Kilduff & Brass, 2010). The question of how network patterns at the team-level of analysis influence team outcomes has received less attention (some exceptions are Balkundi, Kilduff, Barsness, & Michael, 2007; Sparrowe, Liden, Wayne, & Kraimer, 2001), and the precise network configurations that enhance team performance remain a matter of debate (e.g., Crawford & Lepine, 2013; Oh, Chung, & Labianca, 2004; Zhang & Peterson, 2011; cf. Balkundi & Harrison, 2006).

Our paper responds to recent calls asking researchers to examine how aspects of team context may interact with team diversity to shape team outcomes (e.g., Van der Vegt & Janssen, 2003; van Knippenberg & Schippers, 2007). More specifically, we examine the possibility that team diversity and the structure of a team's workflow network interactively determine the confidence a team has in its ability to perform ("team potency") and how it actually goes on to perform ("team performance"). Organizational network research has tended to concentrate on the effects of structure rather than theorizing how network structure and the characteristics of individuals together influence important team outcomes (Kilduff & Krackhardt, 1994; cf. Kilduff & Brass, 2010). Meanwhile researchers who have focused on how diversity in teams influences team outcomes have tended to infer rather than directly observe the emergent networks that are thought to influence attitudes and performance in teams (see the discussions in: Lawrence, 1997; Reagans, Zuckerman, & McEvily, 2004). Rather than neglecting either the structure of social networks or the attributes of the people in the network our paper develops and tests the idea that variance in team potency and team performance may be fruitfully explained as the interactive result of the structural characteristics of the network the team adopts to accomplish work and the team's composition.

Network theory offers a number of different ways of conceptualizing and measuring structure (see, e.g., Borgatti & Halgin, 2011; Borgatti, Mehra, Brass, & Labianca, 2009). Here we focus on two theoretically-relevant aspects of a team's network structure: "density," which reflects the degree to which a team's members are interconnected; and "centralization," which reflects the extent to which one or more members are disproportionately central in the team's network (Borgatti, 2005; Freeman, Borgatti, & White, 1991; cf. Zhang & Peterson, 2011). These two aspects of network structure are conceptually distinct and together provide a richer view of network topology than either measure does alone (see Wasserman & Faust, 1994, p. 182). Density can be thought of as a measure of group cohesion (Blau, 1977). Densely connected networks positively influence member satisfaction and commitment because they facilitate information sharing and interpersonal trust (e.g., Coleman, 1988; Granovetter, 1985; Reagans & McEvily, 2003) and this, in turn, may enhance the confidence a team has in its ability to perform (Guzzo, Yost, Campbell, & Shea, 1993; cf. Lester, Meglino, & Korsgaard, 2002). However, whereas network density may predict team potency, we argue it is a different and less studied aspect of a team's network structure, its centralization (Krackhardt, 1994; Wasserman & Faust, 1994, p. 182), that enables the coordination of work and thereby influences the team's ability to execute tasks efficiently. Previous research on how networks shape team outcomes has tended to focus on either one or the other of these structural characteristics of a team's network. Here we take both of these potentially complementary network characteristics into account and examine how they together shape team potency and performance (cf. Crawford & Lepine, 2013; Zhang & Peterson, 2011).

Investigations of the effects of team-level social networks on team-level outcomes have tended to concentrate on informal, friendship-like relations in teams (e.g., Balkundi et al., 2007; Mehra et al., 2006; Oh et al., 2004). Although informal networks are no doubt important, here we focus on the workflow network because it captures "the processes of acquiring inputs and distributing outputs" and therefore reflects how a team organizes to accomplish work (Brass, 1981, p. 332). The network approach to workflow directly builds on and extends Thompson's (1967, p. 54–65) conceptualization of task interdependence as the structured flow of work among unit personnel. The team's workflow is conceived as "a network that relates task positions in relation to each other" (Brass, 1981, p. 332). Unlike more traditional approaches to the structure of task interdependence, however, the network-based approach preserves data on the ordered arrangement of workflow relations among individuals rather than relying on a process of aggregating individual-level perceptions to infer group-level structures (Brass, 1985). Another advantage of the network-based approach is that it avoids the assumption that technology or task characteristics dictate or impose a workflow (for a review of studies that make this assumption, see Kiggundu, 1983). From a network-based perspective, the emergent flow of work can differ even across teams confronting the same task and employing the same technology. One can think of the emergent workflow network in a team as a "trail of information processing activities associated with managing... the dependencies between goals, activities, and actors" (Contractor et al., 1998, p. 1). Because it traces the structure of mutual dependencies within the team whereby members acquire work inputs and distribute work outputs to other team members, the characteristics of a team's workflow network may be particularly relevant for explaining differences in team-level outcomes.

Diversity in teams can be conceptualized as the distribution of differences among team members with regard to some attribute (for an extended discussion of this and alternative conceptions of team diversity, see Harrison & Klein, 2007). Of the many attributes that could be considered, we focus in this paper on nationality. Not only do individuals from different countries bring different ideas and ways of thinking to a team, they also bring with them different beliefs about how best to organize for task performance (e.g., Stahl et al., 2010; Hofstede, 2001; Kirkman & Shapiro, 1997; Laurent, 1986). The similarity-attraction (Byrne, 1971) and social-categorization (Tajfel, 1982) effects that result when a team's members come from different nationalities tend to operate at a sub-conscious level, so they can be especially difficult to detect and fix. Because cultural differences rooted in nationality can be a strong source of categorization and stereotyping, nationality-based cultural diversity may be an especially potent force in team dynamics and the "generic effects of diversity are likely to be magnified when the source of diversity is national culture" (Stahl et al., 2010: 692).

Using a nationally diverse longitudinal sample of 461 undergraduate business administration students organized as "self-managed" (e.g., Cohen & Ledford, 1994) teams, our paper develops and tests the argument that the structural characteristics of team networks and the diversity of team members interactively shape team potency and team performance.

Theory and hypotheses

Network structure and team performance

Structure can be conceptualized and measured in a number of different ways (see Nadel, 1957). In the literature on teams, one can broadly distinguish at least two perspectives. Rooted in a classic line of work on the architecture of decision making and authority in organizations, the first has typically examined structure in terms of the dispersion of decision-making authority, the distribution of rewards, and the formal allocation of tasks among team members (e.g., Hollenbeck, Ellis, Humphrey, Garza, & Ilgen, 2011). The second has drawn on "network theory" (Borgatti & Halgin, 2011) and its rich arsenal of graph theoretic measures (Harary, 1969) to represent the structure of a team in terms of the patterning of ties among its members (e.g., Brass, 1981; Sparrowe et al., 2001). Although we see these perspectives on team structure as kindred (for initial work on marrying these related perspectives, see Soda & Zaheer, 2012) our study draws primarily from the network-based approach to structure. A key advantage of a network-based approach is that it preserves data on the concrete, emergent arrangement of workflow relations among individuals rather than relying on a process of aggregating individual-level perceptions to infer group-level structures (Brass, 1981). Moreover, representing team structure using network analysis allows us to draw on sophisticated theory and methods for distinguishing the multiple and potentially overlapping characteristics of a team's structure (see, e.g., Krackhardt, 1994; for more detailed discussions of the advantages and disadvantages of studying structure from a network-based perspective, we refer readers to Kilduff & Tsai, 2003; Wasserman & Faust, 1994; Wellman & Berkowitz, 1997).

The influence of a team's network structure on its performance has received comparatively little attention in contemporary network research (which has focused largely on the effects of individual's position in networks on individual-level outcomes) but it was closely studied in a series of experimental network studies in the 1950s and 1960s. A key finding to emerge from these classic experiments was that centralized structures outperformed decentralized structures. This is despite the fact that one can mathematically demonstrate that decentralized structures are more efficient in terms of the time needed to arrive at a solution (Leavitt, 1951). Achieving the mathematically optimal solution, however, would have required team members to execute a complex sequence of information trades. This pattern of laboratory-based results appears to be corroborated in a field-based study of 45 student project groups, which found that network centralization at the team-level of analysis was positively related to team performance (Lin, Yang, Arya, Huang, & Li, 2005). The seemingly pervasive tendency in human (and many non-human) groups to centralize around one or a few individuals (Michels, 1962; Simon, 1981; cf. Friedkin, 2011) may make centralized networks easier for team members to use and to understand.

