One Tie to Capture Advice and Friendship: Leader Multiplex Centrality Effects on Team Performance Change

Ronald Clarke*

Rennes School of Business

Andreas W. Richter*#

University of Cambridge

a.richter@jbs.cam.ac.uk

Martin Kilduff

University College London

* Equal contribution. # Corresponding author.

This research was enabled through a grant from the Spanish Ministry of Science and Education to Andreas Richter (SEJ2007-65202/ECON). We are grateful to the University College London and Cambridge Judge Business School reading groups, as well as to Stefano Tasselli, for valuable comments on earlier versions of this paper.

ABSTRACT

Because leaders' authority is often insufficient to change team performance, formal team leaders seek informal influence through the occupation of central positions in social networks. Prior research focuses on leader centrality involving simplex ties, i.e., either friendship or advice, to the neglect of multiplex ties that involve the overlap of friendship and advice. Friendship and advice ties offer different but complementary resources, so leader centrality in one but not the other network limits leader influence. We provide theory and evidence concerning how leader multiplex centrality affects team performance improvement, particularly if leaders are embedded in team social contexts with sparse friendship and numerous adversarial ties. The research context involved 84 on-going public university service teams headed by formal leaders. Our results show the importance of leader multiplex centrality relative to leader simplex centrality. First, leader multiplex centrality predicted team performance change over a two-year period more strongly than leader centrality in either the advice or the friendship team network. Second, leader multiplex centrality positively predicted team performance change for teams featuring dense adversarial networks or sparse friendship networks. It is not sufficient, therefore, for leaders to be either liked or regarded as expert. It is the integration of both advice and friendship in one tie between the leader and followers that facilitates performance change.

Keywords: social networks; Embeddedness; Multiplex Centrality; Leadership; Team Performance Change

Leaders of on-going and stable organizational teams find performance improvement often desirable yet hard to achieve (Hackman & Wageman, 2005). These teams retain not only their members but also their existing routines (Zellmer-Bruhn et al., 2004). The dilemma that these formal leaders face is that they typically bear responsibility for team outcomes even though formal authority provides them with little leverage to improve team performance (Hackman & Wageman, 2005). This dilemma is accentuated if the social network context in which the formal leader is embedded has reduced social capital resources in that team members have many negative relationships or lack positive relationships (Labianca & Brass, 2006). Team leaders, in such circumstances, may find informal influence through personal relationships efficacious in improving team performance.

Relevant research on informal influence draws on the burgeoning literature concerned with team social networks (for a review, see Grosser et al., 2020), network approaches to leadership in general (Carter et al., 2015), and research on the importance of high-quality leader-follower connections (e.g., Graen & Uhl-Bien, 1995). Building on these relational approaches, team leadership is conceptualized as the process by which leaders use informal influence to coordinate team efforts toward change (e.g., Uhl-Bien, 2006). Specifically, central leaders, those with numerous network ties in either friendship or advice networks, wield influence on team outcomes. A formal leader's position of centrality in an informal network means that the leader provides resources to many people and, thereby, places team members in the situation of expecting to repay diffuse debts in return for the advice or friendship provided by the leader (Blau, 1995, p. 21). Perceived generosity, in the provision of advice, for example, increases the individual's status, and therefore influence (Flynn et al., 2006). Considerable research shows that teams perform well when the formal leader is central in either the team's friendship or the team's advice network (Balkundi & Harrison, 2006).

This prior leader centrality research has tended, however, to focus on single snapshot measures of team performance, rather than on changes in team performance over time. It is questionable whether the influence provided by a leader's centrality in either the friendship or advice network is sufficient to induce change in the performance trajectories of on-going and stable organizational teams, especially if these teams exhibit social capital depletion in terms of relationships among team members. A formal leader's centrality in one but not the other team network limits a leader's influence base because friendship and advice ties are conceptually different and provide complementary benefits (Ibarra & Andrews, 1993; Lincoln & Miller, 1979). Further, leaders who occupy marginal roles in one or the other network risk positions of influence being occupied by others who may oppose leader initiatives (Burt & Ronchi, 1990). These arguments are corroborated by a meta-analysis showing only moderately strong effect sizes for the leader centrality - team performance link (p = .29; Balkundi & Harrison, 2006, p. 59). And the interpretation of prior leader centrality research is further complicated by the tendency to analyze the effects of instrumental and expressive networks separately rather than considering their overlap. The reported centrality effects in one network (advice or friendship) could be due to centrality in an un-examined network combining advice and friendship (Methot & Rosado-Solomon, 2020).

In order to address these deficiencies when addressing our question of how leaders can improve team performance over time, especially in teams that exhibit social capital depletion, we adopt an approach neglected in team research (Grosser et al., 2020, p. 325)—a multiplex perspective on team leadership. A multiplex tie, relative to a simplex tie, explicitly captures the overlap of two types of relations between individuals, typically friendship and advice (Methot & Rosado-Solomon, 2020, p. 87). A leader who is central in a multiplex network may leverage the combined influence of friendship and advice networks to improve team performance. Specifically, benefits to the multiplex leader include commitment from

team members who see the leader as their friend; and an increased understanding of the resources that are needed among those team members to whom the leader dispenses advice. Leaders can use their friendship popularity to reinforce trust among team members which facilitates the receipt and implementation of the information and expertise leaders provide via their centrality as an advice-giver. The multiplex leader avoids falling into the trap of being seen by team members as either the competent jerk (central in the advice but not the friendship network) or the lovable fool (central in the friendship network but not the advice network; Casciaro & Lobo, 2005). Overall, then, the leader's multiplex centrality helps steer team reflection and planning (Marks et al., 2001) toward performance improvement.

Although multiplex relations, relative to simplex relations, provide an enhanced mechanism for coping with work demands (LePine et al., 2012) they also require extra investments of time and energy and can engender conflict between obligations inherent to different types of relationships (e.g., Ingram & Zou, 2008). For instance, whereas obligations in friendship relations commonly concern the other person's welfare, obligations in instrumental relationships often concern reciprocity for benefits previously received (Ingram & Zou, 2008). Leader multiplex centrality is not, therefore, a generically suitable approach for all team situations; rather, we suggest its benefits outweigh its costs in particular when strong leader influence is needed. We propose that this is the case if leaders face the challenge to improve the performance of stable, on-going teams, especially if these teams have depleted social capital resources.

We are not the first to offer a network approach to leadership (see Cullen-Lester & Yammarino, 2016, for a review). But we advance prior social network approaches to team leadership in three specific respects. First, we advance prior work (e.g., Balkundi & Harrison, 2006) that examined the efficacy of formal leader centrality in either affective relationships with team members (i.e., friendship) or instrumental relations (i.e., advice), by comparing

centrality in these simplex networks with centrality in a multiplex network in which each tie between the leader and the team member involves both friendship interactions and advice flows. Second, we take into account not just the multiplex centrality of the leader, but also the leader's social network embeddedness (Brands et al., 2015). Embeddedness research has neglected the countervailing situation in which relationships such as leadership are carried on in contexts that hinder rather than assist. We expand this perspective by looking at leadership embeddedness in both friendship and adversarial networks as well as their interaction, thereby examining how positive and negative embeddedness, both individually and in concert, shape leaders' influence efforts. Third, we advance prior research by examining leader efficacy with respect to team performance trajectories. Changes in the performance routines of the stable, on-going teams that we studied should become manifest in altered team performance trends. Figure 1 serves as a roadmap summarizing study hypotheses.

Theory and Hypotheses

Leadership theory is multifaceted and complex, encompassing at least seventeen different influential approaches (for a review see, Yammarino et al., 2005). We build on this prior work, but reflect these earlier influences through a social network lens. Classic research on the importance of two types of leader behavior related to an emphasis on people-centered leadership and task-centered leadership (e.g., Fleishman, 1995; Judge et al., 2004; Stogdill, 1950), foreshadowing our own emphasis on leader-centered relationships with team members encompassing friendship and advice. Leader-Member Exchange theory focused attention on informal influence by the leader (e.g., Graen & Uhl-Bien, 1995), which is a theme we strongly emphasize in terms of influence, not just with a favored few, but encompassing people across the whole team. Contingency theory (e.g., Fiedler, 1964; Schriesheim et al., 1994) emphasized the importance of favorable and unfavorable leadership contexts, echoed in our own emphasis on the extent of positive and negative leader embeddedness.

Social network approaches to leadership differ from classic leadership theory in emphasizing informal leadership emergence rather than the characteristics or behaviors of formal leaders. Starting with the Hawthorne Studies, network research on teams has discovered and investigated the extent to which different individuals in organizations wield influence irrespective of whether they are formally appointed (Carter et al., 2015). For example, wiremen at the Hawthorne Works found in Taylor "a leader of their own, different from the supervisors given them by the company" (Homans, 1951, p. 148). Emergent leaders, such as Taylor, build bases of power over time that can either facilitate managerial goals or, alternatively, undermine managerial authority, especially to the extent that such informal influence is unperceived (Burt & Ronchi, 1990; Krackhardt & Hanson, 1993).

The challenge for formal team leaders, therefore, that we infer from prior network research, is to harness these informal levers of power themselves in situations requiring strong leader influence, such as contexts where productive informal influence by other team members is lacking; or where team member informal influence impedes the productive work of the team. This challenge of team leadership is neglected in leadership theories that focus on the characteristics and behaviors of formally appointed leaders without taking into account a) the extent to which these leaders have emerged as central in informal networks; and b) the network relationships among team members themselves in terms of density of positive or negative interactions.

