THE EFFECT OF RELATIONAL AND TEAM CHARACTERISTICS ON INDIVIDUAL PERFORMANCE: A SOCIAL NETWORK PERSPECTIVE

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Increasingly, researchers in human resource management are recognizing the impact of relational characteristics of work design on performance outcomes. In particular, complex task interdependencies associated with loosely structured teams call for an approach to work design that incorporates interpersonal relationships and informal communication to help individuals adapt to changing demands. Taking a social network perspective, we propose that position in the structure of informal communication networks shapes the opportunities and constraints to action for individuals and determines their informal roles. We present a multilevel model in which the relationship between position within a social structure and individual performance was examined within the context of team performance and team tenure. Hypotheses were tested using network data collected from nearly 300 employees in 30 sales teams. Results indicated that individuals close to the core of a team outperformed more peripheral individuals, but only to the extent that teams were high-performing or had been together longer as a team. The article concludes with a general discussion of the implications for HR theory and practices targeted at improving individual performance outcomes.

Keywords: social networks, teams, job design

Introduction

A growing and, one could argue, resurgent interest in the social dimension of work (Grant & Parker, 2009; cf. Trist & Bamforth, 1951) has supported nascent development of a social network perspective that places work design in a broader sociotechnical context (Evans & Davis, 2005; Kaše, Paauwe, & Zupan, 2009). Unlike the traditional approach to work design that focuses on actor attributes and task architecture, the

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social network perspective posits that the behavior of individuals is also determined by the pattern or structure of relationships in which they are embedded. One objective of recent theorizing on work design is to understand how the structure of interpersonal relationships shapes important organizational outcomes such as individual performance (Evans & Davis, 2005; Kang & Snell, 2009).

For decades, work-design research has been dominated by a focus on how the task architecture of jobs can be structured to support individual employee performance (e.g., Hackman & Oldham, 1976). More recent research has adopted a relational perspective to explore the ways in which the relational architecture of work can be structured to achieve desired outcomes (Grant & Parker, 2009). Relational characteristics, such as the sources and types of feedback and support that employees can access, have demonstrated their relevance to work design by explaining significant amounts of variance in turnover intentions, organizational commitment, job satisfaction, and subjective performance (Humphrey, Nahrgang, & Morgeson, 2007). The social network perspective is consistent with a relational approach to work design in that both recognize that "jobs, roles, tasks, and projects are inextricably intertwined with interpersonal relationships, connections, and interactions" (Grant & Parker, 2009, p. 323). By considering the organization of work as a network of interpersonal interactions, we can examine how the network structure shapes the ability of individuals within it to enact work role-related behaviors. In this way, the social network perspective contributes a socio-structural understanding of work design (Kilduff & Brass, 2010).

By considering the organization of work as a network of interpersonal interactions, we can examine how the network structure shapes the ability of individuals within it to enact work role-related behaviors.

According to social network theory and research, informal work roles emerge as a function of position in the social structure (Kilduff & Brass, 2010). Different positions in the social structure correspond to different opportunities and constraints, including those related to performance (Brass, 2011). Structural position therefore offers a potential mechanism through which work design influences individual and, ultimately, organizational performance.

Network centrality, the extent to which an individual is central in a network, is the structural position most strongly linked to performance-related outcomes, including more influence, greater access to information, better performance ratings, and higher pay raises (e.g., Brass, 1984; Mehra, Kilduff, & Brass, 2001; Sparrowe, Liden, Wayne, & Kraimer, 2001). Despite the increasingly prominent part that teams play in organizational life, the impact of *intrateam* centrality, and particularly the impact of occupying a central bridging position in teams, on individual performance has been relatively unexplored (but see a related study on individual performance outcomes associated with nonbridging centrality, Sparrowe et al., 2001). Due to complex task interdependencies, especially among loosely structured teams of professionals, individuals who are in a central bridging role in their teams may expend costly time and effort transferring knowledge and coordinating action among team members, possibly reducing the performance advantages of their position. Moreover, team characteristics may moderate the effects of structural position on individual performance, such that a central bridging position in some teams may be more advantageous than in other teams (cf. Shaw, 1964).

We address the impact of informal work role in teams by providing a multilevel model of network and team characteristics that offers a basis upon which to make predictions regarding individual performance outcomes. We include two measures of centrality—*betweenness* and *coreness*—to predict individual performance. Coreness has only recently been identified as a measure of centrality (Borgatti & Everett, 1999) and has yet to be empirically tested within teams. We analyze individual-level and team-level data among 296 knowledge workers in 30 distributed account teams tasked with selling a range of integrated products and services. Our findings

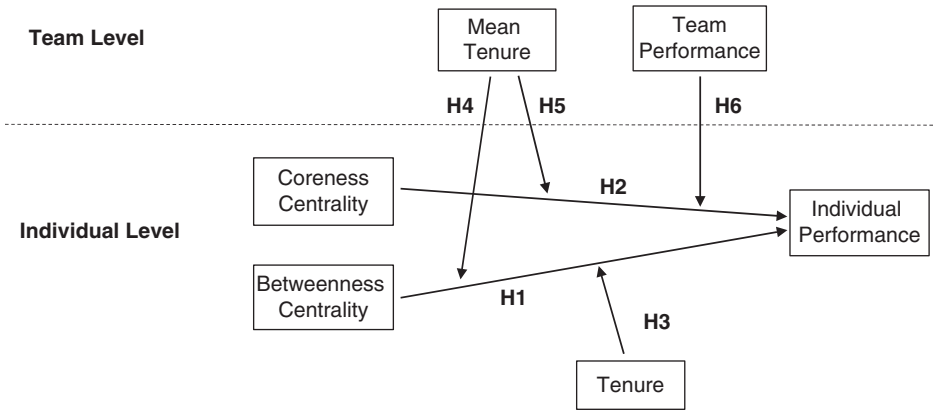

FIGURE 1. Multilevel Model of Centrality and Individual Performance

indicate that occupying a central position in a team's social structure is associated with higher performance but only in the presence of specific team characteristics.

Theoretical Background and Hypotheses

Our conceptual model addresses the moderating influence of team-level characteristics on centrality within a team's communication network on individual performance (see Figure 1). In the next section of this article, we present a brief review of research on the effect of work design on network characteristics. We then provide the theoretical underpinnings of the main elements of our conceptual model.

Work Design and Network Characteristics

Recent theoretical models argue that social structure serves as a mediating mechanism in the link between work design and performance (Collins & Smith, 2006; Evans & Davis, 2005; Kang & Snell, 2009). In these models, work design creates opportunities for workplace interaction, which then shapes the structure and content of informal relationships (Lengnick-Hall & Lengnick-Hall, 2003). Evans and Davis (2005) argue that high-performance work systems can encourage the coordination and exploitation of knowledge accessible through the social structure by increasing flexibility and administrative efficiency. Similarly, Kang and Snell (2009) argue that social relationship structures can be characterized as cooperative (populated by strong, dense networks) or entrepreneurial (populated by weak or nonredundant networks) and that human resource (HR) practices can support their development. For example, work structures that require reciprocal interdependence can foster cooperative archetypes, whereas flexible work structures (e.g., temporary work teams) can foster entrepreneurial archetypes (Kang & Snell, 2009). Once developed, social structure then becomes a resource upon which individuals and firms can draw for competitive advantage (Nahapiet & Ghoshal, 1998; Uhl-Bien, Graen, & Scandura, 2000). The present study seeks to extend work in this area by concentrating on the relationship between informal roles, as represented by position in a team's social structure, and individual performance.

Network Characteristics and Individual Performance

A central premise of the network perspective is that position in the social structure offers opportunities and constraints regarding access to valued resources (Brass, 1984). These resources may be task-related (e.g., knowledge) or non-task-related (e.g., social support). Within *social* networks, resources are usually exchanged through communication.

We focus on position in task-related communication networks, because these networks provide access to instrumental resources that are likely to support high performance (O'Reilly, 1977).