Systematic empirical studies of the effects of network centralization on performance are rare, but a case study from the annals of military history is instructive. In 1942, German submarines were sinking American ships almost at will; but the British navy—which enjoyed no comparative advantage in personnel or equipment—was performing much better against U-boat attacks. The question is: why? That the nature of the task faced by both the British and the American navies was highly complex is not in doubt (Cohen & Gooch, 1990). Rather, it appears that this difference in relative performance had more to do with differences in how workflow was structured:

> "The British excelled at the task [of fighting U-boats] because they had a centralized operational system. The controllers moved the British ships around the Atlantic like chess pieces, in order to outsmart U-boat "wolf packs." By contrast, Admiral King [who commanded the American navy] believed strongly in a decentralized management structure: he held that managers should never tell their subordinates "'how' as well as what to 'do.'" (Gladwell, 2002, p. 32)

Performance, as this historical example suggests, may be higher in centralized team structures because such structures enhance overall coordination by allowing complex information to be gathered and interpreted more quickly and efficiently than is possible in decentralized structures.

Centralized networks, however, may not be an unmitigated boon for teams. A study of 44 product development teams engaged in the development and production of new electronic products found that the centralization of the communication network in a team was negatively related to the creative performance of the team (Leenders, Van Engelen, & Kratzer, 2003). It may be that just as insufficient centralization contributes to inefficiencies in the flow of information, excessive network centralization contributes to (1) an overburdening of the central individuals in the team and (2) elicits the resentment of those relegated to the margins of the network (cf. Amabile, 1996). The central person in highly centralized networks is likely to experience a great deal of autonomy and exercise considerable influence over other team members (cf. Brass, 1981). But individuals in such positions can also become "overloaded by the many communication demands of the situation... and persons in the peripheral positions [can become] unwilling to accept a solution offered by the central person" (Shaw, 1964, p. 121). Moreover, the failure of the central team member in highly centralized networks can disrupt the workflow for the entire team (Brass, 1981). Teams that are excessively centralized are likely to be overwhelmed by the tasks of coordination and are more likely to experience bottlenecks in the flow of work.

When the workflow network in a team is insufficiently centralized, teams may find coordination difficult to achieve and team performance is likely to suffer. However, when the workflow network in a team is overly centralized, this may cause central individuals to become overwhelmed with task demands and may cause those on the margins to become unmotivated and uncooperative resulting in poor task performance by the team. We therefore hypothesize that optimal team performance will be achieved at moderate levels of network centralization:

Hypothesis 1. The centralization of a team's workflow network will have an inverted U-shaped relationship with team performance such that team performance will be greatest at a moderate level of centralization.

Network structure and team potency

The performance of a team can be assessed not only in terms of how well it actually performs but also in terms of how confident its members are that it will go on to perform well. Indeed, the importance of confidence for the conduct of human affairs is difficult to overstate. One of the main findings that have emerged from the sprawling inter-disciplinary literature on confidence is that people are often more confident than is warranted by the facts, and this overconfidence can lead to disastrous consequences (Griffin & Tversky, 1992). The sense of invulnerability that prevailed in the top management team at Bears Stearns, to take just one example, appears to have played a major role in its spectacular collapse, in 2008, when the venerable institution was swallowed whole by its rival J.P. Morgan Chase (Cohan, 2009; Gladwell, 2009). The concept of confidence has been addressed from a variety of theoretical perspectives under a number of different labels but the "basic phenomenon being addressed centers on people's sense of self-efficacy to produce and to regulate events," where self-efficacy "is a comprehensive summary or judgment of perceived capability for performing a certain task" (Bandura, 1982, p. 122). People make judgments of efficacy that influence how much effort they expend and how long they persist in the face of challenges. The link between knowledge and action, from this socio-cognitive perspective, is mediated by self-referent thought. A person can possess certain skills, but whether and how those skills are used will depend on the person's thoughts. This is why people who may possess the same skills can nevertheless perform differently, and why the same person may achieve different levels of performance on different occasions (Bandura, 1986). Because learning tends to improve with practice and perseverance, higher levels of efficacy tend to be related to higher levels of performance. Perceptions of self-efficacy were positively related with the sales performance of life insurance agents (Barling & Beattie, 1983), the research output of professors (Taylor, Locke, Lee, & Gist, 1984), and with the ability of individuals to cope with major career hurdles (Stumpf, Brief, & Hartman, 1987).

At the team level of analysis, confidence has been studied under the rubric of "potency" (Guzzo et al., 1993). The manner in which the concept of confidence has been theorized at the team level is similar to the manner in which it has been theorized at the individual level, but there are some notable differences. Whereas confidence at the individual level is associated with beliefs in the ability to perform specific tasks, potency captures generalized beliefs about the performance capabilities of teams across tasks and contexts (Gibson & Earley, 2007; also see the discussion in Ilgen, Hollenbeck, Johnson, & Jundt, 2005, p. 521-522). Teams with high levels of potency may be better able to channel the motivation and resources of their members to meet the challenges they confront and to persist and even learn in the face of those challenges. However, it is important to keep in mind that team potency is "not a simple sum of the self-efficacy of individual team members, and it develops independently from individual self-efficacy" (Hu & Liden, 2011: 852). Team potency has been found to be positively related to team effort and team satisfaction (e.g., Campion, Medsker, & Higgs, 1993; de Jong, de Ruyter, & Wetzels, 2005).

Which kinds of network structures are likely to be associated with team potency and why? We know that knowledge and support tend to be more easily shared in dense networks, which are characterized by a high degree of interconnectivity among members, than in sparse networks because dense network structures enhance the willingness and motivation of team members to share knowledge with one another (Reagans & McEvily, 2003). Dense social networks also promote interpersonal trust, in part because mutual awareness and surveillance is higher when group members are highly interconnected and member reputations become readily observable and accessible (Coleman, 1988; Granovetter, 1985). Moreover, the level of interpersonal communication is likely to be higher in densely connected groups, which, as previous studies of work teams have shown, fosters openness and facilitates interpersonal learning (Gladstein, 1984). Team members are likely to experience enhanced social support in densely connected networks and members of teams with high levels of social support have been found to display better coping mechanisms and higher levels of self-efficacy (Campion et al., 1993). Indeed, evidence from both the laboratory (Shaw, 1964) and the field (e.g., Mehra et al., 2006) suggests that team members tend to be more satisfied in densely connected networks.

It is possible that team members are more satisfied in densely connected networks because such networks enhance such team-level cognitive variables as perceived goal clarity (cf. Hu & Liden, 2011). Or it may be that densely connected workflow networks produce a sense of equity and fairness regarding how the team has organized for task accomplishment. What seems clear is that a sense of interpersonal trust and a positive mood are likely to prevail in densely knit groups, and such moods have been shown to enhance feelings of efficacy not just in individuals (e.g., Kavanagh & Bower, 1985) but also in groups (Lee, Tinsley, & Bobko, 2002). Furthermore, networks in teams structure interaction and communication and, therefore, the possibilities for collective sensemaking about the team's capabilities to perform effectively (cf. Gibson & Earley, 2007; Weick, 1995). As team members interact with each other and share subjective impressions, they collectively negotiate meaning and develop a sense of team potency (Gibson, 2003). It may even be that team members look to the network structure of their team as an indicator of their performance potential (cf. Kilduff & Krackhardt, 1994; Podolny, 2005). Because dense interconnectivity suggests cohesion and an egalitarian distribution of work, density is likely to be schematically associated, as a kind of proxy (cf. Swedberg, 2010), in the minds of team members with the ability of the team to perform. We expect, therefore, that teams with dense networks will tend to develop high levels of team potency.

Hypothesis 2. The higher a team's workflow network density the higher the team's potency.