Thus, the social network approach to team leadership that we provide in this paper supplements both classic and LMX approaches by bringing into focus informal relationships between leaders and all the members in the team. This informal influence is not solely at the behest of leaders, as is implicit in the LMX approach. Rather, leaders, like other team members, invest personal resources of time and resource exchange to negotiate the emergence and maintenance of friendship and advice relationships.

Formal team leaders may be stymied in terms of implementing classic leadership behaviors such as consideration or initiating structure if they lack network connections to subordinates. Similarly Leader-Member exchange benefits for team members depend on the extent to which leaders establish centrality in informal social networks (Sparrowe & Liden, 2005). These informal social relationships derive not solely from the efforts of leaders, but emerge from the social constructions of leadership by followers (Meindl, 1995). Social network ties are always negotiated between parties.

Specifically, the network approach that we put forward in this paper exploits four distinctive characteristics of social network theory (Balkundi & Kilduff, 2006). First, building on prior emphases on the importance of a leader's task- and relationship orientation, we emphasize the importance of team leader social relations with team members in terms of both affective relationships, that promote team members' welfare; and instrumental relationships, that help structure work across the team. These ties are not simply granted to every leader by virtue of formal authority. Rather, informal ties represent the joint efforts of subordinates and leaders who develop mutual trust and understanding.

Second, building on prior emphases on the importance of leaders establishing positions of informal influence (Balkundi & Harrison, 2006), we advance prior social network approaches to team leadership in contrasting leader centrality in a single team network (friendship or advice) with leader centrality in the multiplex network (combining friendship and advice). This move to focus on multiplexity captures prior intuitions concerning how effective leaders operate through more than one mode of influence.

Third, building on classic theory that recognized the importance of the context in which leadership was taking place (e.g., Fiedler, 1964), we consider leader embeddedness in the proximal social network context (Brands et al., 2015) as a factor that conditions the effectiveness of leader multiplex centrality. Specifically, we build on the notion of structural

embeddedness (Granovetter, 1992; Tulin et al., 2021) measured as the density (i.e., proportion) of relationships among subordinates (e.g., Brands et al., 2015) across both positive (i.e., friendship) and negative (i.e., adversarial) relationships. Density is used interchangeably with embeddedness in this paper as well as elsewhere (e.g., Rowley et al., 2000).

And fourth, we examine the utility of leader social capital in terms of an outcome that is neglected in team research, namely, team performance improvement over time (Quigley et al., 2018). The social network approach incorporates explicitly the notion that network relationships provide opportunities for new ideas and improved knowledge flow (e.g., Allen, 1977; Brown & Duguid, 1991; Burt, 1992). Team leaders who are central in a multiplex network of both friendship and advice relationships have the opportunity to use their social capital to improve performance, especially in those teams that otherwise exhibit communication problems among team members.

Changing Performance Outcomes through Multiplex Centrality Leadership

Social network research on formal team leaders (e.g., Balkundi & Harrison, 2006) has commonly focused on leader centrality in a team network that is 'simplex'—either expressive (e.g., friendship) or instrumental (e.g., advice). Expressive and instrumental ties serve purposes that are in large part complementary, and can provide the leader with different types of benefits. Expressive ties, such as friendship, are conduits for social support and values (Ibarra & Andrews, 1993; Lincoln & Miller, 1979); these ties may generate commitment toward the leader through cooperation and trust (Krackhardt & Stern, 1988; Shah et al., 2017). Instrumental ties, such as advice, are conduits for information and expertise (Lincoln & Miller, 1979); they may provide a leader with a better understanding of the resources that are needed (e.g., Toegel et al., 2007).

In providing benefits to the leader for one type of outcome, however, a friendship or an advice tie may fall short in providing benefits for other outcomes (Shah et al., 2017). Advice ties may fail to instill collaboration and trust, resulting in reduced commitment to the leader. Friendship ties may fail to provide information and advice, thereby depriving the leader of knowledge concerning important resource availability. Leader centrality in one but not the other network is likely to limit the scope of leadership influence and action and may leave open possibilities for other team members to adversely influence team members. These shortcomings may matter for initiatives, such as improving team outcomes over time, that require strong leader influence.

Many workplace relationships combine two or more forms of exchange—they are multiplex in nature (Ferriani et al., 2012; Kuwabara et al., 2010). Multiplex relations can provide people with many benefits including enhanced understanding of problem solving, enhanced coordination, increased trust, and access to valuable information in a timely manner to promote effective teamwork (LePine et al., 2012). However, the organizational network literature on multiplex ties related to performance outcomes is mainly conceptual (e.g., Crawford & LePine, 2013; Ingram & Zou, 2008). Research examining the performance benefits of multiplex ties for individuals (e.g., Shah et al., 2017; Methot et al., 2016) or teams (e.g., Hood et al., 2017) is sparse, suggesting that multiplex networks have, indeed, been neglected in teams research (Grosser et al., 2020, p. 325), as well as in organizational social network research more generally (Methot & Rosado-Solomon, 2020, p. 80). Indicative research suggests that multiplex ties at work are a ‘mixed blessing’, as they entail benefits as well as costs (e.g., Methot et al., 2016).

Because multiplex ties capture different and potentially complementary aspects of dyadic relationships, they create a foundation for the leader to reap the benefits associated with both expressive and instrumental ties (Lazega & Pattison, 1999). Whereas friendship ties

with team members may create a strong commitment toward the leader, advice ties with team members may enhance the leader's understanding of the resources that team members need; and centrality in a multiplex network may provide the type of cognitive social capital characterized by a broadened awareness that problems are occurring and where they are occurring (Balkundi & Kilduff, 2006) that helps direct attention to priority areas.

These benefits, however, do not come without costs. Multiplex relationships require considerable time and effort for relationship development and maintenance. For instance, the development of friendship in addition to work-focused relationships may require the investment of considerable time and energy that can lead to emotional exhaustion (Methot et al., 2016). In addition, leaders who combine the relations of advice provider and friend with many team members may find that these multiplex relationships carry conflicting expectations that increase stresses and strains (Ingram & Zou, 2008; Methot et al., 2016). Whereas exchanges in friendship relationships may be guided by concerns for the other's welfare, such concerns may be irrelevant in instrumental exchanges (Ingram & Zou, 2008). These costs may be multiplied by a position of centrality within the team that signals the accumulation of multiplex relationships with many team members.

Although these costs pertain to the nature of multiplex relationships in general, they may weigh particularly heavy for formal team leaders. By virtue of their linking-pin positions connecting their team members with others in the wider organization, team leaders need to develop relationships with peer team leaders as well as upper echelon management to be effective (Mehra et al., 2006). In light of such competing demands, team leaders need to make choices on how to invest their limited time and energy. Investments in multiplex relationships with members of their team naturally result in less time available for boundary spanning activities with others outside their team.

What is currently unclear is whether the extra influence garnered by a leader's centrality in the team multiplex network outweighs its costs. We propose that this is the case if leaders face substantive challenges that necessitate strong leader influence, such as improving the performance of stable, on-going teams. Teams, from their inception, develop routines that guide their members' collective behavior (Bettenhausen & Murnighan, 1985; McGrath et al., 1984). Habitual routines tend to persist in the absence of external circumstances forcing new courses of action (Edmondson et al., 2001). Stable, continuing groups rarely initiate reassessments of their performance routines (Gersick & Hackman, 1990). Although routines are functional in reducing uncertainty, saving time, and eliminating the need for deliberating actions, they can also be dysfunctional when change is needed—for instance, when management views team performance as sub-optimal (Bresman, 2013; Zellmer-Bruhn et al., 2004; for alternative views, see Feldman & Pentland, 2013).

Team leaders can play a central role in inducing changes in performance routines (e.g., Edmondson et al., 2001). A formal leader who is also at the center of a multiplex network that combines instrumental and expressive ties has two channels of influence through which to steer a team toward performance change. Through the advice network, the leader can facilitate reflection and revision of habitual routines by providing novel information and timely help. 'Novelty' has been suggested as a critical condition for teams to change their routines through reflection (Gersick & Hackman, 1990). Moreover, candid reflection requires team members to lower their guard and expose vulnerabilities as they discuss team performance (Widmer et al., 2009). We propose that this process benefits from the collaboration and trust that accompany the friendship relationships that leaders build with followers. In the absence of collaboration and trust, we expect information processing (and thus reflection) to be impaired by threat-rigidity reactions (Staw et al., 1981). And a position of centrality in both channels augments a formal leader's ability to direct team reflections

toward performance improvement through providing information and advice as well as enabling collaboration and trust.

In sum, we submit that, relative to leaders who are central in either the team friendship or advice network, leaders who are central in a multiplex network that combines friendship relations and advice relations lead teams that improve performance over time. More formally we state the following hypothesis.

Hypothesis 1: Leader multiplex centrality is more strongly related to team performance change than leader simplex centrality.

Social Network Context and Leader Multiplex Centrality

Given the costs to the leader of generating and maintaining multiplex ties, the question arises as to the boundary conditions under which leader multiplex centrality is likely to be more or less influential in improving team performance over time. We draw on the structural embeddedness perspective (Granovetter, 1985) to suggest that a leader's influence efforts are contingent on the leader's social context (e.g., Brands et al., 2015; Brass & Krackhardt, 1999; Chung & Luo, 2012). Structural embeddedness arguments stress the role of personal relations and networks of such relations (i.e., indirect relations) in generating trust, understanding, and commitment among people (Barden & Mitchell, 2007; Granovetter, 1985). Structural embeddedness is not constrained to a focal person's direct connections, but also includes indirect connections (e.g., Uzzi, 1996, 1997). In order to understand the complexities of leader embeddedness, Balkundi and Kilduff (2006) explicitly point to the importance of such indirect ties within which leaders are embedded.