Betweenness Centrality

One important informal role involves bridging in the task-related communication network. Considerable evidence supports the notion that individuals who connect disconnected others gain benefits from their position (for a review, see Burt, 2005). People who occupy this central bridging role benefit for at least two reasons (Burt, 1992; Granovetter, 1973). One, they have access to diverse sources of information, which gives them a particular rich pool of information, opportunities, and resources to draw upon when developing new ideas or solving complex problems. Two, they can control the nature and amount of shared information. Distributing information selectively can maximize their power relative to others (Gould & Fernandez, 1989). Occupying a central bridging role has been positively associated with individual performance outcomes, including job attainment (cf. Granovetter, 1973), promotions in organizations (Brass, 1984, 1985; Burt, 1992), and performance evaluations (Mehra et al., 2001). Betweenness centrality is one measure of the extent to which a person occupies a central bridging position (e.g., Mehra et al., 2001).

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Bridging roles may be particularly relevant for work design because they have the potential to provide access to resources related to skill building and high-quality feedback (Kilduff & Brass, 2010). Occupying a central bridging role can provide the individual with input from a variety of sources that can stimulate creative problem solving and support innovation (Burt, 2005), thereby increasing skill variety. Similarly, feedback concerning job performance is likely to be more complex and diverse to the extent that individuals' communication networks connect them to people or groups who are not themselves working together.

Evidence for the benefits of occupying a central bridging position for individuals comes mainly from studies of intraorganizational networks. Within teams, the relationship between bridging position in communication networks and individual performance has not been tested directly, although many of the arguments supporting a connection between a centrally bridging position in networks and performance are also appropriate for predictions regarding intrateam networks. In particular, individuals who occupy a central bridging role on teams may benefit from having access to diverse and relevant information, which they can then integrate to develop novel and innovative solutions to task-related problems. Moreover, because bridging positions can also be used to coordinate information or action from one part of the network to another, it may be that individuals who occupy intrateam central bridging positions enhance their perceived value to the team by being a primary source of coordination (cf. Evans & Davis, 2005). This discussion leads to the following hypothesis.

Hypothesis 1: Betweenness in a communication network will be positively associated with individual performance.

Coreness Centrality

On the other hand, research on team-level performance has also found an advantage for dense networks that contain few or no opportunities for bridging roles, especially when tasks are uncertain and complex (e.g., Sparrowe et al., 2001). This research is based on the proposition that dense structures promote willingness to devote time and effort to assist others, which maximizes opportunities for knowledge sharing and coordination (Reagans & McEvily, 2003). To the extent that individual performance relies upon knowledge transfer and the coordination of action, then, there may be benefit in

occupying both a bridging role and being closely connected to others. Coreness centrality captures that concept.

Coreness reflects the extent to which an individual is embedded in a central core of tightly knit individuals, who, in turn, are connected to other members who are only loosely connected to each other, if at all (Everett & Borgatti, 2005). Coreness is a departure from other measures of centrality, such as betweenness, because it incorporates the structure of the whole network. More specifically, coreness indicates a person's position in a core-periphery structure in which all members revolve more or less closely around a single cohesive subgroup. In contrast to other types of centrality, which can exist within a highly centralized or decentralized network structure, high (and low) coreness values can only indicate a core-periphery network structure (Borgatti & Everett, 2006). Although findings regarding the effect of core-periphery structure on team performance have been mixed (Cummings & Cross, 2003), the effect of coreness centrality on individual performance has been virtually unexplored.

We argue that high values of coreness will be positively associated with individual performance outcomes in teams, especially in interdependent teams such as sales teams, for at least three reasons. One, by definition, individuals closer to the core of communication networks communicate more frequently with each other. Frequent communication results in similar attitudes and norms (Rice & Aydin, 1991) and greater trust (McEvily, Perrone, & Zaheer, 2003). These commonalities can make core members more likely to give each other preferential access to valuable resources and knowledge (Burt, 2005), consider each other's information (Burt, 2005), transfer knowledge (Argote, McEvily, & Reagans, 2003), and combine information effectively when making decisions (Hansen, 1999).

Two, as a function of their strong relationships, members closer to the team's core may also be more likely to hold information in common. Information that is held by more than one person is more likely to be accessed by a group than information that is held by only one person (Stasser & Titus, 1985). In teams that face coordination challenges, a large pool of common knowledge may even *increase* individual performance since it makes it more likely that commonly held information will be recalled (Lightle, Kagel, & Arkes, 2009). For example, if one member of the core is unavailable to the team due to travel complications or disparate time zones, another core member may recall information held in common with that person. Shared knowledge among core members, then, might further reduce disruptions to collaborative activities caused by uncertain and unpredictable environments. Fewer disruptions, in turn, are likely to increase individual performance.

Lastly, in addition to the benefits of closely knit connections, coreness is also a bridging position since, by definition, members of the core are exchanging information with more peripheral members. Unlike individuals who are simply located in the middle of dense structures, individuals high in coreness are also able to leverage the benefits of their central bridging position. As a result, individuals high in coreness are uniquely able to enjoy the benefits of both being embedded in a strongly connected subgroup as well as having access and control over diverse information from less connected others.

Hypothesis 2: Coreness in a communication network will be positively associated with individual performance.

Team Tenure and Individual Performance

Individual performance may also be a function of work experience. Experience leads to the accumulation of relevant knowledge, skills, and abilities (Sturman, 2003), which, in turn, predicts individual performance (Borman, Hanson, Oppler, Pulakos, & White, 1993). Tenure can be regarded as a proxy for work experience (Tesluk & Jacobs, 1998) and may be related to job performance through increased job knowledge and competences (Borman et al., 1993). Often considered only as a control variable, tenure is rarely included in explicit theorizing (for an exception, see

Sturman, 2003). We argue that team tenure may be an important moderator of the relationship between bridging centrality and individual performance on both the individual and team level.

An individual's tenure on the team may affect the likelihood that others will seek and value information from that individual. Team members are more likely to work with and seek advice from people with greater tenure because people with greater tenure know more about team norms, routines, and values and may therefore be perceived as more knowledgeable than other members (Rollag, 2004). Tenure may provide individuals with intrateam legitimacy as well as a deeper understanding of how to navigate the "political waters" of both the organization and the team (Ibarra, 1993). Members with greater tenure may also be seen as more likely to embody the ideals of the team than members of lesser tenure because they have had more time to observe, accept, and adopt predominant norms and values (Chao, O'Leary-Kelly, Wolf, Klein, & Gardner, 1994). For all of these reasons, greater tenure may make individuals more desirable as sources of information.

We argue that team tenure may be an important moderator of the relationship between bridging centrality and individual performance on both the individual and team level.

Paradoxically, as a result of their perceived value as information sources, the individual performance advantages of greater team tenure may become liabilities for individuals who are high in betweenness centrality. Because the team depends upon them more heavily for information, they may spend considerable time and energy transferring information and coordinating intrateam action. In allocating their resources in this type of extra-role behavior, people high in betweenness centrality may reduce the amount available for the in-role behavior (e.g., selling) that supports individual performance. At the same time, relative newcomers who come to occupy central bridging positions in communication networks may do so as a function of information gathering rather than information sharing. As a result, they may be better poised to take advantage of the benefits of their position without the transfer costs incurred by individuals high in betweenness who have greater tenure.

Hypothesis 3: Betweenness in a communication network will interact with individual team tenure to predict individual performance such that high levels of individual team tenure will be associated with low levels of performance for individuals high in betweenness centrality.

We do not predict that coreness centrality will interact with individual team tenure to predict individual performance because, unlike individuals high in betweenness, individuals high in coreness, even when higher in tenure, can still rely upon others to share the burden of transferring information and coordinating intrateam action. Therefore, we do not expect any additional performance advantages or disadvantages beyond those predicted as main effects.