The interactive effects of cultural diversity and network structure

The predominantly structural orientation of network analysis has meant that culture has been mostly absent from network theory and research (Emirbayer & Goodwin, 1994). We argue that there are several reasons why network studies of team processes should attend to the cultural diversity of a team (indexed here by nationality—see Stahl et al., 2010). First, individuals from different countries bring with them different beliefs about how best to organize for task performance (e.g., Stahl et al., 2010; Hofstede, 2001; Kirkman & Shapiro, 1997; Laurent, 1986). Culture is not deterministic (Laurent, 1983) but there is ample evidence to suggest that it powerfully shapes individuals' values, cognitive schemas, language, demeanor, and preferences for how best to organize for work (e.g., Hambrick, Davison, Snell, & Snow, 1998; Hofstede, 1983—for a review, see Earley & Gibson, 2002). The more that a team is culturally diverse in terms of its composition, the more likely that its members may clash over how to structure the flow of work. Second, similarity-attraction theories (e.g., Byrne, 1971) suggest that people are drawn to similar others, which implies that culturally diverse teams are more likely to face challenges in building and sustaining interpersonal interaction and cooperation among team members. Third, social categorization theory (e.g., Tajfel, 1982) suggests that people tend to categorize each other into in-group and out-group members on the basis of salient characteristics, such as nationality. Because in-group members are treated more favorably relative to out-group members, conflict is likely to be higher in diverse teams than in relatively homogenous ones. Cultural diversity in teams, therefore, is likely to trigger greater uncertainty and conflict over how best to organize for work accomplishment.

We previously argued that densely connected networks are likely to fuel a sense of potency in teams because dense networks are likely to promote (and signal) a sense of fairness and equity. Given the increased potential for conflict and disagreement in multinational teams over how to organize for work, we suggest that the positive relationship between the density of a team's network and team potency should be especially pronounced in teams that are diverse in terms of nationality. When cultural diversity in teams is high, the resultant uncertainty will mean that team members may be more likely to look to the network structure of their team as an indicator of their performance potential (cf. Podolny, 2005). Because dense interconnectivity in the workflow network suggests cohesion and an egalitarian distribution of work, culturally diverse teams may be especially prone to interpreting a dense pattern of network relations as a reason for confidence in the team's ability to perform well in the future.

Hypothesis 3. The positive relationship between team workflow network density and team potency will be stronger in teams that are high in cultural diversity (in terms of member nationality) compared to teams that are low in cultural diversity.

We argued earlier that whereas the density of a team's network may influence team potency it is the centralization of the team's network that is likely to shape the team's performance. Optimal team performance would be achieved at moderate levels of network centralization because too little centralization would lead to inefficiencies in the flow of information and too much would lead to an overburdening of central individuals in the network. Here we argue that because nationality diversity increases the possibility of disagreement and conflict over how to organize for work the amount of network centralization that is optimal for team performance will be greater in teams that are more nationally diverse. The greater potential for disagreement and conflict in teams with high levels of nationality diversity means that the degree of structural coordination required for effective team performance will also be higher.

Hypothesis 4. The inverted u-shaped relationship of team workflow network centralization with team performance will be moderated by the team's cultural diversity (in terms of member nationality) such that the level of team workflow centralization that is optimal for team performance will be higher for teams that are high in cultural diversity (in terms of member nationality) compared to teams that are low in cultural diversity.

Taken together, these four hypotheses suggest an overall theoretical model, summarized in Fig. 1, of how the structural characteristics of a team's workflow network and the cultural diversity of its members interactively influence team potency and team performance.

Method

Sample and setting

Prior work suggests that differences in tasks, formal leadership styles, functional expertise of members, prior performance, and prior expertise all influence team potency (de Jong et al., 2005; Guzzo et al., 1993; Lester et al., 2002). We strategically selected a sample that allowed us to effectively "control" for these effects while providing us with the variance in nationality diversity we needed for testing our hypotheses: 92 student teams (461 individuals with 60 different nationalities) taking part in a for-credit course on organizational analysis at a major European business school. Students were assigned to five-person teams. Care was taken to balance teams in terms of prior student performance (as reflected in prior grades). Because a few students dropped the course after initial team assignments, the sample contains three teams with four members, four teams with six members, and 85 teams with five members. On average, teams had 5.01 members. The results we report below were unchanged when we dropped all but teams of size five from the analysis. The task that each team was assigned was identical: to conduct and write-up, over a period of 11 weeks, a comprehensive firm-analysis. The average respondent was 21 years old. The sample was roughly balanced in terms of gender (female: 43 percent).

The procedure we used for collecting data on the workflow network was modeled after Brass (1981). The roster method collects network data in the following way: First, respondents were presented a list of all names of their team members. Second, we asked respondents to rate for each team member the extent to which they agreed with the statement that individual team members provided them with relevant inputs for their work ("Do not agree at all" (1); "Totally agree" (5)). We defined work inputs as "any materials, information, texts, etc., that you must acquire for your job on the team" (Brass, 1981). We then coded the results in a matrix in which each cell contained a team member's rating of another team member's input. (We also collected, using the same procedure, data on friendship relations, for control purposes, as explained below. The wording of the question used to capture perceptions of friendship was based on Brass, 1981. Respondents could choose between having a friendship relationship with a team member (coded as 1) or not having a friendship relationship (coded as 0). For further details on this approach to network data collection, please see, e.g., Borgatti, Everett, & Johnson, 2013, pp. 44–61).

Our study relied on a longitudinal design: Data on the workflow network in teams were collected via an online survey in week 5 (response rate: 95 percent); data on team potency were collected using an online survey in week 9 just two days before the teams handed in their final reports (response rate: 98 percent); and data on team performance were collected directly from evaluators in week 11 (response rate: 100 percent). Only three teams had response rates below 80 percent on the network survey. Exclusion of these teams from the sample did not change the pattern of results (results available upon request).

Measures

Team performance

Our measure of team performance was the grade that expert faculty graders assigned to the team's final report. A total of eight judges rated the 92 student teams. Graders received explicit grading rubrics from the course instructors to help ensure standardization of the grading procedure. Grades could range from 1 (bad) to 10 (excellent).

Team potency

We measured team potency using the 8 item scale developed by Guzzo et al. (1993). Scale items include "this team believes it is

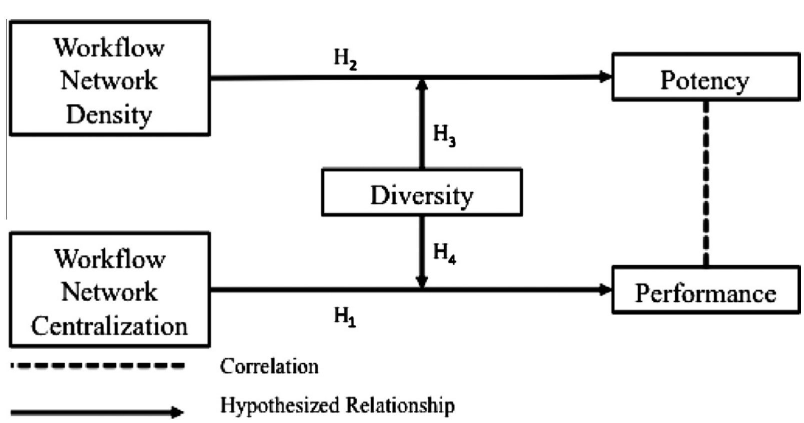

Fig. 1. Theoretical model.

unusually good at producing high-quality work", "this team feels it can solve any problem it encounters," and "no task is too tough for my team". Team members were asked to rate each item on a five-point Likert scale (strongly disagree: 1; strongly agree: 5). Individual responses were then averaged to calculate team potency ($\alpha = .90$). We checked to confirm that this aggregation to the team level was justified: Random group resampling (RGR) showed that team members' within-team agreement was higher than expected by chance (the variance within actual teams was smaller than the variance within randomly generated groups) ($z = -3.90$; $p < .001$) (Bliese, 2000). Rwg was on average .94 with a median of .96. The lowest value was .83 and the highest .99. ICC(1) was .22 and ICC(2) was .63. While these values are above recommended minimum thresholds, some might argue that ICC(2) was slightly below the value of .70 that some recommend as a rule of thumb. This relatively low value for ICC(2), however, is not surprising given the relatively small size of the teams we examined (see Snijders and Bosker, 1999). Low ICC(2) values indicate a limited ability to detect relationships involving group-level variables, which suggests that if we detect such relationships it is unlikely to be a methodological artifact (Bliese, 1998, 2000).