Embeddedness research has focused on positive relationships, but has neglected the countervailing situation in which relationships such as leadership are carried on in contexts that are difficult rather than helpful. We contribute to social network research by separating the effects of positive and negative embeddedness in relation to leadership, drawing from the

social ledger approach to social capital (Labianca & Brass, 2006). This perspective emphasizes the importance of capturing "both the potential benefits and the potential liabilities of social relationships. Just as a financial ledger records financial assets and liabilities, the social ledger is an accounting of social assets—or social capital—derived from positive relationships and social liabilities derived from negative relationships" (Labianca & Brass, 2006, p. 596). To this end, we look at leadership embeddedness in friendship and adversarial networks.

Negative embeddedness. Teams differ in the extent to which members have adversarial relationships. As with other researchers who are interested in team performance, in looking at negative relationships, we focused on relationships with coworkers that are difficult (Baldwin et al., 1997). The concept of the adversarial network captures negative relationships in broad and generic terms so that comparisons to positive tie networks are clear (Yang et al., 2020, pp. 54-55). Negative embeddedness in such a network is the extent to which a leader's team has a high versus a low proportion of adversarial ties. Teams in which coworkers' negative ties are so extensive that they thwart task behaviors—i.e., teams with dense adversarial networks—are vulnerable to performance losses (Sparrowe et al., 2001). Teams characterized by negative embeddedness have reduced social capital resources (Oh et al., 2006) in that they fail to share information effectively (e.g., Yang et al., 2020). And team members are likely to lack the collaboration and trust needed to commit to altering their performance behavior. As a result, these teams are likely to experience difficulty reflecting on prior performance and agreeing on changes for future actions (Marks et al., 2001).

It is precisely these teams with dense adversarial networks that are likely to be responsive to leaders who occupy positions of multiplex centrality across friendship and advice team networks. As we noted above, the multiplex leader has a strong influence base to provide, as needed, information and advice; invoke collaboration and trust; and direct the

team's efforts toward performance improvement over time. Through these informal influence mechanisms, the multiplex leader can facilitate the team's reflection on prior performance, and help the team prepare for future actions (Marks et al., 2001).

By contrast, teams with sparse adversarial networks are relatively free of the interpersonal obstacles that impair information sharing, and therefore are in little need of multiplex leadership to stimulate reflection. Indeed, a position of multiplex centrality is likely to tempt a leader of a well-functioning team toward unnecessary involvement in team processes (Tost et al., 2013). We predict, therefore, a 'strengthening' interaction effect (Gardner et al., 2017) where a leader who is central in a multiplex network that combines friendship and advice is more likely to lead the team toward positive performance change if the team exhibits a high proportion of adversarial relationships among team members.

> *Hypothesis 2:* Adversarial network density interacts with leader multiplex centrality, such that leader multiplex centrality is more positively related to team performance change for dense rather than sparse networks.

Positive embeddedness. We further argue that leader multiplex centrality may be less relevant for teams with dense positive relationships, namely friendship. Friendship relations transmit enthusiasm, eagerness and happiness among team members and connote intimacy, proximity and reciprocity (Lydon et al., 1997). Teams in which many members have friendship ties with one another exhibit positive team social capital (Oh et al., 2006) that facilitates effective teamwork via multiple mechanisms. High levels of emotional closeness among team members are likely to trigger information sharing and collaboration that is needed for effective task completion (Coleman, 1988). Indeed, meta-analysis shows comparably strong and positive effect sizes for expressive (i.e., friendship) tie density as for instrumental (i.e., advice) tie density on team performance (Balkundi & Harrison, 2006).

In teams with dense (relative to sparse) friendship networks, the greater influence available to a leader who is central in the team's multiplex network is likely to provide redundant resources that may add little to a team's efforts to change its habitual performance routines. When communication among team members is facilitated by good relationships, decisions are taken with consensus, and information flows interchangeably (Rulke & Galaskiewicz, 2000). Consensus and information flow help team reflection and planning during transition processes (Marks et al., 2001) relatively independently of leader input.

By contrast, teams characterized by low friendship embeddedness have reduced social capital resources, notably impaired information sharing (Oh et al., 2006). As a result, such teams are likely to experience difficulty altering habitual performance routines through reflection on past achievements or through planning for future actions (Marks et al., 2001). In such teams, leaders may use positions of multiplex centrality to provide information and advice; to instill collaboration and trust; and to direct team efforts toward performance improvement over time. Thus, we posit a 'weakening' interaction effect (Gardner et al., 2017) where a leader who is central in a multiplex network that combines friendship and advice is likely to lead the team toward positive performance change if the team exhibits a low proportion of friendship relationships among team members, but where this effect weakens for teams with higher proportions.

> *Hypothesis 3:* Friendship network density interacts with leader multiplex centrality, such that leader multiplex centrality is more positively related to team performance change for sparse rather than dense networks.

Combined effects of negative and positive embeddedness. We have so far argued for separate effects of two types of embeddedness given their different meanings. A low proportion of adversarial ties does not equate to a high proportion of friendship ties; and a low proportion of friendship ties does not equate to a high proportion of adversarial ties.

Given their conceptual independence, leadership embeddedness may comprise both positive *and* negative interpersonal relationships. This is in line with the notion of a social ledger (Labianca & Brass, 2006) that views positive and negative social capital in concert, rather than in isolation. Thus, from the perspective of leaders trying to improve team performance over time, the two types of embeddedness may combine interactively to form the team context in which leader multiplex centrality is either vital or redundant. An examination of the interplay of both types of embeddedness may thus offer a more comprehensive understanding of the boundary conditions under which leader multiplex centrality is likely to be more or less influential in improving team performance over time.

Various combinations of embeddedness may either reduce or increase the efficacy of leader multiplex centrality for team performance improvement over time. Situations in which the extra influence provided by a position of leader multiplex centrality is likely to be redundant include the following. First, teams with dense adversarial networks may compensate for their difficulties at work by relying on friendships to overcome their difficulties without having to resort to leader intervention (dense adversarial and dense friendship networks). Second, coordination in teams with low friendship density may be facilitated by the absence of adversarial relationships (sparse adversarial and sparse friendship networks). In such teams, the exchange of information and resources may still be in working order. Third, teams with low adversarial density and high friendship density have a surplus of social capital allowing for seamless coordination and exchange (sparse adversarial and dense friendship networks). In each of these cases, teams are likely to have well-functioning transition processes (Marks et al., 2001), and team reflection and planning may occur relatively independently of leader input. From the perspective of team leaders, a position of multiplex centrality is likely to provide redundant resources with only incremental benefits for a team's performance efforts.

By contrast, leader multiplex centrality may be highly facilitative in teams with high adversarial density and low friendship density. Such teams are likely to exhibit severely impaired team transition processes (Marks et al., 2001) and are therefore likely to benefit from the provision of information and advice, the instillation of collaboration and trust, and the direction of team efforts toward performance improvement, by leaders high in multiplex centrality. Put differently, a leader who is central in the team multiplex network can provide the necessary input to stimulate team transition processes and thereby change these teams' habitual performance routines, resulting in team performance increase over time. In sum, we expect that a leader who is central in a multiplex network that combines friendship and advice is more likely to lead the team toward performance improvement if the team exhibits a high proportion of adversarial relationships and a low proportion of friendship relationships. More formally, we posit the following hypothesis.

> *Hypothesis 4:* Friendship and adversarial network density interact with leader multiplex centrality, such that leader multiplex centrality (a) is positively related to team performance change for teams with dense adversarial networks and sparse friendship networks, and (b) is unrelated to team performance change for teams with other combinations of high and low adversarial and friendship density.

Methods

Sample and Procedures

We collected data at a public university in Spain from service teams that met criteria of organizational teams. IRB approval was obtained from Instituto de Empresa Business School (project title: "Predicting Effective Intergroup Relations: A Social Network Perspective" SEJ2007-65202/ECON). These definitional criteria were: organizationally relevant tasks performed by two or more people who shared one or more common objectives, interacted socially, fulfilled different roles and responsibilities, performed tasks

interdependently, maintained and managed boundaries, and were located within an organizational context (Kozlowski & Bell, 2013). We incentivized participation by raffling two iPods among participants. Out of 96 teams that were invited to respond, 93 (97% response rate) participated. Because leader centrality calculations required at least three members in a team, we further excluded nine two-person teams, resulting in a final sample of 84 work teams. These teams provided services and resources (e.g., career advice, legal counseling, research support, planning, library services, accounting) to faculty members, students, and the general public. All teams had been created at least two years prior to this study, and team members had worked in their present positions for an average of 6.77 years (SD = 6.64).

Each of the 84 participating teams was headed by a designated leader, who was a member of the team. Teams were overseen by 57 line managers who were not part of the teams but managed their respective teams' operational area (e.g., Human Resources, Research Support). From these managers, we collected rosters containing the names of team members. Following established procedures (Brislin, 1980), two independent bilingual translators translated surveys and rating forms from English to Spanish and back to English, in order to ensure the accuracy of original items. Subsequent pilot testing was performed with 13 employees who did not participate in the main study in order to gauge survey completion time, as well as to ensure that instructions and items were clear and unambiguous.