Interaction Between Team Characteristics and Network Characteristics: Team Tenure

If one of the primary mechanisms by which individual-level tenure translates into performance is through knowledge and skill development (Borman et al., 1993), then a similar process might be identified at the team level of analysis (Kozlowski & Klein, 2000). The greater the average team tenure, the better contribution each team member can make. Moreover, as teams develop, members learn how to work together in terms of managing task competencies, interpersonal interactions, and task interdependencies (Kozlowski, Gully, Nason, & Smith, 1999). Teams with longer mean tenure are likely to have a better understanding of how to deal with routine and normative situations. For this reason, although variance in individual team tenure may be important for team-level innovation, mean team tenure may be more important in terms of team and individual performance and efficiency (Bell, Villado, Lukasik, Belau, & Briggs, 2011). The greater the mean team tenure, the easier it should be for any one team

member to utilize and distribute a piece of information. In terms of betweenness, then, higher mean team tenure should reduce the coordination and transfer costs of occupying the central bridging role.

Hypothesis 4: Mean team tenure will moderate the relationship between betweenness and individual performance such that betweenness in high-tenure teams will be more strongly associated with individual performance than will betweenness in low-tenure teams.

At the same time, members who have worked together longer may have greater shared knowledge and experience, and also more opportunity to form stronger bonds and attachments (Maertz & Griffeth, 2004). Overlapping knowledge and strong relationships increase the likelihood that members will turn to each other for work-related information and advice (Casciaro & Lobo, 2008) and give each other preferential access to important resources and knowledge (Burt, 2005). Individuals who have a history of working together are more likely to develop a shared understanding of who knows what, increasing their ability to transfer knowledge effectively (Lewis, 2004). Individuals high in coreness already have access to more information than individuals low in coreness as a function of their central position but individuals on teams whose members have been together longer may be better able to leverage coreness to increase their performance.

Hypothesis 5: Mean team tenure will moderate the relationship between coreness and individual performance such that coreness in high-tenure teams will be more strongly associated with individual performance than will coreness in low-tenure teams.

Interaction Between Team Characteristics and Network Characteristics: Team Performance

In organizational settings, teams are largely tasked with work that may be incompletely defined and for which the outcome is not known in advance. Accomplishing the work requires members of the team to be able to access and share complex or ambiguous information that is distributed throughout the group (Wegner, 1986). For this reason, high-performing teams tend to develop better group-level systems for storing, locating, and retrieving information than low-performing teams (Argote et al., 2003). Given that members of the core have access to information held by both core and periphery members and that members of the core may coordinate and exchange information more rapidly than noncore members, individuals closer to the core in high-performing teams are predicted to be able to more successfully leverage the team's collective expertise than individuals closer to the core in low-performing teams.

Hypothesis 6: Team performance will moderate the relationship between coreness and individual performance such that coreness in high-performing teams will be more strongly associated with individual performance than will coreness in low-performing teams.

In contrast, individuals high in betweenness should be unaffected by team performance because more developed group-level systems mean that their ability to exploit holes in the flow of intrateam information is reduced.

Methods

Design

To test our hypotheses, we conducted a web-based survey of members of sales teams within a large international organization based in the United States that specializes in technology and related services. Our study involved the active participation of senior management within the organization, including the executive vice president of sales operations, who provided detailed information regarding the structure, dynamics, needs, and composition of typical and specific sales teams. Their insights helped shape survey items. The sales teams provide hardware, software, and other technology services to an account, usually a large, multinational

organization. Accounts represent a wide range of industries, including public-sector nonprofits, as well as retail, service, and manufacturing organizations. Team members represent a variety of roles, including information technology specialists and relationship managers. Some team members are dedicated to a particular account; others work simultaneously on multiple accounts.

Teams have a matrixed structure such that members represent different functional divisions and report to a division manager rather than the team leader. Individuals travel frequently and spend extended time at client sites, often located in different cities or states. Team members work out of multiple offices, including home-based offices. Face-to-face meetings that include all team members typically occur less than twice a year. More often, members communicate via technology or during unplanned encounters at company or client sites. Although members can operate largely independently of each other, they need to coordinate and pool their information about the customer in order to meet sales targets and deadlines.

The selection process for participants included several steps. First, three executive vice presidents of regional sales in the United States were asked to generate a list of 60 extended account teams in their region (out of a possible 800), half of which they deemed to be "well-positioned" and the other half to be "struggling." Leaders of the teams were contacted; 53 agreed to participate. Team leaders identified a total of 1,039 mobile sales team members. Invitations to participate in the study were emailed to all team members. The invitation was followed up by emails from team leaders as well as phone calls by senior researchers within the organization.

Sample

After removing from consideration individuals who were no longer in their teams, 898 members of 53 mobile teams constituted the pool of potential survey takers. Of these, 693 completed the survey (overall 77 percent survey response rate). In order to increase our accuracy in capturing team structure, we further removed from consideration all teams that had less than an 80 percent response rate. To guard against selection bias in our dataset, we ran independent sample *t*-tests, which revealed that respondents on low response rate teams ($<$ 80 percent) did not differ from respondents on teams with high response rates ($\geq$ 80 percent) in terms of *individual performance* ($t_{547} = -.73$, n.s.) or *gender* ($\chi^2 = 2.742$, n.s.). However, they did differ in terms of team *tenure* ($t_{691} = -2.36$, $p < .05$). People on teams with low response rates reported lower levels of team tenure (mean = 2.59, SD = 1.18) than people on teams with high response rates (mean = 2.81, SD = 1.20). Our selected sample may be somewhat higher than average in terms of time on team. High response teams did not differ from low response teams in team *size* ($t_{51} = 1.88$, *n.s.*), *mean tenure* ($t_{51} = -1.60$, n.s.), or *team performance* ($\chi^2 = 2.07$, n.s.). Missing data on some variables, primarily *individual performance* ($n = 80$) but also *gender* ($n = 9$) and *tenure* ($n = 2$), further lowered the sample size to 295 respondents in 30 teams. Team size ranged from 5 to 28 (mean = 12.80, SD = 7.30).

Variables

The sociometric portion of the survey instrument yielded network data. To capture communication frequency, individuals were provided with a roster of teammates and asked to respond to the following statement relative to each of their teammates: *How often do you communicate with this person about opportunities for the client?* (1 = not at all, 5 = very frequently/daily). Although single-item measures can be problematic in some studies, they can effectively capture network relationships without undue burden on respondents, especially when they refer to enduring behaviors (Marsden, 1990). From these data, an asymmetrical (directed) and a symmetrical (undirected) communication matrix were constructed for each team. For the directed matrix, each cell X_{ij} was coded as 1 if *either* respondent *i or* respondent *j* reported communicating with the other at least frequently (≥ 4). For the undirected communication matrix, cell X_{ij} was coded as 1 if *both*

respondent *i and* respondent *j* reported communicating with the other at least frequently ($\geq$ 4). From these network data, additional measures, including coreness, betweenness, and density, were extracted using UCINet 6.311 (Borgatti, Everett, & Freeman, 2002).

To capture perceptions of competence, individuals were asked the extent to which they agreed with the following statement relative to each of their teammates on a five-point scale (1 = strongly disagree, 5 = strongly agree): *This person is very competent at his/her job*. Data were dichotomized such that *agree* and *strongly agree* were given a value of 1; all others were set to 0. Because competency ratings are not necessarily symmetrical, for each team, an unsymmetrized matrix was created in which respondent *i*'s rating of *j* could differ from *j*'s rating of *i*. From these directed network data, an additional measure was extracted using UCINet 6.311 (Borgatti et al., 2002), which is described next.

Dependent Variable

Individual Performance. The primary dependent variable is *individual performance*. *Individual performance* was measured by employee year-end performance ratings, which are determined by line managers who are outside the team structure. Performance ratings are based primarily on sales quota attainment. Because teams are composed of individuals from across several divisions of the company, performance ratings are also influenced by line managers' perception that individuals contributed to the products and services represented by their division. *Individual performance* ranged from 1 to 4; higher values indicate higher performance.