Workflow network centralization

Whereas much of the prior literature on social networks in work settings has focused on the extent to which a given individual is central in a larger network, our focus in this paper is on the degree to which the larger, team-level network is itself centralized around one or a few individuals. Network centralization at the team-level can be thought of as a measure of the range or variability of individual-level centrality indexes (Wasserman and Faust, p. 176). There are a number of different conceptualizations of the notion of centrality; and each conceptualization is tied to one or more different measures and/or algorithms (see the discussion in Borgatti et al., 2013: 164–165). It is important, therefore, that the measure one uses fits the theoretical claims one is using the measure to test. Our theory emphasizes the role of workflow network centralization as a structural device whereby a team is able to coordinate its activities. We therefore picked a measure of centrality ("flow betweenness," see Freeman et al., 1991; cf. Freeman, 1979) that gets directly at the theoretical notion of structural coordination. Considered at the individual-level, this is a measure of the extent to which the flow of work passes through a given individual (cf. Brass, 1981, p. 335). Considered at the team-level, this is a measure of the extent to which the overall flow of work within the team is coordinated through a few individuals. Unlike its more familiar variant, the "betweenness" measure of centrality (Freeman, 1979), the flow betweenness algorithm can handle—more realistic—valued data; and it does not make the "restricted" and "potentially misleading" assumption that work only flows along the shortest ("geodesic") path (Freeman et al., 1991, p. 144).

We computed workflow network centralization at the team level using the flow beweenness algorithm in UCINET VI, Version 6.335 (Borgatti, Everett, & Freeman, 2002). The algorithm first computes a flow betweenness score for each individual in a team's network that is then normalized for team size (because teams differed in size). A team member's normalized flow betweenness score is calculated as (Freeman et al., 1991):

$$C'_F(p_i) = \frac{\sum_{j<}^{n}\sum_{k}^{n} m_{jk}(x_i)}{\sum_{j<}^{n}\sum_{k}^{n} m_{jk}}$$

Here m_{jk} represents the maximum flow of work from a team member x_j to another team member x_k and $m_{jk}(x_i)$ represents the maximum flow from x_j to x_k that passes through team member x_i. Then the degree to which the maximum flow between all unordered pairs of team members depends on x_i, where $j < k$ and $i \neq j \neq k$. The flow betweenness centralization score for each team in our sample was calculated as the average difference between the centrality of the most central team member and that of all other team members. The equation is given as follows, where $C_F(p^*)$ is the normalized centrality of the most central person (Freeman et al., 1991).

$$C_F \frac{\sum_{i=1}^{n}\left[C_F\left(p^*\right) - C_F^*\left(p_j\right)\right]}{n-1} \times 100$$

Values for this measure of team network centralization can range from zero to one-hundred, with one-hundred meaning that a single team member completely coordinates workflow and zero meaning that all team members are equally dependent on each other for the flow of work. Prior to submitting the data to the flow betweenness routine in UCINET, we symmetrized the network data using the "minimum rule," which assigns the weight of a tie between A and B as the minimum of the tie-weight reported by A and B. This conservative approach to tie-symmetrization avoids overrating the amount of work that flowed between two individuals and is a standard approach used in network research to enhance reliability.

Workflow network density

We followed previous work (e.g., Sparrowe et al., 2001) and calculated workflow network density as the average strength of ties between members of a team. The measure could vary from a minimum of 1 (i.e., team members do not exchange work input/output) to a maximum of 5 (all team members are heavily involved in exchanging work inputs/outputs). We used UCINET VI, Version 6.335 (Borgatti et al., 2002) to compute the measure. Note that whereas our measure of network centralization quantifies the spread or dispersion of workflow, network density quantifies the average flow of work within the team.

Cultural diversity

We used nationality as a proxy for underlying cultural differences (e.g., Stahl et al., 2010). Data on nationality were collected from respondents using a drop-down list on the online survey. Our sample comprised 60 different nationalities. Dutch students were the most numerous in our sample (49.3%) followed by Germans (10%), Chinese (6.4%), and Bulgarians (4.5%). We used Blau's (1977) index to compute nationality diversity at the team level of analysis. The value of the index is given by (p is the proportion of unit members in kth category):

$$1 - \sum p_k^2$$

Values of Blau's index can range from zero to $(K-1)/K$ where K is the number of categories (in our case, nationalities) in each unit (in our case, teams). The mean nationality diversity score in our teams was .46 (*SD* = .26). The minimum was .00 (a team composed of only one nationality) and a maximum of .80 (a five person team with team members from five different nationalities).

This measure captures the idea of diversity as variety. Variety is maximized when each member of the team has a different nationality and it is minimized when all members of the team have the same nationality.

Our theory focuses on the potential for greater conflict in teams—arising from processes described by similarity-attraction (Byrne, 1971) and social-categorization (Tajfel, 1982) theories—whose members come from different nationalities. For our theory to apply, nationality would have to be a relatively salient attribute in this setting. There was ample evidence that this was the case. The data were collected at a university that emphasized, on its website and in promotional materials, the nationality diversity of its students as a source of strength and distinctive competence. A representative quote from one of the students in our study highlights the salience of nationality in the setting we examined: "The program promotes the fact that it takes students of around 40 different nationalities each year—and that is true! I am surrounded by students from virtually all corners of the earth and [this] interaction significantly strengthens my ambition to prepare for a career in international business."

Our theory makes no claims about how the degree of difference between different national cultures influences the likelihood of conflict in teams. We therefore ruled out measures of team-level diversity (see Harrison & Klein, 2007) that would have required us to make assumptions about the relative distance between nations in terms of work-related cultural preferences and beliefs.

Control variables

Teams can be demographically diverse in a number of different ways. Although the focus of our analysis was nationality, we included in our analysis controls for team diversity for gender, age, length of tenure at the university (all computed using Blau's index of heterogeneity), and student GPA (collected directly from university records and computed as within-group standard deviation). The focus of our study was the workflow network but we included centralization in the friendship network ("*friendship network centralization*") and density in the friendship network (*"friendship network density")* as controls in the regression models. We also included a perceptual measure of task interdependence based on Van de Ven, Delbecq, and Koenig's (1976) pictorially-based measure of team-level task interdependence. Finally, we included team size as a control variable because not all teams were of the same size, which could have affected team outcomes.

Analysis

The performance score for each team was based on the evaluation of one of eight judges, each of whom was provided with the same grading rubric. Because judges evaluated more than one group, team performance could be correlated within raters, which violates the OLS assumption of independence of observations and generates invalid test statistics. To test Hypotheses 1 and 4 we therefore used the cluster option in STATA 12.0 (StataCorp, 2011), which uses linearization/Huber/White/sandwich (robust) estimates of variance. These estimates of variance are robust to any correlation of team performance evaluations within raters because they estimate the variance–covariance matrix and assume covariance between ratings by the same rater but no covariance across different raters (Rogers, 1993). To construct this matrix, the conventional variance–covariance matrix is weighted by using contributions (to the score function) of each rater (see Glomb and Liao (2003) for a similar application of this method). We used standard OLS regression to test Hypotheses 2 and 3, which predicted team potency. All variables were mean-centered prior to analysis to reduce the effects of multicollinearity (Aiken & West, 1991; Snijders & Bosker, 1999).

Results

Descriptive statistics and correlations among the variables in our study are reported in Table 1.