Out of 343 full-time employees, 339 respondents (98.8%) returned useable surveys. Team response rates for each individual team exceeded 80% (e.g., Oh et al., 2004). Two hundred (78.4 %) employees, and 65 (77.4 %) leaders were female. Two hundred and seven (61.1%) employees, as well as all leaders, had a college degree or higher. Employees were on average 43 years old (SD = 8.04), whereas leaders were on average 44 years old (SD = 7.16).

Our theorizing concerns on-going, stable teams. Employees' tenure with their teams in our sample averaged 6.48 years (SD = 3.80), whereas leaders were in their current team leadership role for an average of 9.51 years (SD = 7.09). Thus, these were relatively unchanging teams in terms of membership and leadership[i]. This was further confirmed by team members' perception of the clarity of team boundaries as well as team stability. Both constructs were measured with two-item scales (Wageman et al., 2005); ratings ranged from 1 ("very inaccurate") to 5 ("very accurate"). On average, team members perceived clear team boundaries (for example, "Team membership is quite clear—everybody knows exactly who is and isn't in the team"; mean = 4.56, SD = .38), and teams were perceived as stable (for example, "This team is quite stable, with few changes in membership"; mean = 4.16, SD = .59).

The tenacity of the habitual routines (Gersick & Hackman, 1990) in on-going teams suggests changes in performance require time. Although temporally separated outcome measures have previously been used in team research, theory and research offer little specific advice concerning when changes in team performance should ideally be observed (Kozlowski & Bell, 2013). General recommendations suggest that team performance change should be measured over a time period that captures both the first occurrence of an effect and the extent of the effect (Mitchell & James, 2001). After consultation of the team literature, we chose a comprehensive and context-sensitive approach. We assessed team performance at the time the team survey was distributed (Time 1), six months later (Time 2) to capture short-term change, as well as two years later (Time 3) to capture long-term change. These variably spaced data collection points were informed by conversations with organizational representatives, as well as by the duration of particular projects that teams were working on. Interviews with organizational representatives revealed no organizational changes (such as organizational restructuring, alterations in strategy, or important external events) that would

have substantially affected the work of these teams over the two-year study period[ii]. All 57 line managers returned usable team performance ratings at all three time points.

Measures

Team networks. The team questionnaire was completed by team members and team leaders, and included questions concerning friendship, advice, and adversarial relationships between the respondent and other team members listed alphabetically (Marsden, 1990). All network measures were calculated using UCINET (version 6.497; Borgatti et al., 2002).

Friendship and advice ties have commonly been used as generic representations of expressive and instrumental ties within the tradition of social networks research (e.g., Ibarra & Andrews, 1993; Krackhardt, 1990). Lincoln and Miller (1979) refer to friendship networks as the "primary network." For friendship relations, each respondent indicated on a five-point scale (1 = acquaintance, 2 = distant colleague, 3 = friendly colleague, 4 = good friends, 5 = very close friends) closeness to each other team member (Perry-Smith, 2006). For advice relations, each respondent indicated on a five-point scale (1= little extent to 5 = strong extent) the extent of information or advice obtained from each other team member to get tasks done (Chua et al., 2008). For adversarial relations, each respondent indicated on a six-point scale (ranging from 0 = no extent to 5 = strong extent) the extent to which the relationship with each other team member was difficult (Baldwin et al., 1997). Adversarial ties capture difficult relationship at a broader level of abstraction that tap into affect, cognition, and behavior (Yang et al., 2020). Such a generic measure is desirable as it "…allows all of the research to be brought together under one umbrella, and for it to be compared as a whole to positive tie research" (Yang et al., 2020, p. 54). The emphasis on high response rates in network research renders single-item measures standard to reduce participant fatigue (e.g., Marsden, 1990).

Leader simplex and multiplex centrality. Leader centrality in friendship and advice simplex networks was calculated as leaders' normalized in-degree centrality (Sparrowe et al.,

2001) within a simplex friendship or advice matrix, respectively. To create the friendship matrix, we followed prior work in coding a friendship tie as "1", if a team member indicated they were "good friends" or "very close friends" with a colleague; and "0" otherwise (e.g., Perry-Smith, 2006). For the advice matrix, we coded an advice tie as "1" if a team member indicated that the extent to which they obtained information or advice from a colleague was either a "great extent" or "very great extent"; and "0" otherwise. Normalization allowed us to compare centrality scores across teams of different sizes.

Leader multiplex centrality was calculated as leaders' normalized in-degree centrality within a multiplex matrix that combined both friendship and advice ties. In this combined matrix, a "1" indicated that a team member had both a friendship and advice tie with the team leader, and a "0" that a team member had only a friendship tie, only an advice tie, or no friendship or advice tie with the team leader.

Positive and negative embeddedness. In line with social capital research on teams (Oh et al., 2004; 2006), we measured embeddedness with density. Density is the number of ties in the team network divided by the maximum number of ties that are possible (Kilduff & Brass, 2010, p. 356). Because we had valued data (i.e., tie strength was measured from 1 to 5), measures of team density for friendship and adversarial networks were computed as the sum of the values of all team member ties (excluding relations involving team leaders) in the team divided by the number of possible team member ties (Hanneman & Riddle, 2005), thereby reflecting the average strength of ties across all possible ties within teams.

Team performance over time. Informal interviews with organizational representatives suggested that the organization was striving to continuously improve its performance, an ambition that was regularly communicated to staff. Performance of employees and teams was formally assessed as part of an annual performance scheme. Team

leaders were held accountable for the performance of their teams, and leaders of poorly performing teams suffered reputational damage.

We asked line managers to rate team performance at times 1, 2, and 3 with Vinokur-Kaplan's (1995) 5-item scale ranging from 1 (not at all) to 5 (completely). The measure captured the extent to which the team met its performance standards of (1) quality, (2) quantity, (3) timeliness, (4) implementation, and (5) whether it had a reputation for work excellence within the organization (Hackman, 1987). We chose this theory-based measure because it was generic enough to apply to a variety of teams in the service sector, thereby enabling comparisons of the extent to which various teams met their respective performance standards. An example item is, "To what extent do you feel that this team met the standards of quality expected by your organization?" Cronbach's alpha was .74 (Time 1), .80 (Time 2), and .91 (Time 3). The time frame provided for these ratings was the past six months.

Control variables. We controlled for variables that could present potential confounds or alternative explanations. We dummy-coded participating teams as technology-based services, health-based services, legal services, and miscellaneous other services, in order to capture different areas of expertise. Team size was taken from the rosters provided by line managers (range = 3-16). Team task interdependence was assessed with a single item, "Generating the outcome or product of this team requires a great deal of communication and coordination among members" (Wageman et al., 2005). The item ranged from 1 (very inaccurate) to 5 (very accurate) and was aggregated to the team level (median $r_{wg(j)}$ = .83, ICC1 = .22, ICC2 = .52). Perceptions of team stability were captured with Wageman et al.'s (2005) two-item measure introduced earlier, aggregated to the team level (median $r_{wg(j)}$ = .80, ICC1 = .08, ICC2 = .25). In order to illustrate the incremental value of leader multiplex centrality above and beyond team member ties, we controlled for team multiplex density. This was calculated based on the combined friendship and advice relations excluding

relations involving team leaders, as the sum of the values of all ties divided by the number of possible ties (Hanneman & Riddle, 2005). Team members' tenure with their team in months was captured by a free recall question and averaged across team members. Because the level of authority that a team has over its operations may affect its dependence on its team leader, we controlled for team authority with Wageman et al.'s (2005) four-item measure. Each item offered a 'yes' (1) or 'no' (0) choice. An example item is, "Our team also has the authority to monitor our own work processes and to change or adjust them if needed." The final team authority index was the mean of team members' responses to those four binary questions. We controlled for the centrality of team leaders within the larger organization by summing leaders' team-external ties in response to a free recall question (Oh et al., 2004). Leader gender, leader age (in years), and leader tenure in their current position (in years) were taken from the leader survey.

Analytical Approach

In order to create a measure of team performance change, we conceptualized temporal change as a slope capturing the trajectory across three measurement points. Specifically, we used the multilevel package in R (Bliese, 2002) to generate each team's slope value from the empirical Bayes slope estimate. We drew this estimate from a mixed-effects baseline model where team performance was regressed on time (coded as 0, 6, and 24 for months elapsed at times 1, 2, and 3), with a level added for clustering of team performance ratings within line managers (Bliese & Ployhart, 2002). This baseline model showed no evidence of quadratic time trends. Empirical Bayes estimates are commonly used to describe change (e.g., Chen et al., 2011; Mathieu & Rapp, 2009). These estimates are more precise than ordinary least squares (OLS) estimates, because values generated for a specific team are weighted by overall sample information in addition to team information (Singer & Willett, 2003).

The time-based nature of the team performance outcome measures suggests that within-team errors exhibit some autocorrelation. We thus examined models with alternative error variances and found that a model with autocorrelated error terms fit the data best (see Bliese & Ployhart, 2002). Note that any nonindependence due to time (e.g., correlated residuals) or nestedness within line managers was modeled as part of this mixed-effects model used to generate team performance scores. With this approach, positive estimates reflect positive change, negative estimates reflect negative change, and an estimate that equals zero indicates no change in team performance over time.

In order to enable comparisons of effects on team performance change relative to a more static team performance assessment, we also included models with team performance Time 1 as outcome. To create this measure, time was coded in the baseline model such that the empirical Bayes estimate for the intercept represents team performance at Time 1—specifically, we coded time as T1 = 0, T2 = 6, and T3 = 24 (Biesanz et al., 2004).