Independent Variables

Betweenness. *Betweenness* and coreness centrality are difficult to interpret with directed data because they include consideration of third-party relationships (e.g., connections between friends of friends) (Mehra et al., 2001). We thought it likely that only "strong" ties—that is, those that are both frequent and reciprocated—would provoke the coordination and knowledge transfer processes suggested by our model. Considering a relationship to exist only if it is reciprocated also minimizes potential bias in the accuracy of perceived communication between individuals. *Betweenness* centrality indicates the extent to which a person lies on the shortest path between two other individuals. Using the undirected communication network data, *betweenness* was calculated as the number of times a person lies on the shortest path between two other people and, to eliminate differences due to the size of the team, divided by the number of possible such paths. Higher values of *betweenness* indicate that a person lies on more paths between others on the team.

Coreness. *Coreness* indicates position in the undirected communication structure. It captures the extent to which a specific individual is embedded in a central group of people who communicate a lot with each other (Borgatti & Everett, 1999). More technically, it is the correlation between any one individual and the centroid of a cloud of points in Euclidean space (Borgatti & Everett, 1999). A high *coreness* score indicates that a person is more likely to be located in the core of the team structure. A low *coreness* score indicates that a person is less likely to be located in the core of the group structure.

Tenure. Individual-level *tenure* was measured by a four-point scale in response to the question *How long have you been on this team?* Our response options were based on insider knowledge of average team tenure and included: less than a year, one to two years, two to three years, and more than three years. High values indicate longer team tenure. For each team, the average team tenure (*mean tenure*) was also calculated. *Mean tenure* was included in the model at the team level.

Team Performance. The performance of each group was evaluated by one of three executive vice presidents of regional sales, each of whom decided whether a particular team in their region was low performing or high performing. The vice presidents reported that they had made their judgments based on "the numbers," along with many "invisible" factors, such as knowledge of recently

secured contracts, trends in various industries, and the financial health of client organizations. High-performing teams ($n = 19$) were assigned a *team performance* value of 1; low-performing teams ($n = 11$) were assigned a *team performance* value of 0. This measure of *team performance* has the advantage of avoiding common methods bias because independent and dependent variables are drawn from different sources. We found no difference between mean *individual performance* levels in high (mean = 2.88, SD = .45) versus low (mean = 2.80, SD = .21) performing teams ($t_{28} = -.55$, n.s.).

Control Variables

Several control variables were added to the model at individual and team levels, including demographic and network variables. At the individual level, the demographic control variables were *gender* and *leader*. *Gender* was included as a control variable because performance evaluation and communication patterns may be subject to gender biases (Bartol, 1999). Males were assigned a value of 1; females were assigned a value of 0. We included *leader* as a dichotomous control variable, indicating whether or not an individual was the formal team leader, because leaders are likely to have more central positions than other team members as a function of their formal role.

People who are perceived to be competent are the target of more communication than people who are not perceived as competent.

Indegree and Outdegree. Although communication may be logically symmetrical, it is not necessarily symmetrical. In fact, the reciprocation rate in our data was only 58.28 percent. We drew upon the directed matrix when constructing degree centrality measures because this matrix captured the amount of frequent communication that each person reported, making this likely to be an accurate measure of perceptions regarding the time and energy devoted to communicating with others and managing incoming communication. *Indegree centrality* in the directed communication network indicates the extent to which individuals are nominated as targets of communication. *Indegree centrality* was calculated by taking the sum of incoming communication ties and, to eliminate differences due to availability of communication partners, dividing this sum by the maximum possible degree in the team. Higher values of *indegree centrality* indicate a greater proportion of incoming communication ties. *Outdegree centrality* in the directed communication network indicates how many people a particular individual nominates as a communicant. *Outdegree centrality* was calculated by taking the sum of outgoing communication ties and, to eliminate differences due to availability of communication partners, dividing this sum by the maximum possible degree in the team. Higher values of *outdegree centrality* indicate a greater proportion of outgoing communication ties.

Competence. People who are perceived to be competent are the target of more communication than people who are not perceived as competent. At the same time, people who are perceived as more competent are also likely to receive higher performance evaluations than people who are perceived as less competent. To control for these effects, perceived competence was added to the analyses as a control variable. *Competence* captures the extent to which people on the team believe a person is competent at his/her job. *Competence* was calculated by taking each person's degree centrality in the competence network and dividing by the maximum possible degree in the team expressed as a percentage. It is equal to the (normalized) average competence rating a person receives from others on his/her team. Higher values of *competence* indicate that more people on the team regard the individual as competent.

Density. The effect of network structure on individual outcomes may also be influenced by the total *amount* of communication in a team. For example, individuals in teams with a lot of communication may receive higher performance evaluations than individuals in teams with less overall communication because more information is potentially available. *Density* is equal to the team's average degree centrality in the undirected

matrix. It is the average number of communication ties between team members relative to the number of possible communication ties among team members. Including density in our analyses controls for variance due to between-team differences in the amount of reciprocated communication.

Team Size. The size of the team influences the ease with which any one member can communicate frequently with another. It is easier in smaller teams to communicate frequently with everyone; it is much harder to do so in larger teams. In this way, team size may influence individual position in the communication structure as well as team density. For this reason, *size* was added as a control variable.

Results

Analysis

Examining connections between different levels of analysis calls for a multilevel approach in order to statistically partition variance at different levels of analysis, and evaluate relationships both within and across levels (Kozlowski & Bell, 2003). Traditional individual-level analyses do not control for the nested structure of data and may misrepresent within-team effects (Klein, Dansereau, & Hall, 1994). Nested data violate the assumption of independent observations upon which ordinary-least-squares regression is based (Raudenbush & Bryk, 2002). For this reason, hypotheses were tested using multilevel modeling (MLM) with the statistical package HLM6 (Raudenbush, Bryk, & Congdon, 2004). MLM analysis obtains unbiased estimates of standard errors by using separate regression equations at higher levels to predict the slopes and intercept parameters of variables at lower levels in the model. The slopes-as-outcomes model was conducted because Hypotheses 4 through 6 examined the impact of level-2 team characteristics on the level-1 relationship between individual attributes and *individual performance* (Raudenbush & Bryk, 2002). It should be noted that MLM doesn't allow for consideration of higher-level outcomes in the same model as lower-level outcomes. Thus, although individual attributes may also affect team-level outcomes, the dependent variable must be at the lowest level of analysis.

Descriptive Statistics

Descriptive statistics, including means, standard deviations, and zero-order correlations, are presented in Tables I and II. Correlation coefficients are calculated level by level because disaggregating higher-level variables to lower levels of analysis to calculate correlations among variables across different levels is inadequate to deal with the nested nature

TABLE I Means, Standard Deviations, and Correlations of Individual-Level Variables ($n = 295$)

Variables	M	SD	1	2	3	4	5	6	7	8
1. Gender[a]	.26	.44								
2. Leader[b]	.06	.25	.07							
3. Tenure	2.84	1.19	−.03	.11						
4. Competency	56.46	25.95	−.15*	.35***	.26***					
5. Indegree	.49	.39	−.10	.41***	.09	.64***				
6. Outdegree	.53	.42	−.13*	.33***	.07	.54***	.70***			
7. Betweenness	.05	.11	.02	.44***	.08	.36***	.47***	.50***		
8. Coreness	.20	.19	−.04	.55***	.04	.56***	.70***	.64***	.64***	
9. Individual Performance	2.81	.83	.05	−.02	.03	.09	−.03	−.03	−.05	−.03

*$p < .05$, **$p < .01$, ***$p < .001$.
[a]1 = male, 0 = female.
[b]1 = leader, 0 = not leader.

TABLE II Means, Standard Deviations, and Correlations of Team-Level Variables ($n = 30$)

Variables	M	SD	Density	Size	Mean Tenure
Density	.29	.15			
Size	12.80	7.30	−.59**		
Mean Tenure	2.82	.49	.26	−.05	
Team Performance	.63	.49	.28	−.44*	.28

*$p < .05$, **$p < .01$.

of the data (Raudenbush & Bryk, 2002). Level-1 variables, with the exception of *gender, leader, and individual performance,* were group-mean centered prior to calculating the correlation coefficients to control for the grouping effects in these variables (Kreft, Leeuw, & Aiken, 1995).