Our first hypothesis predicted a curvilinear (inverted U) relationship between workflow network centralization and objective team performance. The standardized results of the clustered regression analysis are presented in Table 2. In the first step of the clustered regression, we entered network density, which did not have a significant effect on objective team performance. We then entered the linear term for centralization, which was not significant, either. As hypothesized the coefficient for the squared term for centralization was negative and significant ($\beta = -.46$, $p < .01$) and the linear effect was also significant ($\beta = .67$, $p < .01$) (Table 2, Model 2). The significant negative squared effect of network centralization indicates that the curve has an inverted U-shaped curve (Aiken & West, 1991). Team performance was higher at moderate levels of workflow network centralization than at low and high levels of centralization. The maximum performance was reached at higher levels of centralization than the average level of network centralization for the teams in our sample (+0.73 SD). Beyond this point network centralization had a negative influence on performance. These results indicate support for Hypothesis 1.

Our second hypothesis predicted a positive relationship between workflow network density and team potency. OLS regression results reported in Table 3 show support for this hypothesis: the coefficient for network density is significant ($\beta = .19$, $p < .001$) (Table 3, Model 2). Note that the regression model included network centralization as a control ($\beta = -.03$, *ns*). These results suggest that workflow network density (and not network centralization) positively influences team potency. Hypothesis 2 was supported.

Our third hypothesis predicted that workflow network density would be more strongly related to potency in teams that were culturally diverse in terms of member nationality relative to teams that were homogeneous. The regression results in Table 3, Model 3, show support for this prediction: the regression coefficient for network density ($\beta = .18$, $p < .001$) and the interaction term between network density and cultural diversity ($\beta = .07$, $p < .05$) are both significant. We plotted the relationship between workflow network density and team potency for high levels (+1 SD) and low levels (−1 SD) of cultural diversity. Fig. 2 shows that workflow network density had a stronger relationship with team potency for culturally diverse teams ($\beta = .25$, $p < .001$) than for more homogeneous teams ($\beta = .11$, $p < .05$). The difference between the slopes was significant ($t = 1.84$, $p < .05$).

Some prior research has found an inverted U-shaped relationship between a team's network density and the team's performance (e.g., Balkundi et al., 2007; Oh et al., 2004) whereas other research has not (e.g., Mehra et al., 2006; Zhang & Peterson, 2011). We explored this discrepancy by conducting a post hoc analysis to see if there was support for an inverted U-shaped relationship between network density and our measure of team performance. The results of clustered regression analyses indicated that the quadratic term of task network density was not significant ($\beta = .09$, $p = .33$). There was no support for an inverted U-shaped relationship between task network density and team performance in our study.

Our final hypothesis predicted that the degree of workflow centralization required to achieve maximum task performance would be higher in culturally diverse teams than in relatively homogenous teams. For this hypothesis to be supported, the interaction effect of network centralization and cultural diversity and the squared effect of centralization would both have to be significant (Aiken & West, 1991). Table 2 (Model 3) shows that the term representing the interaction between network centralization and cultural diversity was significant ($\beta = .24$; $p < .05$) and the squared main effect of centralization was also significant and negative ($\beta = -.66$; $p < .01$). These results indicate that the curvilinear relationship between workflow network centralization and performance differed for high and low levels of cultural diversity. To further unpack these results, we followed the graphing method outlined by Aiken and West (1991) for interpreting interactions

Table 1
Correlations, means, and standard deviations.

Variables	Mean	*SD*	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Team potency	3.82	0.43												
2. Team performance	7.29	1.17	.29**											
3. Task interdependence	2.32	0.44	.22*	.01										
4. Team size	5.01	0.28	.05	.05	−.02									
5. Grade diversity	0.84	0.88	.12	.10	−.11	−.01								
6. Tenure diversity	0.44	0.19	−.33**	−.21*	−.30**	.08	.05							
7. Age diversity	0.58	0.17	.12	.04	−.04	.12	.16	.18						
8. Gender diversity	0.27	0.21	−.07	−.06	−.06	.04	−.06	.14	.19					
9. Friendship network centralization	0.18	0.14	−.04	.05	−.12	.27**	−.01	.07	.11	.24*				
10. Friendship network density	3.30	0.23	.24*	.05	.25*	−.01	−.03	−.24*	−.18	−.28**	−.30**			
11. Workflow network density	0.66	0.23	.44***	.02	.11	−.11	.01	−.17	.03	−.12	−.46***	.38***		
12. Workflow network centralization	8.15	6.91	−.14	.02	−.09	.10	−.04	.16	−.04	.27*	.81***	−.34***	−.44***	
13. Cultural diversity	0.47	0.26	−.07	.02	−.02	.14	.25*	.15	.35***	.15	.06	−.06	−.02	.03

Note: N = 92.
* $p < .05$.
** $p < .01$.
*** $p < .001$, significance levels are two-tailed.

Table 2
Results of clustered regression analysis predicting team performance.

Variables	Model 1	Model 2	Model 3
Control variables			
Task interdependence	−.06 (.15)	−.04 (.15)	−.01 (.17)
Team size	.05 (.18)	.08 (.18)	.09 (.18)
Grade diversity	.10 (.10)	.10 (.10)	.13 (.10)
Tenure diversity	−.26* (.12)	−.27* (.13)	−.25 (.14)
Age diversity	.05 (.10)	.08 (.11)	.10 (.10)
Gender diversity	−.07 (.13)	−.08 (.12)	−.08 (.12)
Friendship network centralization	.14 (.15)	−.10 (.11)	−.23* (.11)
Friendship network density	−.01 (.20)	.02 (.18)	.03 (.21)
Workflow network density	.16 (.21)	.18 (.21)	.19 (.20)
Main variables			
Workflow network centralization		.67** (.20)	.98** (.23)
Workflow network centralization squared		−.46** (.14)	−.66** (.18)
Cultural diversity		−.01 (.11)	.02 (.09)
Workflow network centralization X cultural diversity			.24* (.09)
R^2	.08	.10	.13
ΔR^2		.02	.03

Note: N = 92. Robust regression coefficients are reported together with standard errors.
* $p < .05$.
** $p < .01$, significance levels are one-tailed.

Table 3
Results of Regression Analysis Predicting Team Potency.

Variables	Model 1	Model 2	Model 3
Control variables			
Task interdependence	.04 (.05)	.05 (.04)	.05 (.04)
Team size	.02 (.04)	.03 (.04)	.03 (.04)
Grade diversity	.05 (.04)	.06 (.04)	.06 (.04)
Tenure diversity	−.12** (.05)	−.09* (.04)	−.10** (.04)
Age diversity	.07 (.05)	.06 (.04)	.05 (.04)
Gender diversity	.00 (.05)	.00 (.04)	.00 (.04)
Friendship network centralization	.05 (.08)	.11 (.07)	.11 (.07)
Friendship network density	.08 (.05)	.03 (.05)	.02 (.05)
Main variables			
Workflow network centralization	−.05 (.08)	−.03 (.07)	−.04 (.07)
Workflow network density		.19*** (.05)	18*** (.05)
Cultural diversity		−.06 (.04)	−.05 (.04)
Workflow network density X Cultural diversity			.07* (.04)
R^2	.12	.27	.29
ΔR^2		.15	.02

Note: N = 92. Standardized regression coefficients are reported together with standard errors.
* $p < .05$.
** $p < .01$.
*** $p < .001$, significance levels are one-tailed.

in the presence of curvilinear relationships. Fig. 3 depicts the interaction at two levels of cultural diversity—plus and minus one standard deviation (+1 SD/−1 SD; Aiken & West, 1991). An examination of this graph shows that the maximum-point of the inverted U-shaped relationship between workflow network centralization and performance shifts horizontally as a function of cultural diversity ($p < .05$). The performance of teams with higher cultural diversity (i.e., plus one standard deviation) benefited more from higher levels of network centralization than teams with lower cultural diversity (i.e., minus one standard deviation; see Fig. 2). Simple calculus revealed that the maximum of the curve was just above the mean of network centralization for teams low in cultural diversity (+.56 SD) and almost half standard deviation higher for highly cultural diverse teams (+.92 SD). This means that diverse teams required almost half a standard deviation more centralization to perform optimally compared to more homogeneous teams. These results support Hypothesis 4.