We z-standardized all predictor variables prior to hypotheses testing. This served to facilitate interpretation, and to reduce multicollinearity when computing interaction terms (cf. Iacobucci et al., 2016). Some team leaders reported to the same line managers. We therefore adjusted standard errors for correlations of error terms due to clustering within line managers with STATA's vce cluster command in all regression analyses[iii].

Results

Table 1 summarizes descriptive statistics and Pearson's correlations among study variables. Comparable to prior research on negative ties (e.g., Sparrowe et al., 2001), adversarial density was relatively low across teams (mean = .20). Leader multiplex centrality positively predicted team performance at Time 3 (r = .45, p < .01).

Hypothesis Testing

Table 2 presents regression results on team performance over time. To enable relevant comparisons with team performance change, we included baseline models of team performance Time 1 (Models 1, 3, and 5). Because much of our theorizing concerns the influence of leader multiplex centrality relative to simplex centrality, we also provide, for the sake of comparison, effects of leader centrality in simplex advice and friendship networks (Models 1 to 4)[iv]. Across models, variance inflation factors (VIF) were below 2.90, and thus well below the often-recommended threshold of 10 (e.g., Kutner et al., 2004), suggesting that multicollinearity was negligible. Following Aiken and West (1991), we do not present separate control or main effect models due to the presence of significant interaction terms.

Main effects of leader simplex versus leader multiplex ties. Hypothesis 1 stated that leader multiplex rather than simplex centrality positively predicts change in team performance. As the positive coefficient for leader multiplex centrality in Table 2, Model 6, shows, this hypothesis was supported ($b = .02$, $p < .01$). And, consistent with our expectations, leader simplex centrality did not affect performance change, whether we consider the advice network (Table 2, Model 2, $b = .00$, *ns*) or the friendship network (Table 2, Model 4, $b = .01$, *ns*).

We further examined whether the effect of leader multiplex centrality on performance change was stronger than the effect of leader centrality in either friendship or advice networks, by employing the 'suest' and 'test' commands in STATA. Suest is based on the seemingly unrelated estimation procedure, which enables the testing of cross-model hypotheses. The procedure allows for correlated errors across estimated models by combining the estimation results into a single, simultaneous covariance matrix. Specifically, we evaluated the null hypothesis that the coefficient estimate for leader multiplex centrality is not significantly different from the coefficient estimate for leader friendship and leader advice centrality, respectively. This analysis suggested that leader multiplex centrality was a

stronger predictor than leader centrality in friendship ($\chi^2(1) = 6.50$, $p < .05$), as well as a stronger predictor than leader centrality in advice networks ($\chi^2(1) = 12.19$, $p < .001$). Thus, Hypothesis 1 was supported.

Interactions between leader multiplex ties and team density. Hypothesis 2 predicts that adversarial embeddedness (measured in terms of density) positively moderates the relationship between leader multiplex centrality and team performance over time, such that this relationship is more positive for dense relative to sparse team adversarial networks. Providing initial support for Hypothesis 2, Table 2, Model 6, shows that the adversarial density × leader multiplex centrality interaction on team performance change was significant ($b = .01$, $p < .01$). And Table 2 confirms that leader centrality in neither advice (Model 2, $b = .00$, *ns*) nor friendship (Model 4, $b = .00$, *ns*) networks interacted with adversarial density to affect team performance change.

Additional simple slope analyses (Preacher et al., 2006) clarified that the relationship between leader multiplex centrality and team performance change was positive and significant when team adversarial networks were dense ($b = .03$, $t = 4.32$, $p < .001$), but was non-significant when team adversarial networks were sparse ($b = .00$, $t = .36$, *ns*). Thus, Hypothesis 2 was supported. Figure 2 illustrates this relationship at high (mean +1 SD) and low (mean -1 SD) levels of adversarial density.

Hypothesis 3 proposes that friendship embeddedness negatively moderates the relationship between leader multiplex centrality and team performance over time, such that this relationship is more positive for sparse relative to dense team friendship networks. Table 2, Model 6, provides initial support for this hypothesis ($b = -.01$, $p < .01$). And Table 2 confirms that leader centrality in neither advice (Model 2, $b = .00$, *ns*) nor friendship (Model 4, $b = .00$, *ns*) networks interacted with friendship density to affect team performance change.

Further probing of this interaction with simple slope tests suggests that the relationship between leader multiplex centrality and team performance change was positive and significant for sparse (b = .02, t = 4.23, p < .001), but non-significant for dense friendship networks (b = .01, t = 1.40, *ns*). Thus, Hypothesis 3 was supported. Figure 3 illustrates this interaction effect.

Hypothesis 4 proposed a three-way interaction effect, such that leader multiplex centrality is positively related to team performance over time if team networks are both dense with adversarial and sparse with friendship ties. Table 2, Model 6, provides initial support for this hypothesis by showing a significant three-way interaction between adversarial density, friendship density, and leader multiplex centrality on team performance change (b = -.01, p < .01). And Table 2 shows the non-significance of interactions involving leader simplex centralities. Specifically, the three-way interaction effects with leader centrality in advice (Model 2, b = .00, *ns*) and friendship (Model 4, b = -.01, *ns*) networks were non-significant.

Further probing of the significant three-way interaction revealed that the relationship between leader multiplex centrality and team performance change was positive and significant if team networks were dense with adversarial and sparse with friendship ties (b = .05, t = 5.67, p < .001). No other slope was significant (for dense adversarial and dense friendship networks, b = .01, t = 1.64, *ns;* for sparse adversarial and friendship networks, b = .00, t = .06, *ns;* for sparse adversarial and dense friendship networks, b = .00, t = .42, *ns*). Thus, Hypothesis 4 was supported. Figure 4 illustrates this three-way interaction effect.

Robustness Checks

Following Chen et al. (2011), we cross-checked our hypothesized results on team performance change by substituting the empirical Bayes estimate of the slope with the team performance measure Time 3, controlling for team performance Time 1. These analyses replicated the hypothesized effects and resulted in identical interpretations.

In order to gauge multiplexity effects, prior research has contrasted multiplexity measures with uniplex measures. A uniplex friendship tie captures exclusively friendship and not advice relationships, whereas a uniplex advice tie captures exclusively advice and not friendship relationships (Shah et al., 2017). Applied to our case, we examined the assumption that leaders' centrality in either their exclusive advice or friendship networks does not have the same influence on team performance change as leader multiplex centrality. We computed leader centrality in advice and friendship uniplex networks by computing leaders' normalized in-degree centrality (Sparrowe et al., 2001) within a uniplex matrix of exclusively friendship or advice ties. In the advice matrix, a "1" indicated that a team member had an advice tie but no friendship tie with the team leader. Conversely, in the friendship matrix, a "1" indicated that a team member had a friendship tie but no advice tie with the team leader. We then ran a regression model to test our hypotheses substituting for leader multiplex centrality with leader uniplex advice and leader uniplex friendship centrality, respectively. These analyses revealed that leader centrality in uniplex advice or friendship networks did not positively predict increase in team performance under any condition. However, leader centrality in uniplex advice networks was *negatively* associated with team performance change (b = -.01, $p < .05$). Thus, leaders central in team networks that were exclusively advice-focused led teams with reduced performance over time. Also, leader centrality in the uniplex friendship network interacted with team adversarial networks to predict team performance change (b = -.01, $p < .01$). Specifically, simple slope tests showed that whereas leader centrality in the uniplex friendship network was negatively associated with team performance change for teams with dense adversarial networks (b = -.01, t = -2.45, $p < .05$), it was unrelated to team performance change for teams with sparse adversarial networks (b = .01, t = 1.41, *ns*). In sum, and in line with expectations, leader uniplex centrality in team advice or friendship

networks was either unrelated or negatively related to team performance change. These findings further emphasize the strength of leader multiplex centrality.

Additional Analyses

Demographic characteristics. We explored participants' age, tenure, gender, occupation, and education level as predictors of leader multiplex centrality. Leader tenure in current position was the sole demographic predictor and was included as a control.

Addressing endogeneity. We addressed the omitted variable problem of endogeneity (Wooldridge, 2002) in two ways. First, we conduced Impact Threshold of Confounding Variable (ITCV) analysis to examine the severity of omitted variable bias (Frank, 2000). ITCV examines the severity of this endogeneity issue by determining the minimum correlations of the independent and dependent variables with a hypothetical omitted variable that is required to overturn the results from significant to nonsignificant. For our findings predicting team performance change reported in Table 2's main study model 6, ITCV analyses showed that to invalidate H1 (leader multiplex centrality predicting team performance change), 36 (i.e., 42.67%) cases in our sample would have to be replaced with cases for which there is an effect of 0. A hypothetical omitted variable would have to be correlated at least at .457 with *both* leader multiplex centrality *and* team performance change (conditional on observed covariates) to invalidate this inference. Our analysis further suggests that a hypothetical omitted variable would have to be correlated at least at .458 with both the leader multiplex centrality X adversarial density interaction and team performance change to invalidate H2; at least at .321 with both the leader multiplex centrality X friendship density interaction and team performance change to invalidate H3; and at least at .364 with both the leader multiplex centrality X adversarial X friendship density interaction and team performance change to invalidate H4. These analyses suggest that a potential omitted variable

is unlikely to invalidate H1 and H2 findings, but that further examination of potential omitted variables is advisable to gauge the robustness of H3 and H4.