As can be seen in the level-1 correlation matrix (Table I), *competency* is significantly and positively (with the exception of *gender*) correlated with every other level-1 control and predictor variable, underscoring the importance of controlling for perceptions of competence when evaluating the effects of position in communication network on individual performance. However, *competency* was not significantly correlated with *individual performance*, suggesting that *competency* by itself does not determine *individual performance*. *Leader* was also significantly correlated with all measures of centrality, indicating that leaders tend to be in the center of teams and providing additional support for including this variable as a control in analyses. Associations among network variables (range of *r*'s = .36 to .70, all $p < .001$) were moderate to strong. While significant correlations among measures of centrality are to be expected (Borgatti & Everett, 1999), we tested for multicollinearity by regressing individual performance on controls and all group-mean-centered centrality measures. Chatterjee and Price (1991) suggest that evidence of significant multicollinearity exists if (a) variance inflation factors (VIFs) are greater than 10 or (b) the mean value of the VIFs is considerably greater than 1. VIFs in our data ranged from 1.05 to 3.12, with a mean of 1.87. Moreover, all condition indices (CIs) were below 4. According to Belsey, Kuh, and Welsch (1980), only CI values above 30 are cause for concern, and those between 10 and 30 are considered instances of moderate to strong multicollinearity. Given these checks, we do not believe that multicollinearity was a cause for concern in our data, increasing confidence in the robustness of our results.[1]

At the team level, team *size* is negatively correlated with both *density* ($r = -.59$, $p < .001$) and *team performance* ($r = -.44$, $p < .001$), indicating that smaller teams tend to be denser and higher performing than larger teams, providing additional support for including *size* as a control in analyses. Although team *density*, *mean tenure*, and *team performance* all shared positive associations, none of these relationships reached statistical significance.

Predicting Individual Performance

Analytically, three steps are required to build our model. First, we must establish that sufficient between-respondent variance exists to warrant use of MLM. A hierarchical null model with no predictors, which is equivalent to a random effects ANOVA test, was conducted to assess the degree of between-group variance in the dependent variable, *individual performance* (Raudenbush & Bryk, 2002). A chi-squared test on the residual variance indicates whether the level-2 between-group variance is significantly different from zero. In this case, the results provided evidence of significant between-group variance in *individual performance* ($U_{0j} = .057$, $\chi^2 = 54.98$, df = 29, $p < .01$) and allowed us to reject the null hypothesis of no systematic variance between teams. The intraclass correlation coefficient (ICC), which measures the level of interdependence of the data within

nesting units, was calculated following Snijder and Bosker's (1999) example (p. 65). The analysis yielded an ICC of .08 (= .05729/.69523). This modest but significant clustering effect of the data further supported using MLM data analysis techniques. The coefficient for the fixed effect (B_{00}) in this null model was 2.84, representing the grand mean of *individual performance* across individuals (range = 1 to 4). The null model is summarized as Model 1 in Table III.

Centering decisions are critical when examining cross-level interactions because they can influence interpretation of level-2 slopes (Hofmann & Gavin, 1998). Group-mean centering of level-1 predictors removes the variance attributable to between-group differences and thus produces scores that are uncorrelated with level-2 variables (Enders & Tofighi, 2007). Group-mean centering also yields a more accurate estimation of level-2 moderating effects because it removes distortion that might be present due to an interaction with team means (Enders & Tofighi, 2007; Hofmann & Gavin, 1998). Since we are interested in understanding how team characteristics moderate the relationship between individual attributes (e.g., *coreness*) and our outcome variable (i.e., *individual performance*)—a slopes-as-outcomes model—we group-mean centered all level-1 predictors, removing all between-team variation from the predictor variables. We left the binary level-1 predictors (*gender* and *leader*) and all level-2 predictors in their raw metric.

In the second step, all level-1 and level-2 control variables are entered into the model at the same time. Initially, only *gender* was entered as a fixed effect. However, an analysis of variance components showed that some of the random effects did not differ significantly between teams (χ^2 p value $>$.30). Each level-1 control variable was fixed, and the resulting model was tested against a model with all random effects. Chi-square statistics that were insignificant ($p >$ .30) supported the decision to enter *indegree* and *leader* as fixed effects (in addition to *gender*) and to allow the remaining control variables to vary randomly. In hypothesis testing, only the random effect associated with *coreness* demonstrated significant variance (χ^2 (22) = 46.93, $p <$ .01). This variable was allowed to vary randomly; all other remaining effects were fixed.

TABLE III Summary of Improvement in Model Fit of the HLM Tests

Random Effect	Deviance Score	# of Estimated Parameters	Drop in Deviance Score	Change in # of Estimated Parameters
Model 1: Null Model	744.343346	3		
Model 2	703.767210	22	40.57614**	19
Model 3a[a]	703.285731	23	0.48148	1
Model 3b[a]	690.336820	28	13.43039*	6
Model 3c[a]	689.748201	29	14.01901*	7
Model 4	685.256235	30	4.49197*	1
Model 5a	681.878715	31	3.37752[†]	1
Model 5b[b]	676.655187	31	8.60105**	1
Model 5c[b]	676.609778	32	8.64646*	2
Model 6[b]	679.774218	31	5.48202*	1
Model 7[a]	674.643109	32	29.12410**	10

[†]Significant drop in chi-square at .05 (one-tailed). *Significant drop in chi-square at .05. **Significant drop in chi-square at .01.
[a]The comparisons were made with Model 2 (controls) as the reference point.
[b]The comparisons were made with Model 4 as the reference point.

As can be seen in Model 1 (Table III), only *competency* is a significant predictor of individual performance in this step of the analysis. After accounting for the influence of other variables, people who receive proportionately more nominations of competence tend to receive higher performance evaluations ($B_{competency} = .008$, $p < .05$). A comparison of the deviance scores of Models 1 and 2, χ^2 (19) = 744.343−703.767 = 40.576, $p < .01$, shows that the improvement in model fit was significant.

In the next step of our analysis, we test our hypotheses.[2] Hypotheses 1 and 2 proposed that *betweenness* and *coreness* centrality are positively related to individual performance levels. As reported in Model 3a and 3b (Table IV) and made evident by examination of the unstandardized regression coefficients, neither *betweenness* ($B_{betweenness} = -0.382$, n.s.) nor *coreness* ($B_{coreness} = .542$, n.s.) was significantly related to *individual performance*, providing no support for Hypothesis 1 or 2.

Hypothesis 3 was supported by the finding (Model 4, Table IV) that an interaction between time on team (*tenure*) and *betweenness* was significantly related to *individual performance* ($B_{betweenness} = -.929$, $p < .01$). The level-1 residual variance *e* of Model 4 dropped from .521 of Model 3c to .514, meaning that the interaction effect explained only 1 percent of level-1 variance in the outcome variable. Nevertheless, a comparison of the deviance scores of Models 3c and 4, χ^2 (1) = 689.748 −685.256 = 4.492, $p < .05$, indicates that the improvement in model fit was significant. A plot of the interaction, controlling for other effects (see Figure 2), shows that at relatively low levels of *betweenness, tenure* does not significantly affect *individual performance* but at relatively high levels of *betweenness,* high levels of *tenure* are associated with lower *individual performance* and low levels of *tenure* are associated with higher *individual performance*.

Hypotheses 4 through 6 predicted moderating effects of mean team tenure and team performance on the relationship between structural position and individual-level performance. As reported in Models 5a and 5b (Table IV), *mean tenure* moderated the relationship between *individual performance* and *betweenness* ($\gamma_{betweenness\ x\ mean\ tenure} = 2.296$, $p < .05$) and *coreness* ($\gamma_{coreness\ x\ mean\ tenure} = 2.466$, $p < .001$), providing support for Hypotheses 4 and 5. However, the moderating effect of *mean tenure* on *betweenness* must be qualified by the lack of significance in the combined model (Model 5c, Table IV). As can be seen in Model 5c (Table III), when both interaction terms are entered into the same equation, *mean tenure* moderated the relationship between *individual performance* and *coreness* ($\gamma_{coreness\ x\ mean\ tenure} = 2.338$, $p < .01$) but not that of *individual performance* and *betweenness* ($\gamma_{betweenness\ x\ mean\ tenure} = .303$, n.s.). Figure 3 presents the moderating effect described in Model 5b (Table III). All else being equal, members of teams with high *mean tenure* demonstrate higher *individual performance* to the extent that they have relatively higher *coreness*. Members of teams with low *mean tenure*, on the other hand, do not show a significant relationship between *coreness* and *individual performance*.