Discussion

This paper examined the interactive effects of network structure and the cultural diversity present within a team on both a team's confidence in its ability to perform ("team potency") and its actual performance. Our theory and analysis distinguished

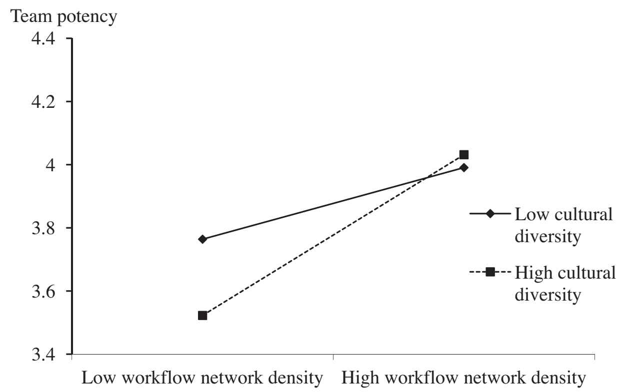

Fig. 2. Influence of workflow network density and cultural diversity on team potency.

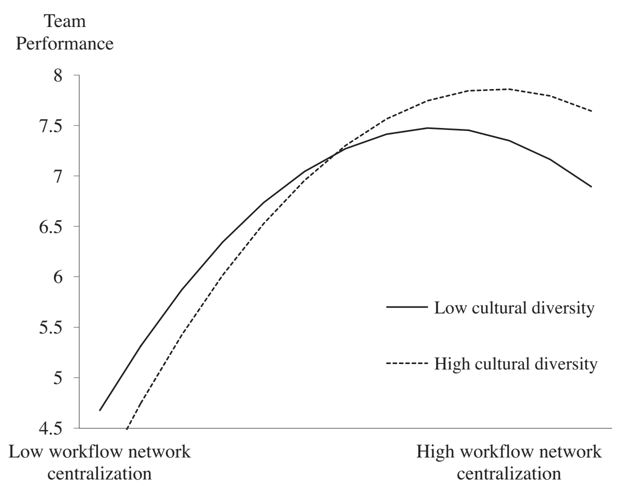

Fig. 3. Influence of workflow network centralization and team diversity on team performance.

two related but conceptually distinct characteristics of a team's workflow network: density, which represents the average strength of relations in the network, and centralization, which is a measure of the dispersion of workflow relations. In support of hypotheses, we found that whereas dense workflow networks promoted team potency it was the development of (moderately) centralized workflow networks that facilitated team performance. These network effects, moreover, were more pronounced in teams that were diverse (in terms of member nationality) than in teams that were relatively homogenous. These results indicate support for the idea that team diversity may be a key contingency factor in the relationship between a team's network structure, the level of team potency achieved within the team, and the team's performance.

Implications for theory and future research

Our study suggests that the structure of emergent workflow networks in teams help shape team performance. The teams we examined achieved optimal performance at moderate levels of network centralization: When centralization was low, teams may have lacked the necessary coordination for effective performance; when it was too high, team performance suffered, presumably because the central nodes become overburdened and because the peripheral nodes resented the disproportionate influence that central nodes had over how work was accomplished. Our results are consistent with those found in a classic line of laboratory studies (Shaw, 1964) and more recent field-based work suggesting a curvilinear relationship between a network measure of team fragmentation and team performance (Balkundi et al., 2007). It is important to note, however, that the effects of network structure on team performance are likely to vary as a function of the kind of tasks that teams have to accomplish (Crawford & Lepine, 2013). The student teams we examined were each tasked with conducting and writing up a company analysis. It could be that greater task complexity would have required less centralized networks for effective task performance, a pattern that would fit the findings reported in the study of new product development teams in the electronics industry (Leenders et al., 2003). It is also possible that the effects of network centralization on task performance would vary if performance were broken down into such categories as creativity and pace. Centralized networks may help teams produce faster solutions but decentralized networks could help teams produce more creative solutions. We encourage future studies in this line of work to systematically vary task type and disaggregate team performance so we can better understand the effects of a team's network structure on how it performs.

Prior research has identified a number of compositional factors—such as the team's prior experience and performance, mean levels of personality, external support, goal clarity, verbal persuasion, leadership styles, and the diversity of functional competencies available within a team—that appear to influence team potency (e.g., de Jong et al., 2005; Hu & Liden, 2011; Zhang & Peterson, 2011). The role that social network structures may play in shaping team potency has received comparatively little attention, an omission that struck us as surprising given the well-established importance of social relationships in the formation and diffusion of shared beliefs and attitudes in teams (e.g., Friedkin, 1998). Social networks channel resources and this may help explain why teams with certain network structures outperform others (e.g., Sparrowe et al., 2001). What the results of our study suggest is that in addition to playing this role as pipes that channel resources network structures may also serve a cognitive function as signals of the underlying potential of the team. Dense networks may influence the confidence the team's members have in the ability of the team to perform because they are schematically associated, as a kind of proxy (cf. Swedberg, 2010), with a high potential for success. Distinguishing the role of networks as pipes that transmit resources from their potential role as signals of underlying team potential should be a high priority for future research. One possibility, for example, would be to use a laboratory-based design (relying perhaps on a computer-generated virtual environment) that would allow actual and perceived network structures to be systematically manipulated. Teasing apart the flow-based from cognition-based mechanisms whereby networks in teams influence team outcomes would not only enhance our understanding of how teams work but would address questions that are fundamental to the progress of network theory (cf. Burt, Kilduff, & Tasselli, 2013; Podolny, 2005).

Researchers and practitioners have both sought to identify the configuration of network ties within a group that is optimal for group effectiveness. Our study suggests that the answer to this question may be a highly contingent one. We found that the network configurations that optimize certain aspects of group effectiveness (e.g., team potency) were different from network configurations that optimized certain other aspects of group effectiveness (e.g., team performance). Moreover, these network effects varied as a function of the cultural composition of the team. It seems likely to us that there may be other important contingencies—such as the content of network ties (workflow, advice, friendship, etc.), and the quality of leadership exercised in the group (Zhang & Peterson, 2011)—that both researchers and practitioners should take into consideration when attempting to optimize network configurations in teams. We found statistical support for our hypotheses, but the amount of variance our models have explained is modest. This is particularly the case with our interactional hypotheses; but it should be kept in mind that moderation effects are difficult to detect in the field and that even relatively small percentages of explained variance are arguably meaningful (McClelland & Judd, 1993). Another potential limitation of our study is that we theorized that workflow network structure influences team-level outcomes through such mechanisms as enhanced interpersonal trust and motivation and the perceived efficiency and fairness with which work is distributed, but we did not measure these cognitive variables directly (cf. Hu & Liden, 2011). Future studies may want to more directly investigate the role of these more proximal variables in linking network structure with team potency and performance. To the extent that these team cognitive variables represent alternate routes for influencing team outcomes, they may well substitute for the effects of network structure on team potency and performance. A different possibility we did not examine here is that the independent and interactive effects of network structure on team outcomes vary as a function of team size. Whether the network effects we observed would be heightened or muted in much larger teams is a question left for future studies to tackle. Finally, our conceptualization and measurement of team diversity focused on the potential for differences in member nationality to influence conflict and workflow coordination in teams through processes specified in theories of similarity-attraction (e.g., Byrne, 1971) and social-categorization (e.g., Tajfel, 1982). We therefore ruled out measures of team-level diversity that would have required us to make assumptions about the relative distance between nations in terms of work-related cultural preferences and beliefs (for an extended discussion, see Harrison & Klein, 2007). However, it may be that diversity in teams is not simply a matter of the variety of different people in a team but also hinges on the extent of difference between people of different nations. Theorizing how team diversity conceived in terms of "separation" and "variety" (Harrison & Klein, 2007) combines with network structure to influence team potency and performance strikes us a topic in need of attention.