We thus explored the robustness of our findings against the addition of further variables. We focused specifically on variables that could be associated with unobserved changes during the two-year study period or the stability of team networks, i.e., team membership change and team boundedness. Both constructs are central to the notion of fluidity in teams (Mortensen & Haas, 2018). We reran study models controlling for membership change computed as the number of employees who left or joined a team during the two-year study period, divided by team size (Hirst, 2009). Results remained unchanged with respect to the hypothesized direction and significance of effects. Also, membership change did not significantly correlate with team performance change (r = -.00, p = .97) or predictor variables. We conducted the same analysis with Wageman et al.'s (2005) measure of clarity of team boundaries introduced earlier. Again, hypothesized results remained unchanged, and boundedness did not significantly correlate with team performance change (r = -.13, p = .24) or predictor variables. In the interest of parsimony, and in light of the literature cautioning against the use of impotent controls (Becker, 2005), we did not include these variables in the main study models.

Short- versus long-term growth in team performance. We expected the effects of leader multiplex centrality to manifest mainly in the long term given the constraints leaders experience in trying to increase performance in on-going teams (Hackman & Wageman, 2005); and the tendency for teams in bureaucratic settings to develop work practices that mitigate against speedy change (Hambrick, 1995; Katz, 1982). We ran regression analyses with standard errors adjusted for clustering within line managers for both short-term (on team performance T2 controlling for team performance T1) and long-term (on team performance T3 controlling for team performance T2) performance change. Results revealed that

hypothesized main and interaction effects were insignificant short-term (b leader multiplex centrality = .06, *ns;* b leader multiplex centrality x adversarial density = .02, *ns*; b estimate leader multiplex centrality x friendship density = -.01, *ns;* b interaction leader multiplex centrality x adversarial density x friendship density = .06, *ns*), but significant long-term (b leader multiplex centrality = .41, $p < .001$; b leader multiplex centrality x adversarial density = .28, $p < .01$; b leader multiplex centrality x friendship density = -.19, $p < .001$; b leader multiplex centrality x adversarial density x friendship density = -.21, $p < .01$).

In order to further examine whether performance effects differed long-term versus short-term, we again employed STATA's 'suest' and 'test' commands that we introduced previously. We tested the null hypothesis that the coefficient estimate for leader multiplex centrality is equal for short- and long-term team performance change. This analysis confirmed that leader multiplex centrality main and interactive effects were stronger for long-term than for short-term change (for leader multiplex centrality, $\chi^2(1) = 13.04$, $p < .001$; for leader multiplex centrality x adversarial density, $\chi^2(1) = 5.75$, $p < .05$; for leader multiplex centrality x friendship density, $\chi^2(1) = 7.69$, $p < .01$; and for leader multiplex centrality x adversarial density x friendship density, $\chi^2(1) = 13.14$, $p < .001$). This analysis suggests that the proposed main and interactive effects of leader multiplex centrality were more pronounced in the long term rather than the short term.

Discussion

Changing the performance of ongoing, stable organizational teams is a key challenge for team leaders (Hackman & Wageman, 2005). This challenge is accentuated by a leader's embeddedness in dysfunctional patterns of social interaction characterized by few team member friendships or many difficult relationships among team members. Our results show that, given these team embeddedness contexts, leaders who have many ties in a multiplex network improve team performance over a two-year period. It is not sufficient for these

leaders to be either liked or regarded as expert. It is the integration of both friendship and advice in one tie between the leader and followers that affects performance change.

Research Contribution

There are three main contributions to theory and research relating to multiplexity, embeddedness, and team performance change. First, we respond to calls for theory and research on multiplexity (Shipilov et al., 2014). Multiplex research has hitherto focused mainly at the interorganizational level (e.g., Rogan, 2014). Our research suggests that multiplexity is relevant also for formal team leaders. We advance our understanding of leadership in teams by providing insights into the differential influence provided by leader centrality in multiplex versus simplex team networks. Our theory and results add to existing research on leadership centrality in either team friendship or advice networks (see Balkundi & Harrison, 2006, for a review) the construct of leader multiplex centrality as a means to improve team performance over time, in particular for teams with depleted social capital resources. In addition, the multiplex centrality approach advanced in this research may supplement (rather than compete with) alternative approaches that emphasize the static traits and behaviors of formal leaders. For instance, formal team leaders that endorse consideration or structuring behaviors (Judge et al., 2004) may increase their efficacy by channeling these behaviors through a social network of multiplex relationships with team members.

The second contribution of our study is to open up embeddedness research to consideration of both negative and positive embeddedness. Prior work has focused almost exclusively on positive-tie embeddedness despite emerging research that considers multiplexity across different negative tie network relationships (e.g., Marineau et al., 2018). Embeddedness in friendship and kinship networks has been considered by some researchers the key to understanding the emergence of community and its benefits for individuals including trust (e.g., Coleman, 1990). For other researchers, a high density of positive

relationships reduces opportunities for the development and transmission of new ideas (e.g., Burt, 1992; Granovetter, 1973). In our research, we balance this prior emphasis on positive-tie embeddedness, by introducing the idea of embeddedness in a negative-tie network. The challenge facing a team leader is not just to respond to the positive ties among team members. Team leaders also need to grapple with the ways in which team members may be hindering each other's work efforts. A balanced approach to embeddedness challenges, therefore, is to include both positive and negative embeddedness in research designs.

Our third contribution relates to our dependent variable, team performance over time. Prior theoretical and empirical accounts of temporal dynamics in teams have predominantly emphasized either team development (e.g., Gersick, 1988) or task-based cycles (e.g., Marks et al., 2001). Notable exceptions examined team performance change of experimental ad-hoc student teams performing simulation tasks (e.g., Dierdorff et al., 2011, Lorinkova et al., 2013; Mathieu et al., 2015). But there is a dearth of research on how to evoke performance change in on-going and stable organizational teams that commonly develop habitual performance routines that are resistant to change (Gersick & Hackman, 1990). This is surprising because both theory (e.g., McGrath 1991; Quigley et al., 2018) and research evidence (e.g., Landis, 2001) point to the dynamic, fluctuating nature of team performance. Capturing a team's performance trajectory over a considerable time period may be a better indicator of sustainability at the team level than team performance assessments at single points in time. In sum, our study presents a call to arms for more research on dynamic conceptualizations of team performance.

Future Research

We anticipate future research that examines the boundary conditions of leader multiplex centrality in predicting outcomes, thereby contributing to the debate among social network researchers regarding the team social structures that foster or thwart the effectiveness

of central leaders (e.g., Balkundi & Harrison, 2006). In our research, the boundary conditions relate to leaders' embeddedness in positive and negative networks. But it may be that teams that exhibit demographic faultlines (Lau & Murnighan, 1998) will benefit from leaders whose influence is reinforced across two quite different channels of interaction, given the effects of such faultlines on a range of team outcomes including performance (Lau & Murnighan, 2005; Li & Hambrick, 2005). Further, leader multiplex centrality may be necessary in teams that display a high density of different types of negative relationships such as task conflict and relationship conflict (e.g., de Wit et al., 2013).

Limitations

First, the study design draws on longitudinal measurement of outcome but not predictor variables. Although temporal precedence of predictor over outcome variables allows for stronger causal inferences than cross-sectional designs (Shadish et al., 2002), we are unable to exclude the possibility that the networks we measured have changed over the study period. However, absent external shocks that disturb on-going social network ties (e.g., Barley, 1990; Sasovova et al., 2010), social network relationships tend to persevere. For example, friendship relationships tend to persist even when people are motivated and expected to engage with new people (e.g., Ingram & Morris, 2007; Mollica et al., 2003). And adversarial relationships tend to persist over long time periods (e.g., Hambrick, 1995). Moreover, additional analyses of variables associated with the stability of network ties, notably team membership change and clarity of team boundaries (Mortensen & Haas, 2018), did not alter the hypothesized results. Nonetheless, future research may replicate study findings with experimental or longitudinal panel data.

A second limitation concerns the lack of team process measures in our study. More specifically, because we did not empirically demonstrate that team reflection indeed conveyed the proposed effects, we are unable to rule out competing hypotheses or alternative

explanations on how leader multiplex centrality affects team performance change. Future research can help uncover whether and how these processes operate in teams, building on research that emphasizes the importance of critical reflection in order for team performance to improve (Edmonson et al., 2001). Addressing this limitation would echo the call (Park, Grosser et al., 2020) for future research to integrate social network and team research to confirm the team processes that mediate the effects of leader network position on team performance change. Such research could integrate leadership perspectives with team perspectives that have advanced our understanding of team processes and social network configurations (e.g., Crawford & LePine, 2013; Park, Mathieu et al., 2020).

To respond to the need for contextualization and context theorizing in team research (Maloney et al., 2016), we incorporated the type of teams (i.e., on-going, stable) that we studied into our theory development. This, however, raises the question as to whether study findings are generalizable to team structures with less stability and longevity. We argued that the initiation of performance change is more difficult to realize in stable, on-going teams, than in teams with more dynamic and fluid structures (e.g., Mortenson & Haas, 2018). More fluid team structures may render the extra influence provided by leader multiplex centrality less relevant. In this case, a leader's costs associated with the development and maintenance of multiplex ties may not outweigh their benefits. However, it is also possible that leader multiplex centrality accelerates change in such teams. Future research that examines optimal team leader networks for different types of teams may thus be useful.