Hypothesis 6 predicted that individuals on high-performing teams will have a positive relationship between *coreness* and *individual performance*. As can be seen in Model 6 (Table III), *team performance* moderated the relationship between *individual performance* and *coreness* ($\gamma_{coreness\ x\ team\ performance} = 1.825$, $p < .01$), providing support for Hypothesis 6. All else being equal, members of high-performing teams have higher values of *individual performance* to the extent that they have relatively higher *coreness*. Members of low-performing teams, on the other hand, do not show a significant relationship between *coreness* and individual performance. Figure 4 presents this information graphically.

The summary model containing only significant effects is presented in Model 7 (Table III). As can be seen in Model 7 (Table III), the moderating effect of *team performance* on the relationship between *individual performance* and *coreness* drops in significance when included in the final model ($\gamma_{coreness\ x\ team\ performance} = 1.140$, $p = .08$), weakening support for Hypothesis 6. Taken together, the results fully supported the following *interaction effects*: the same-level interaction effect between *betweenness* and *tenure* (Hypothesis 3), as well as the cross-level interaction effect between *coreness*

TABLE IV Results for Model Testing

Fixed Effect	Model 2 Controls Only	Model 3A H1	Model 3B H2	Model 3C	Model 4 H3	Model 5a H4	Model 5b H5	Model 5c	Model 6 H6	Model 7 Summary Model
Intercept^{L1}	2.1786*** (.4074)	2.1636*** (.4104)	2.0034*** (.4099)	1.1000*** (.4007)	1.9828*** (.4030)	2.0609*** (.4059)	2.1650*** (.4155)	2.1631*** (.4165)	2.0763*** (.4046)	2.1774*** (.4069)
Outdegree^{L1}	.0241 (.1646)	.0100 (.1712)	−.0348 (.2069)	−.0200 (.1778)	−.0660 (.1634)	−.0757 (.1578)	−.0267 (.1559)	−.0297 (.1564)	.0413 (.1645)	.0282 (.1549)
Indegree^{L1}	−.2537 (.2027)	−.2312 (.2049)	−.4121† (.2382)	−.4034* (.1824)	−.3597* (.1819)	−.3574† (.1887)	−.3835† (.1953)	−.3829* (.1956)	−.2244 (.1448)	−.2848† (.1673)
Gender^{L1}	.1533 (.1016)	.1590 (.0996)	.1790† (.1062)	.1788† (.0956)	.1696† (.0981)	.1758† (.0946)	.1872* (.0938)	.1872* (.0936)	.1862† (.0972)	.1945* (.0933)
Leader^{L1}	.2205 (.2105)	−.1803 (.2049)	−.170374 (.2214)	−.1546 (.1825)	−.0790 (.1707)	−.0688 (.1668)	−.0973 (.1731)	−.0946 (.1717)	−.0744 (.1696)	−.0849 (.1730)
Tenure^{L1}	−.0002 (.0475)	−.0005 (.0475)	.0065 (.0524)	.0075 (.0462)	−.0049 (.0462)	−.0037 (.0452)	−.0129 (.0456)	−.0123 (.0457)	−.0170 (.0461)	−.0182 (.0462)
Competency^{L1}	.0080* (.0030)	.0080* (.0030)	.0073* (.0035)	.0073* (.0030)	.0069* (.0028)	.0069* (.0028)	.0071* (.0027)	.0071* (.0028)	.0059* (.0028)	.0064* (.0028)
Mean Tenure^{L2}	.1745 (.1386)	.1747 (.1382)	.2256 (.1389)	.2240 (.1383)	.2160 (.1373)	.1885 (.1380)	.1414 (.1441)	.1425 (.1444)	.1997 (.1384)	.1543 (.1412)
Density^{L2}	.5681 (.5200)	.5772 (.5197)	.5843 (.5311)	.5975 (.5371)	.6439 (.5345)	.6540 (.5399)	.7032 (.5459)	.7013 (.5454)	.6146 (.5302)	.6631 (.5401)
Team Size^{L2}	−.0039 (.0068)	−.0036 (.0068)	−.0017 (.0099)	−.0016 (.0071)	−.0008 (.0070)	−.0009 (.0071)	−.0001 (.0070)	−.0002 (.0070)	−.0019 (.0072)	−.0015 (.0071)
Team Performance^{L2}	.0772 (.0881)	.0815 (.0883)	.0534 (.1243)	.0544 (.0899)	.0736 (.0907)	.0667 (.0905)	.0738 (.0909)	.0730 (.0909)	.0272 (.0898)	.0391 (.0895)

(*Continued*)

TABLE IV Results for Model Testing (Continued)

Fixed Effect	Model 2 Controls Only	Model 3A H1	Model 3B H2	Model 3C	Model 4 H3	Model 5a H4	Model 5b H5	Model 5c	Model 6 H6	Model 7 Summary Model
H1: Betweenness^{L1}		−.3815 (.6307)		−.4763 (.7749)	−.3736 (.6630)	−7.0118* (2.1945)	−.5380 (.6097)	−1.4035 (2.5940)	−.4271 (.6222)	−.5419 (.5956)
H2: Coreness^{L1}			.5416 (.6706)	.6796 (.6532)	.7105 (.6212)	.7262 (.5953)	−6.1984** (1.7920)	−5.8360* (2.2942)	−.5416 (.6829)	−5.5512** (1.7297)
H3: Betweenness^{L1} × Tenure^{L1}					−.9291** (.3025)	−.8568** (.2972)	−.8713** (.3065)	−.8629** (.3042)	−.9760** (.3406)	−.9169* (.3407)
H4: Betweenness^{L1} × Mean Tenure^{L2}						2.2963* (.6968)		.3032 (.8540)		
H5: Coreness^{L1}× MeanTenure^{L2}							2.4662*** (.5987)	2.3379** (.7647)		1.9530** (.6122)
H6: Coreness^{L1} × Team Performance^{L2}									1.8250** (.6366)	1.1399† (0.6374)

The numbers in the parentheses are standard errors, which can be used to calculate the *t*-ratios of the unstandardized regression coefficients reported immediately above.
†Significant at .05 (one-tailed) *Significant at the .05 level (two-tailed) **Significant at the .01 level (two-tailed) ***Significant at the .01 level (two-tailed).

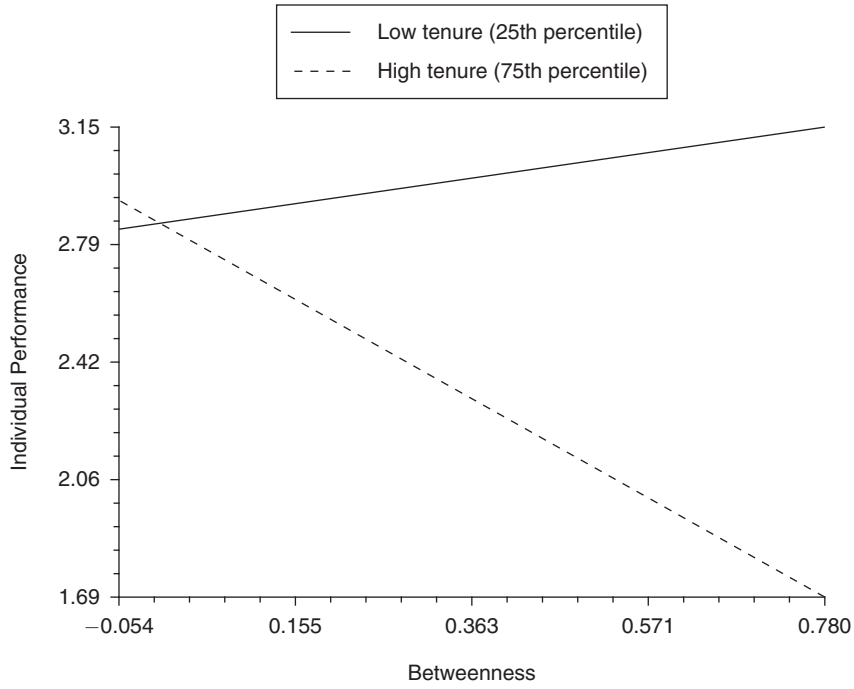

FIGURE 2. Interaction Effect Between Betweenness and Tenure on Individual Performance