Conclusion

One can distinguish two distinct approaches for evaluating the potential of work teams: the first ("compositional") approach focuses on relevant demographic characteristics of team members; the second ("structural") approach focuses on the pattern of connections between team members (see Reagans et al., 2004). The compositional approach has tended to assume that one can infer the characteristics of emergent social networks from the attributes of a team's members. For example, higher levels of turnover in demographically diverse teams can be attributed to suboptimal patterns of interpersonal communication. This approach is attractive because demographic variables are easily measured and offer parsimonious explanation. However, in leaving the hypothesized patterns of interpersonal communication unexamined, the demographic approach runs the risk of generating spurious theory (Lawrence, 1997; for evidence, see Reagans & Zuckerman, 2001). The network-based approach, by contrast, focuses directly on the patterns of interaction that influence team outcomes rather than assuming that indicators of team diversity can be taken as reliable proxies for unobserved, emergent network structures in teams (e.g., Reagans et al., 2004). What the network approach has tended to ignore, however, is the possibility that the effects of a team's network may be contingent on the demographic makeup of the team. The results of our study strongly suggest that the predictive accuracy of our theories can be enhanced by considering both the demographic makeup of teams *and* the structural characteristics of their networks. It may be that in seeking to understand team outcomes "a social network-based approach is preferable to an exclusive focus on team demography" (Reagans et al., 2004, p. 131). What our study suggests is that rather than relying on an exclusive focus on either team networks or team demography, theory development should focus on how structural and demographic factors interactively shape important team outcomes.

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References

Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park, CA: Sage.
Amabile, T. M. (1996). *Creativity in context*. New York: Westview Press.
Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist, 37*, 122–147.
Bandura, A. (1986). *Social foundations of thought and action: A social-cognitive view*. Engelwood Cliffs, NJ: Prentice-Hall.
Balkundi, P., & Harrison, D. A. (2006). Ties, leaders, and time in teams: Strong inference about the effects of network structure on team viability and performance. *Academy of Management Journal, 49*, 49–68.
Balkundi, P., Kilduff, M., Barsness, Z. I., & Michael, J. H. (2007). Demographic antecedents and performance consequences of structural holes in work teams. *Journal of Organizational Behavior, 28*, 241–260.
Barling, J., & Beattie, R. (1983). Self-efficacy beliefs and sales performance. *Journal of Organizational Behavior Management, 5*, 41–51.
Blau, P. M. (1977). *Inequality and heterogeneity*. New York: Free Press.
Bliese, P. D. (1998). Group size, ICC values, and group-level correlations: A simulation. *Organizational Research Methods, 1*, 355–373.
Bliese, P. D. (2000). Within-group agreement, non-independence, and reliability: Implications for data aggregation and analyses. In K. J. Klein & S. W. J. Kozlowski (Eds.), *Multilevel theory, research, and methods in organizations: Foundations, extensions, and new directions* (pp. 349–381). San Francisco, CA: Jossey-Bass.
Borgatti, S. P. (2005). Centrality and network flow. *Social Networks, 27*, 55–71.
Borgatti, S. P., Everett, M. G., & Freeman, L. C. (2002). *Ucinet for windows: Software for social network analysis*. Harvard, MA: Analytic Technologies.
Borgatti, S. P., Everett, M. G., & Johnson, J. C. (2013). *Analyzing social networks*. SAGE Publications Limited.
Borgatti, S. P., & Halgin, D. (2011). On network theory. *Organization Science, 22*, 1168–1181.
Borgatti, S. P., Mehra, A., Brass, D. J., & Labianca, G. (2009). Network analysis in the social sciences. *Science, 323*, 892–895.
Brass, D. J. (1981). Structural relationships, job characteristics, and worker satisfaction and performance. *Administrative Science Quarterly, 26*, 331–348.
Brass, D. J. (1985). Men's and women's networks: A study of interaction patterns and influence in an organization. *Academy of Management Journal, 28*, 327–343.
Burt, R. S., Kilduff, M., & Tasselli, S. (2013). Social network analysis: Foundations and frontiers on advantage. *Annual Review of Psychology, 64*, 527–547.
Byrne, D. (1971). *The attraction paradigm*. Orlando, FL: Academic Press.
Campion, M. A., Medsker, G. J., & Higgs, C. A. (1993). Relations between work group characteristics and effectiveness: Implications for designing effective work teams. *Personnel Psychology, 46*, 823–850.
Cohan, W. D. (2009). *House of card: A tale of hubris and wretched excess on wall street*. New York: Double Day.
Cohen, E. A., & Gooch, J. (1990). *Military misfortunes: The anatomy of failure in war*. New York: Free Press.
Cohen, S. G., & Ledford, G. E. Jr., (1994). The effectiveness of self-managing teams: A quasi-experiment. *Human Relations, 47*, 13–43.
Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology, 94*, 95–120.
Contractor, N. S., Whitbred, R., Fonti, F., Hyatt, A., Jones, P., & O'Keefe, B., 1998. Self-organizing communication networks in organizations. Validation of a computational model using exogenous and endogenous theoretical mechanisms. Paper presented at the *Top Paper Panel, Organizational Communication Division, International Communication Association, Jerusalem, Israel*.
Crawford, E. R., & Lepine, J. A. (2013). A configural theory of team processes: Accounting for the structure of taskwork and teamwork. *Academy of Management Review, 28*, 32–48.

de Jong, A., de Ruyter, K., & Wetzels, M. (2005). Antecedents and consequences of group potency: A study of self-managing service teams. *Management Science, 51*, 1610–1625.

Earley, P. C., & Gibson, C. B. (2002). *Multinational teams: A new perspective*. Mahwah, NJ: Lawrence Earlbaum and Associates.

Emirbayer, M., & Goodwin, J. (1994). Network analysis and the problem of agency. *American Journal of Sociology, 99*, 1411–1454.

Freeman, L. C. (1979). Centrality in social networks: Conceptual clarification. *Social Networks, 1*, 215–239.

Freeman, L. C., Borgatti, S. P., & White, D. R. (1991). Centrality in valued graphs: A measure of betweenness based on network flow. *Social Networks, 13*, 141–154.

Friedkin, N. E. (1998). *A structural theory of social influence*. Cambridge, UK: Cambridge University Press.

Friedkin, N. E. (2011). A formal theory of reflected appraisals in the evolution of power. *Administrative Science Quarterly, 56*, 501–529.

Gibson, C. B. (2003). The efficacy advantage: Factors related to the formation of group efficacy. *Journal of Applied Social Psychology, 33*, 2153–2186.

Gibson, C. B., & Earley, C. (2007). Collective cognition in action: Accumulation, interaction, examination, and accommodation in the development and operation of group efficacy beliefs in the workplace. *Academy of Management Journal, 32*, 438–458.

Gladstein, D. L. (1984). Groups in context: A model of task group effectiveness. *Administrative science quarterly, 29*, 499–517.

Gladwell, M. (2002). The talent myth. *The New Yorker*, 28–33.

Gladwell, M. (2009). Cocksure: Banks, battles, and the psychology of overconfidence. *The New Yorker*, 24–28.

Glomb, T. M., & Liao, H. (2003). Interpersonal aggression in work groups: Social influences, reciprocal and individual effects. *Academy of Management Journal, 46*, 486–496.

Granovetter, M. (1985). Economic action and social structure: The problem of embeddedness. *American Journal of Sociology, 91*, 481–510.

Griffin, D., & Tversky, A. (1992). The weighing of evidence and the determinants of confidence. *Cognitive Psychology, 24*, 411–435.

Guzzo, R. A., Yost, P. R., Campbell, R. J., & Shea, G. P. (1993). Potency in groups: Articulating a construct. *British Journal of Social Psychology, 32*, 87–106.

Hambrick, D. C., Davison, S. C., Snell, S. A., & Snow, C. C. (1998). When groups consist of multiple nationalities: Towards a new understanding of the implications. *Organization Studies, 19*, 181–205.

Harary, F. (1969). *Graph theory*. Reading, MA: Addison-Wesley.

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.

Hofstede, G. (1983). The cultural relativity of organizational practices and theories. *Journal of International Business Studies, 14*(2), 75–89.

Hofstede, G. (2001). *Culture's consequences* (2nd ed.). Thousand Oaks, CA: Sage.

Hollenbeck, J. R., Ellis, A. P. J., Humphrey, S. E., Garza, A. S., & Ilgen, D. R. (2011). Asymmetry in structural adaptation: The differential impact of centralizing versus decentralizing decision-making structures. *Organizational Behavior and Human Decision Processes, 114*, 64–74.