Finally, it is important to consider the cultural context of our study. The theory-driven approach to research in different cultural contexts (Brewer, 2006) that we adopted has the key advantage of allowing comparability and integration with the existing body of research. This approach views theories developed primarily in the US to be valid in other cultural contexts. However, it also demands sensitivity to culture-specific considerations. Although we expect

the dynamics of leadership and teams to be similar in Spain and the US, we point to culture-specific considerations with potential relevance to our study. Notably, Spain scores high on power distance, the extent to which a community accepts and endorses authority, power differences, and status privileges (House et al., 2004). This could render the leader more accountable for team outcomes, as well as more influential compared to societies low on power distance. We view this as a difference in quantity though, rather than a difference that would evoke qualitatively different dynamics. In a similar vein, our interactions and interviews with members of the study organization did not lead us to see the traditional and bureaucratic nature of the teams that we studied, nor the meaning of teamwork (Gibson & Zellmer-Bruhn, 2001), to be idiosyncratic for the Spanish culture. Nonetheless, future research is needed to replicate study findings in other cultures.

Practical Implications

If leadership itself is to be found in social network relations (Cullen-Lester et al., 2017), then formally appointed team leaders may be unable to rely on their positional power to solve team problems. The selection of team leaders, therefore, may need to consider candidates' interpersonal engagements in both work advice and friendship network domains, particularly in cases where team members' relationships are difficult. Achieving relations with team members that combine being liked and being the go-to person for expert advice may be particularly worthwhile for such formally appointed team leaders in precisely those teams in which trust and collaboration may have broken down. The overall practical implication of our research is that team leaders of even the most stable, bureaucratic teams need engagement in the social networks in which influence and persuasion operate in order to effect positive change in team performance. A social network approach to leadership is not the preserve of teams without formal leaders: positions of multiplex centrality within traditional teams can significantly enhance leadership influence on performance outcomes.

Conclusion

Team leaders, relying on formal power, often fail to change the performance of on-going, stable organizational teams (Gersick & Hackman, 1990; Hackman & Wageman, 2005). Leadership itself has been described as a type of social network (Carter et al., 2015) in which influence is wielded by prominent team members through contacts within and outside the team. Under these circumstances, we suggest, formal leaders, if they are not to lose influence within the teams that they supposedly run, must endeavor to focus their resources through participation in the relevant affective and instrumental networks (Cullen-Lester et al., 2017). In order to evoke positive change in the performance of on-going, stable teams, team leaders may need to win positions of multiplex centrality.

References

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

Allen, T. J. (1977). *Managing the flow of technology: Technology transfer and the dissemination of technological information within the R&D organization*. MIT Press.

Baldwin, T., Bedell, M., & Johnson, J. (1997). The social fabric of a team-based M.B.A. program: Network effects on student satisfaction and performance. *Academy of Management Journal, 40*(6), 1369–1397.

Balkundi, P., & Harrison, D. (2006). Ties, leaders, and time in teams: Strong inference about network structure's effects on team viability and performance. *Academy of Management Journal, 49*(1), 49–68.

Balkundi, P., & Kilduff, M. (2006). The ties that lead: A social network approach to leadership. *Leadership Quarterly, 17*(4), 419–439.

Barden, J. Q., & Mitchell, W. (2007). Disentangling the influences of leaders' relational embeddedness on interorganizational exchange. *Academy of Management Journal, 50*(6),

1440 –1461.

Barley, S. R. (1990). The alignment of technology and structure through roles and networks. *Administrative Science Quarterly, 35*(1), 61–1103.

Becker, T. E. (2005). Potential problems in the statistical control of variables in organizational research: A qualitative analysis with recommendations. *Organizational Research Methods, 8*(3), 274–289.

Bettenhausen, K., & Murnighan, J. K. (1985). The emergence of norms in competitive decision-making groups. *Administrative. Science Quarterly, 30*(3), 350–372.

Biesanz, J. C., Deeb-Sossa, N., Aubrecht, A. M., Bollen, K. A., & Curran, P. J. (2004). The role of coding time in estimating and interpreting growth curve models. *Psychological Methods, 9*(1), 30–52.

Blau, P. M. (1995). Population Structure and Exchange Process. *Ethik Und Sozialwissenschaften, 6*(1), 20–22.

Bliese, P. D. (2002). *Multilevel modeling in R: A brief introduction to R, the multilevel package, and the NLME package.* Walter Reed Army Institute of Research.

Bliese, P. D., & Ployhart, R. E. (2002). Growth modelling using random coefficient models: Model building, testing, and illustrations. *Organizational Research Methods, 5*(4), 362–387.

Borgatti, S. P., Everett, M. G., & Freeman, L. C. (2002). *Ucinet for Windows: Software for social network analysis.* Analytic Technologies.

Brands, R., Menges, J., & Kilduff, M. (2015). The leader in social network schema: Perceptions of network structure affect gendered attributions of charisma. *Organization Science, 26*(4), 1210–1225.

Brass, D. J., & Krackhardt, D. (1999). The social capital of 21st century leaders. In J. G. Hunt & R. L. Phillips (Eds), *Out-of-the-box leadership for the 21st Century* (pp. 179–194). JAI

Press.

Bresman, H. (2013). Changing routines: A process model of vicarious group learning in pharmaceutical R&D. *Academy of Management Journal, 56*(1), 35–61.

Brewer, M. B. (2006). Bringing culture to the table. In Y.-R. Chen (Ed.), National culture and groups. *Research on managing groups and teams*, Vol. 9 (pp. 353–365). JAI Press.

Brislin, R. W. (1980). Translation and content analysis of oral and written material. In H. C. Triandis & J. W. Berry (Eds.), *Handbook of cross-cultural psychology* (pp. 389–444). Allyn and Bacon.

Brown, J. S., & Duguid, P. (1991). Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovation. *Organization Science, 2*(1), 40–57.

Burt, R. S. (1992). *Structural holes: The Social structure of competition*. Harvard University Press.

Burt, R. S., & Ronchi, D. (1990). *Contested Control in a Large Manufacturing Plant.* In J. Weesie & H. Flap (Eds.), Social Networks through Time. (pp. 121–157). ISOR.

Carter, D. R., DeChurch, L. A., Braun, M., & Contractor, N. (2015). Social network approaches to leadership: An integrative conceptual review. *Journal of Applied Psychology, 100*(3), 597–622.

Casciaro, T., & Lobo, M.S. (2005). Competent jerks, lovable fools, and the formation of social networks. *Harvard Business Review, 83*(6), 92–99.

Chen, G., Ployhart, R. E., Thomas, H. C., Anderson, N., & Bliese, P. D. (2011). The power of momentum: A new model of dynamic relationships between job satisfaction change and turnover intentions. *Academy of Management Journal, 54*(1), 159–181.

Chua, R. Y. J., Ingram, P., & Morris, M. W. (2008). From the head and the heart: Locating cognition- and affect- based trust in managers' professional networks. *Academy of*

Management Journal, 51(3), 436–452.

Chung, C., & Luo, X. (2012). Leadership succession and firm performance in an emerging economy: Successor origin, relational embeddedness, and legitimacy. *Strategic Management Journal, 34*(3), 338–357.

Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology, 94*, 95–120.

Coleman, J. S. (1990). Rational organization. *Rationality and Society, 2*(1), 94–105.

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, 38*(1), 32–48.

Cullen-Lester, K. L., Maupin, C. K., & Carter, D. R. (2017). Incorporating social networks into leadership development: A conceptual model and evaluation of research and practice. *Leadership Quarterly, 28*(1), 130–152.

Cullen-Lester, K. L., & Yammarino, F. J. (2016). Collective and network approaches to leadership: Special issue introduction. *The Leadership Quarterly, 27*(2), 173–180.

de Wit, F. R. C., Jehn, K. A., & Scheepers, D. (2013). Task conflict, information processing, and decision-making: The damaging effect of relationship conflict. *Organizational Behavior and Human Decision Processes, 122*(2), 177–189.

Dierdorff, E. C., Bell, S. T., & Belohlav, J. A. (2011). The power of 'we': Effects of psychological collectivism on team performance over time. *Journal of Applied Psychology, 96*(2), 247–262.

Edmondson, A. C., Bohmer, R. M., & Pisano, G. P. (2001). Disrupted routines: Team learning and new technology implementation in hospitals. *Administrative Science Quarterly, 46*(4), 685–716.

Feldman, M. S., & Pentland, B. T. (2013). Reconceptualizing organizational routines as a

source of flexibility and change. *Administrative Science Quarterly*, *48*(1), 94 –118.

Ferriani, S., Fonti, F., & Corrado, R. (2012). The social and economic bases of network multiplexity: Exploring the emergence of multiplex ties. *Strategic Organization, 11*(1), 7–34.

Fiedler, F. E. (1964). A contingency model of leadership effectiveness. *Advances in Experimental Social Psychology, 1*, 149–190.

Fleishman, E. A. (1995). Consideration and structure: Another look at their role in leadership research. In F. Dansereau & F. J. Yammarino (Eds.), *Leadership: The multiple-level approaches* (pp. 51–60). JAI Press.

Flynn, F. J., Reagans, R. E., Amanatullah, E. T., & Ames, D. R. (2006). Helping one's way to the top: Self-monitors achieve status by helping others and knowing who helps whom. *Journal of Personality and Social Psychology, 91*(6), 1123–1137.

Frank, K. A. (2000). Impact of a confounding variable on a regression coefficient. *Sociological Methods & Research, 29*(2), 147–194.