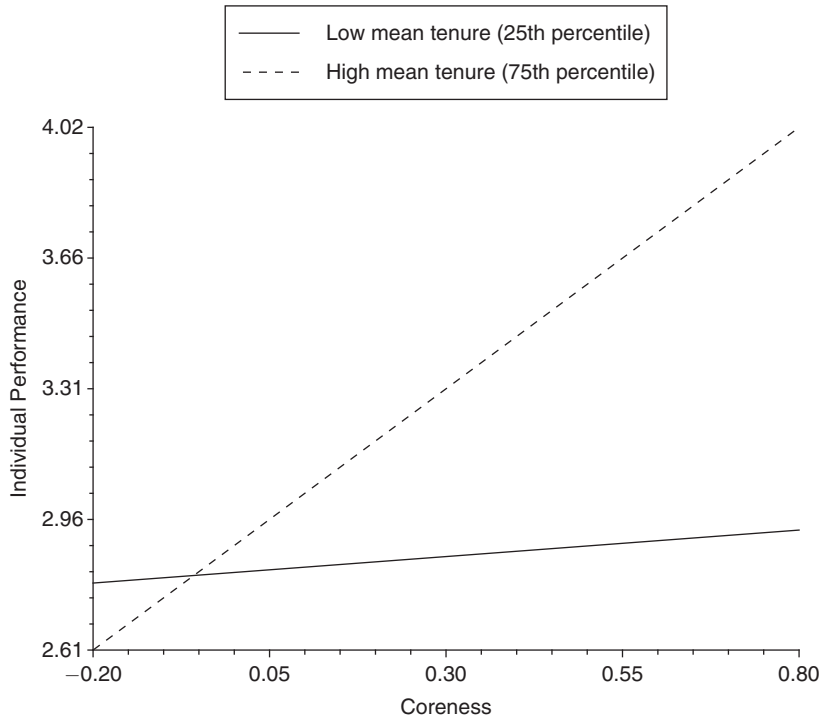

FIGURE 3. Interaction Effect Between Coreness and Mean Tenure on Individual Performance

and *mean tenure* (Hypothesis 5). Results also partially supported the cross-level interaction between *coreness* and *team performance* (Hypothesis 6). The level-1 residual variance *e* of Model 7 dropped to .509 from .601 of Model 2, meaning that the research variables retained in the summary model explained 15 percent of level-1 variance in individual

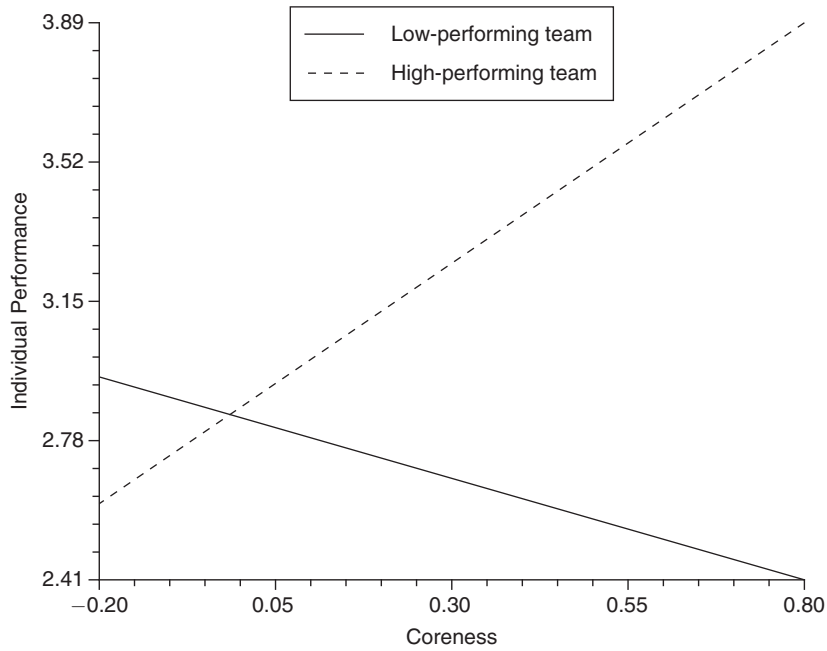

FIGURE 4. Interaction Effect Between Coreness and Team Performance on Individual Performance

performance over and above the control variables. A comparison of the deviance scores of Models 2 (controls only) and 7, χ^2 (10) = 703.767−674.643 = 29.124, $p < .01$, indicates that the improvement in model fit was significant.

Discussion

This article set out to examine the effect of informal role, as represented by position in the team communication network, on individual performance, as a way to gain insight into ways that social structure mediates performance to shed light on one aspect of work design. Specifically, we proposed that occupying a central bridging position within an intrateam communication network shapes a person's ability to engage in behaviors that lead to high performance. The current study focused on two measures of the central bridging position: betweenness and coreness centrality. We found that coreness predicted individual performance but only in the context of high-tenure or high-performing teams. Betweenness, on the other hand, interacted with individual-level tenure to predict individual performance. Our results imply a modification to our earlier proposal that informal role as determined by network position has a direct impact on individual performance. Instead, consideration of the larger social context (i.e., team characteristics) in which formal roles are embedded may be necessary to explain individual performance.

Contrary to predictions, neither betweenness nor coreness centrality demonstrated a significant main effect on individual performance. One explanation for this may be that occupying a central bridging position in teams has costs that may counterbalance the position's advantages in larger networks. For example, being high in betweenness within a team may indicate the existence of team conflict (Balkundi, Barsness, & Michael, 2009). Indirectly connected people may be in direct conflict if they are aware of each other, have collaborative goals, and choose not to communicate with each other. Given the interdependent nature of teams and their tasks, individuals high in betweenness may find themselves acting as mediators in addition to or instead of transferring intrateam knowledge and coordinating team action. The additional stress and energy expended on the mediator function may be a significant

cost that the person in the central bridging role must bear. The significant interaction effect of tenure and betweenness centrality on individual performance suggests that betweenness may be particularly costly for high-tenure individuals. It may be that these individuals have come to occupy the position *because* they sought to manage the bridge between individuals who were not communicating with each other. Although these disadvantages are also likely to be at play for individuals high in coreness, unlike people high in betweenness, they can distribute the burden among other members of the core. Without any additional moderating factors, however, the advantages of coreness may be balanced by its disadvantages.

Consistent with our predictions, we found that mean team tenure moderated the effect of betweenness and coreness on individual performance such that coreness is positively related to performance but only on high-tenure teams. However, the relationship with betweenness disappeared in the combined model. This suggests that there is something unique about the coreness role. We have proposed that, unlike betweenness, coreness combines the advantages of being embedded in a subgroup as well as occupying a bridging position, while minimizing the costs. On teams with high mean tenure, the potential disadvantages of coordination and knowledge transfer are lower than they may be on teams with lower mean tenure because teams with high mean tenure are more likely to share a common language and overlapping knowledge bases. For this reason, coreness shares a positive relationship with performance but only on high-tenure teams.

At the team level, also consistent with our hypotheses, we found that team performance moderates the coreness-performance relationship such that coreness is positively related to individual performance but only on high-performing teams. Given that we controlled for perceived competency and also that there was no overall difference in average performance between the high- and low-performing team, we ruled out alternate explanations based on competency and perceived competency. High-performing teams did not include more high-performing members on average than did low-performing teams. Taken together, we conclude that coreness shares a positive association with individual performance but only in the presence of specific team characteristics.