Hu, J., & Liden, R. C. (2011). Antecedents of team potency and team effectiveness: An examination of goal and process clarity and servant leadership. *Journal of Applied Psychology, 96*, 851–862.

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

Katz, D., & Kahn, R. L. (1978). *The social psychology of organizations*. New York: Wiley.

Kavanagh, D. J., & Bower, G. H. (1985). Mood and self-efficacy: Impact of joy and sadness on perceived capabilities. *Cognitive Therapy and Research, 9*, 507–525.

Kiggundu, M. N. (1983). Task interdependence and job design: Test of a theory. *Organizational Behavior and Human Performance, 31*, 145–172.

Kilduff, M., & Brass, D. J. (2010). Organizational social network research: core ideas and key debates. *Academy of Management Annals, 4*, 317–357.

Kilduff, M., & Krackhardt, D. (1994). Bringing the individual back in: A structural analysis of the internal market for reputation in organizations. *Academy of Management Journal, 37*, 87–108.

Kilduff, M., & Tsai, W. (2003). *Social networks and organizations*. Sage.

Kirkman, B. L., & Shapiro, D. (1997). The impact of cultural values on employee resistance to teams: Toward a model of globalized self-managing work team effectiveness. *Academy of Management Review, 22*, 730–757.

Krackhardt, D. (1994). Graph theoretical dimensions of informal organizations. In K. Carley & M. Prietula (Eds.), *Computational Organizational Theory* (pp. 89–111). Hillsdale, NJ: Lawrence Erlbaum Associates.

Laurent, A. (1983). The cultural diversity of western conceptions of management. *International Studies of Management and Organizations, 13*, 75–96.

Laurent, A. (1986). The cross-cultural puzzle of international human resource management. *Human Resource Management, 25*, 91–102.

Lawrence, B. W. (1997). The black box of organizational demography. *Organization Science, 8*, 1–22.

Leavitt, H. J. (1951). Some effects of certain communication patterns on group performance. *Journal of Abnormal and Social Psychology, 46*, 38–50.

Lee, C., Tinsley, C. H., & Bobko, P. (2002). An investigation of the antecedents and consequences of group-level confidence. *Journal of Applied Social Psychology, 32*, 1628–1652.

Leenders, R. T. A., Van Engelen, J. M., & Kratzer, J. (2003). Virtuality, communication, and new product team creativity: a social network perspective. *Journal of Engineering and Technology Management, 20*, 69–92.

Lester, S. W., Meglino, B. M., & Korsgaard, M. A. (2002). The antecedents and consequences of group potency: A longitudinal investigation of newly formed groups. *Academy of Management Journal, 45*, 352–368.

Lin, Z., Yang, H., Arya, B., Huang, Z., & Li, D. (2005). Structural versus individual perspectives on the dynamics of group performance: Theoretical exploration and empirical investigation. *Journal of Management, 31*, 354–380.

McClelland, G. H., & Judd, C. M. (1993). Statistical difficulties of detecting interactions and moderator effects. *Psychological Bulletin, 114*, 376.

Mehra, A., Smith, B., Dixon, A. L., & Robertson, B. (2006). The social network ties of group leaders: Implications for group performance and leader reputation. *Organization Science, 17*, 64–79.

Michels, R. (1962). *Political parties: A sociological study of the oligarchical tendencies of modern democracy*. New York, NY: Free Press.

Nadel, S. F. (1957). *The theory of social structure*. London: Cohen and West.

Oh, H., Chung, M. H., & Labianca, G. (2004). Group social capital and group effectiveness: The role of informal socializing ties. *Academy of Management Journal, 47*, 860–875.

Podolny, J. M. (2005). *Status signals: A sociological study of market competition*. Princeton, NJ: Princeton University Press.

Reagans, R., & McEvily, B. (2003). Network structure and knowledge transfer: The effects of cohesion and range. *Administrative Science Quarterly, 48*, 240–267.

Reagans, R., & Zuckerman, E. (2001). Networks, diversity, and productivity: The social capital of corporate R&D teams. *Organization Science, 12*, 502–517.

Reagans, R., Zuckerman, E., & McEvily, B. (2004). How to make the team: Social networks versus demography as criteria for designing effective teams. *Administrative Science Quarterly, 49*, 101–133.

Roethlisberger, F. J., & Dickson, W. J. (1939). *Management and the worker: An account of a research program conducted by the Western Electric Company, Hawthorne Works, Chicago*. Cambridge, MA: Harvard University Press.

Rogers, W. H. (1993). Sg17: Regression standard errors in clustered samples. *Stata Technical Bulletin, 3*, 19–23.

Shaw, M. E. (1964). Communication networks. In L. Berkowitz (Ed.). *Advances in experimental social psychology* (Vol. XX, pp. 111–147). New York: Academic Press.

Simon, H. A. (1981). *The sciences of the artificial*. Cambridge, MA: MIT Press.

Snijders, T. A. B., & Bosker, R. J. (1999). *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. Thousand Oaks, CA: Sage.

Soda, G., & Zaheer, A. (2012). A network perspective on organizational architecture: Performance effects of the interplay of formal and informal organization. *Strategic Management Journal, 33*, 751–771.

Sparrowe, R. T., Liden, R. C., Wayne, S. J., & Kraimer, M. L. (2001). Social networks and the performance of individuals and groups. *Academy of Management Journal, 44*, 316–325.

StataCorp, 2011. *Stata statistical software: Release 12*. College Station, TX, USA: StataCorp LP.

Stahl, G. K., Maznevski, M. L., Voigt, A., & Jonsen, K. (2010). Unraveling the effects of cultural diversity in teams: A meta-analysis of research on multicultural work groups. *Journal of International Business Studies, 41*, 690–709.

Stumpf, S. A., Brief, A. P., & Hartman, K. (1987). Self-efficacy expectations and coping with career-related events. *Journal of Vocational Behavior, 31*, 91–108.

Swedberg, R. (2010). The structure of confidence and the collapse of Lehman brothers. *Research in the Sociology of Organizations, 19*, 71–114.

Tajfel, H. (1982). Social psychology of intergroup relations. *Annual Review of Psychology, 33*, 1–30.

Taylor, M. S., Locke, E. A., Lee, C., & Gist, M. E. (1984). Type A behavior and faculty research productivity: What are the mechanisms? *Organizational Behavior and Human Decision Processes, 34*, 402–418.

Thompson, J. D. (1967). *Organizations in action: Social science bases of administration*. NY: McGraw-Hill.

van Dijk, H., van Engen, M. L., & van Knippenberg, D. (2012). Defying conventional wisdom: A meta-analytical examination of the differences between demographic and job-related diversity relationships with performance. *Organizational Behavior and Human Decision Processes, 119*, 38–53.

van Knippenberg, D., & Schippers, M. C. (2007). Work group diversity. *Annual Review of Psychology, 58*, 515–541.

Van der Vegt, G. S., & Janssen, O. (2003). Joint impact of interdependence and group diversity on innovation. *Journal of Management, 29*, 729–751.

Van de Ven, A. H., Delbecq, A. L., & Koenig, R. Jr, (1976). Determinants of coordination modes within organizations. *American Sociological Review, 41*, 322–338.

Wasserman, S., & Faust, K. (1994). *Social network analysis: Methods and applications* (Vol. 8). Cambridge University Press.

Weick, K. E. (1995). *Sensemaking in organizations*. Thousand Oaks, California: Sage Publications Inc..

Wellman, B., & Berkowitz, S. D. (1997). *Social structures: A network approach*. Greenwich: CT JAI Press.

Williams, K. Y., & O'Reilly, C. A. I. I. I. (1998). Demography and diversity in organizations: A review of 40 years of research. In B. Staw & R. Sutton (Eds.). *Research in organizational behavior* (Vol. 20, pp. 77–140). Greenwich, CT: JAI Press.

Zhang, Z., & Peterson, S. J. (2011). Advice networks in teams: The role of transformational leadership and members' core self-evaluations. *Journal of Applied Psychology, 96*, 1004–1017.