Contributions

Our findings contribute to the ongoing conversation about including relational characteristics in work design (Grant & Parker, 2009; Humphrey et al., 2007; Kilduff & Brass, 2010). To this emerging perspective, we add consideration of relational characteristics as shaped by team characteristics. By examining effects of team-network position on individual performance, we argue that individual performance may be a function of the way in which an individual is embedded in a team and not just a function of an individual's knowledge, skills, and abilities. Our findings support the proposition that social structure may be a mediating mechanism in the link between work design and performance (see also Kaše et al., 2009).

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Our findings have direct implications for future research on job characteristics and other aspects of work design. For example, research on task interdependence and interpersonal feedback—both of which have been associated with increased performance (Humphrey et al., 2007)—may benefit from consideration of social structure. Task interdependence is usually considered an aspect of the task, but, of course, tasks and the people who perform them are embedded in social structures. It may be that individuals in central bridging roles experience higher levels of task interdependence than do individuals in other roles within the same team. Yet, high task interdependence may be easier to maintain in high-performing or long-tenured teams because shared knowledge and familiarity ease communication and coordination costs. Similarly, although the type and amount of interpersonal feedback concerning job performance has been

hypothesized to be richer and more diverse to the extent that individuals' work connects them to people or groups who are not themselves working together (Kilduff & Brass, 2010), our study suggests that perhaps individuals embedded in cores benefit from receiving a mix of redundant and diverse information concerning work performance and other aspects of tasks (cf. Aral & Van Alstyne, 2011). It may be that being embedded among respected, trusted others provides an optimal balance of diverse and redundant feedback that motivates individuals to improve performance, whereas the performance benefits of interpersonal feedback are not realized when individuals are low in coreness or if they receive feedback from individuals whom they either don't know well or who have not supported high team performance in the past.

Our study suggests that perhaps individuals embedded in cores benefit from receiving a mix of redundant and diverse information concerning work performance and other aspects of tasks.

Our study also links to research on relational coordination, which focuses on interdependencies between units and the extent to which units share goals, knowledge, and mutual respect and engage in frequent, timely, accurate, and problem-solving communication (Gittell, Seidner, & Wimbush, 2010). For example, a recent study of patient care demonstrated that relational coordination mediated the relationship between high-performance work practices and performance outcomes (Gittell et al., 2010). The value of relational coordination, the authors argue, is that it is role-based and not tie-based, meaning that specific ties between specific individuals matter less than the nature of the relationship between units. In contrast, our findings suggest that outcomes—at least for individuals—may be strongly influenced by the patterning of communication ties. It may be that relational coordination taps into the relational dimension of social networks, whereas our study contributes an understanding of how the structural dimension of social relationships influences the effectiveness of the coordinating role.

Lastly, our findings also contribute to research on social networks in several ways. First, our study adds to an increasing awareness within social network research that centrality alone may not be enough to explain individual performance (Reinholt, Pedersen, & Foss, 2011). Our conceptual model stresses the importance of considering the context in which a network is located. More specifically, we considered the effect of team characteristics on the relationship between network position and individual outcomes. Taking a multilevel approach allowed us to parse out the effects of factors at and across different levels of analysis. In particular, we demonstrated that effects previously assumed to occur at the individual level (i.e., betweenness centrality) may in part be accounted for by differences in the team in which an individual is embedded. We also offer what we believe is the first empirical test of the effect of coreness centrality on individual performance. Our findings suggest that coreness may be an important and understudied network position that may be particularly relevant when seeking to understand individual performance outcomes. Consideration of coreness may help resolve debates regarding the value of centralized versus dense networks (e.g., Huang & Cummings, 2011). Our study suggests that optimal performance benefits for any one individual may not be realized in a centralized or dense network but by being located in the dense center of a somewhat centralized network, and only in certain team contexts.

Practical Implications

Our study also has practical implications for human resource professionals concerned with issues of work design (Grant & Parker, 2009). HR is uniquely positioned to influence the development of social structure, thereby providing a competitive advantage to individuals and, through them, organizations (Uhl-Bien et al., 2000). In general, HR professionals have overlooked the structure of intrateam relationships when seeking to optimize

individual employee performance outcomes (Campion, Mumford, Morgeson, & Nahrgang, 2005). A team-based approach to work design may offer ways of balancing needs for efficiency and flexibility (Campion et al., 2005). Our study suggests that, under the right team conditions, individuals can benefit by occupying a central bridging role. In practical terms, this could translate into providing the right incentive mechanisms for people in successful teams to adopt behaviors that will move them toward the core of the team.

Relatedly, although job design has tended to neglect the informal structuring of workplace relationships (Kilduff & Brass, 2010), practitioners may want to rethink team design in a way that includes consideration of relational structures. For example, managers of teams that have worked together for a long time may wish to change the structure of formal and informal meetings to increase meeting times for a core group of team members while changing meetings from required to optional for other team members. Alternatively, formal task assignments could be structured to create interdependencies that foster particular network structures.

Our findings also suggest that HR professionals may want to reconsider disseminating the popular career advice given to aspiring organizational members to build social networks that are high in bridging centrality (e.g., Burt & Ronchi, 2007) because such structures may not bring career benefits when individuals are embedded in high-performing or high-tenure teams. HR training that raises awareness of the value of social relationships and their contingent benefits may encourage motivated individuals to initiate role making judiciously.

Limitations and Further Research

Although we posited the causal sequence of individual position leading to individual performance, consistent with previous social network research (Borgatti & Foster, 2003), our data do not rule out the possibility that individual performance outcomes lead to the adoption of different network positions or that the relationship between individual performance and network structure is reciprocal. For example, previous research on high performers suggests that they may be more adept than low performers at developing relationships that provide them with access to needed knowledge rapidly rather than attempting to develop all the knowledge and skills themselves (Cross & Thomas, 2008). If so, then perhaps they are also more sensitive to performance context and create advantageous positions accordingly. It may also be that teams that adopt a core-periphery structure outperform teams that adopt other network structures. Perhaps a core-periphery structure allows these teams to leverage their high performers by giving them responsibility for team coordination, and also freeing others to contribute new information to central members. A fruitful avenue for future research is to study the interplay between team structure and team performance.

Notes

1. As an additional check on the effects of multicollinearity, we examined the standard errors in our models. Large jumps in error size can indicate multicollinearity and instability in coefficient estimates (Fox, 1991). The standard errors for all control variables change very little across models. For example, the largest jump between standard errors for variables in the controls-only model and summary model occurs with *density*, which increases from .5200 in the controls-only model to .5401 in the summary model, an increase of only .02. Many of the other standard errors actually decrease in value (e.g., *indegree*). There is a slightly larger but still relatively small jump in the size of the standard error of *betweenness* when *coreness* is added to the model (compare .6307 in Model 3a with .7749 in Model 3c). The change in the size of the standard error for the moderating effects of mean tenure and team performance on the slope of the association between coreness and individual performance show similarly small changes across models. In contrast, the introduction of the level-2 moderating effects of mean tenure on betweenness and coreness (Models 5a, 5c, and 7) does result in large jumps in standard error size for the main effects of betweenness (compare .6630 in Model 4 with 2.5940 in Model 5c) and coreness

(compare .6212 in Model 4 with 2.2942 in Model 5c), although not for tenure. Both of these changes indicate multicollinearity and suggest that the estimated coefficient for the main effect of coreness may be unstable. However, this finding is not unusual given that the interaction term is a product of other variables in the model (i.e., coreness and mean tenure). To summarize, standard error sizes are relatively small and stable across models for all reported moderation effects. As a result of our analyses, we do not believe that multicollinearity compromises our interpretation of reported effects.

2. Given the restricted range of the outcome variable, all analyses were also run based upon an ordinal model that tests the proportional odds for each category of response (e.g., 1, 2, 3, and 4). The pattern of results was the same.

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