Gardner, R. G., Harris, T. B., Li, N., Kirkman, B. L., & Mathieu, J. E. (2017). Understanding "it depends" in organizational research: A theory-based taxonomy, review, and future research agenda concerning interactive and quadratic relationships. *Organizational Research Methods, 20(4),* 610-638.

Gersick, C. J. G. (1988). Time and transition in work teams: Toward a new model of group development. *Academy of Management Journal*, *31*(1), 9–41.

Gersick, C. J. G., & Hackman, J. R. (1990). Habitual routines in task-performing teams. *Organizational Behavior and Human Decision Processes*, *47*(1), 65–97.

Gibson, C. B., & Zellmer-Bruhn, M. E. (2001). Metaphors and meaning: An intercultural analysis of the concept of teamwork. *Administrative Science Quarterly*, *46*(2), 274–303.

Graen, G. B., & Uhl-Bien, M. (1995). Relationship-based approach to leadership: Development of leader-member exchange (LMX) theory of leadership over 25 years: Applying a multi-level multi-domain perspective. *The Leadership Quarterly, 6*(2), 219–247.

Granovetter, M. (1973). The strength of weak ties. *American Journal of Sociology, 78*(6), 1360–1380.

Granovetter, M. (1985). Economic action and social structure: The problem of embeddedness. *American Journal of Sociology, 91*(3), 481–510.

Granovetter, M. (1992). Economic institutions as social constructions: A framework for analysis. *Acta Sociologica, 35*(1), 3–11.

Grosser, T. J., Park, S., Mathieu, J. E., & Roebuck, A. A. (2020). Network thinking in teams research. In D. Brass & S. P. Borgatti (Eds), *Social networks at work* (pp. 308–331). Routledge.

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

Hackman, J. R., & Wageman, R. (2005). When and how team leaders matter. *Research in Organizational Behavior, 26*, 37–74.

Hambrick, D. C. (1995). Fragmentation and the other problems CEOs have with their top management teams. *California Management Review, 37*(3), 110–127.

Hanneman, R., & Riddle, M. (2005). *Introduction to social network methods*. University of California.

Hirst, G. (2009). Effects of membership change on open discussion and team performance: The moderating role of team tenure. *European Journal of Work and Organizational Psychology, 18*(2), 231–249.

Homans, G. C. (1951). *Classics in organization and management series. The human group.*

Transaction Publishers.

Hood, A. C., Cruz, K., & Bachrach, D. G. (2017). Conflicts with friends: A multiplex view of friendship and conflict and its association with performance in teams. *Journal of Business and Psychology, 32*(1), 73–86.

House, R. J., Hanges, P. J., Javidan, M., Dorfman, P. W., & Gupta, V. (2004). *Culture, leadership and organizations: The GLOBE study of 62 societies*. Sage Publications, Inc.

Iacobucci, D., Schneider, M. J., Popovich, D. L., Georgios, A., & Bakamitsos, G. A. (2016). Mean centering helps alleviate "micro" but not "macro" multicollinearity. *Behavior Research Methods, 48*(4), 1308–1317.

Ibarra, H., & Andrews, S. B. (1993). Power, social influence, and sense making: Effects of network centrality and proximity on employee perceptions. *Administrative Science Quarterly, 38*(2), 277–303.

Ingram, P., & Morris, M. W. (2007). Do people mix at mixers? Structure, homophily, and the "life of the party." *Administrative Science Quarterly, 52*(4), 558–585.

Ingram, P., & Zou, X. (2008). Business friendships. *Research in Organizational Behavior, 28*, 167–184.

Judge, T. A., Piccolo, R. F., & Ilies, R. (2004). The forgotten ones? The validity of Consideration and Initiating Structure in leadership research. *Journal of Applied Psychology, 89*(1), 36–51.

Katz, R. (1982). The effects of group longevity on project communication and performance. *Administrative Science Quarterly, 27*(1), 81–104.

Kilduff, M., & Brass, D. J. (2010). Organizational social network research: Core ideas and key debates. *Academy of Management Annals, 4*(1), 317–357.

Kozlowski, S. W. J., & Bell, B. S. (2013). Work groups and teams in organizations. In N. W. Schmitt, S. Highhouse, & I. B. Weiner (Eds.), *Handbook of psychology: Industrial and*

organizational psychology (pp. 412–469). John Wiley & Sons Inc.

Krackhardt, D. (1990). Assessing the political landscape: Structure, cognition, and power in organizations. *Administrative Science Quarterly, 35*(2), 342–369.

Krackhardt, D., & Hanson, J. R. (1993). Informal Networks: The Company behind the Chart. *Harvard Business Review, 71*, 104-111.

Krackhardt, D., & Stern, R. N. (1988). Informal networks and organizational crises: An experimental simulation. *Social Psychology Quarterly, 51*(2), 123–140.

Kutner, M. H., Nachtsheim, C. J., & Neter, J. (2004). *Applied linear regression models* (4th ed.). McGraw-Hill Irwin.

Kuwabara, K., Luo, J., & Sheldon, O. (2010). Multiplex exchange relations. In Lawler, E. J., Thye, S. R. (Eds.), *Advances in group processes* (pp. 239–268). Emerald Group.

Labianca, G., & Brass, D. J. (2006). Exploring the social ledger: Negative relationships and negative asymmetry in social networks in organizations. *Academy of Management Review, 31*(3), 596–614.

Landis, R. S. (2001). A note on the stability of team performance. *Journal of Applied Psychology, 86*(3), 446–450.

Lau, D., & Murnighan, J. (1998). Demographic diversity and faultlines: The compositional dynamics of organizational groups. *Academy of Management Review, 23*(2), 325–340.

Lau, D., & Murnighan, J. (2005). Interactions within Groups and Subgroups: The Effects of Demographic Faultlines. *Academy of Management Journal, 48*(4), 645–659.

Lazega, E., & Pattison, P. E. (1999). Multiplexity, generalized exchange and cooperation in organizations: A case study. *Social Networks, 21*(1), 67–90.

LePine, J. A., Methot, J. R., Crawford, E. R., & Buckman, B. R. (2012). A model of positive relationships in teams: The role of instrumental, friendship, and multiplex social network ties. In L. T. d. T. Eby & T. D. Allen (Eds.), *SIOP organizational frontiers series.*

Personal relationships: The effect on employee attitudes, behavior, and well-being (pp. 173–194). Routledge/Taylor & Francis Group.

Li, J., & Hambrick, D. C. (2005). Factional groups: A new vantage on demographic faultlines, conflict, and disintegration in work teams. *Academy of Management Journal, 48*(5), 794–813.

Lincoln, J. R., & Miller, J. (1979). Work and friendship ties in organizations: A comparative analysis of relational networks. *Administrative Science Quarterly, 24*(2), 181–199.

Lorinkova, N. M., Pearsall, M. J., & Sims, H. P. (2013). Examining the differential longitudinal performance of directive versus empowering leadership in teams. *Academy of Management Journal, 56*(2), 573–596.

Lydon, J. E., Jamieson, D. W., & Holmes, J. G. (1997). The meaning of social interactions in the transition from acquaintanceship to friendship. *Journal of Personality and Social Psychology, 73*(3), 536–548.

Maloney, M. M., Bresman, H., Zellmer-Bruhn, M. E., & Beaver, G. R. (2016). Contextualization and context theorizing in teams research: A look back and a path forward. *The Academy of Management Annals, 10*(1), 891–942.

Marineau, J. E., Hood, A. C., & Labianca, G. "J.". (2018). Multiplex conflict: Examining the effects of overlapping task and relationship conflict on advice seeking in organizations. *Journal of Business and Psychology, 33*(5), 595–610.

Marks, M., Mathieu, J., & Zaccaro, S. (2001). A temporally based framework and taxonomy of team processes. *Academy of Management Review, 26*(3), 356–376.

Marsden, P. V. (1990). Network data and measurement. *Annual Review of Sociology, 16*, 435–463.

Mathieu, J. E., Kukenberger, M. R., D'Innocenzo, L., & Reilly, G. (2015). Modeling reciprocal team cohesion–performance relationships, as impacted by shared leadership

and members' competence. *Journal of Applied Psychology, 100*(3), 713–734.

Mathieu, J. E., & Rapp, T. L. (2009). Laying the foundation for successful team performance trajectories: The roles of team charters and performance strategies. *Journal of Applied Psychology, 94*(1), 90–103.

McGrath, J. E. (1991). Time, interaction, and performance (TIP): A theory of groups. *Small Group Research, 22*(2), 147–174.

McGrath, J. E., Kelly, J. R., & Machatka, D. E. (1984). The social psychology of time: Entrainment of behavior in social and organizational settings. *Applied Social Psychology Annual, 5*, 21–44.

Mehra, A., Dixon, A. L., Brass, D. J., & Robertson, B. (2006). The social network ties of group leaders: Implications for group performance and leader reputation. *Organization Science, 17*(1), 64–79.

Meindl, J. R. (1995). The romance of leadership as a follower-centric theory: A social constructionist approach. *The Leadership Quarterly, 6*(3), 329–341.

Methot, J. R., LePine, J. A., Podsakoff, N. P., & Christian, J. S. (2016). Are workplace friendships a mixed blessing? Exploring tradeoffs of multiplex relationships and their associations with job performance. *Personnel Psychology, 69*(2), 311–355.

Methot, J. R., & Rosado-Solomon, E. (2020). Multiplex relationships in organizations: Applying an ambivalence lens. In D. J. Brass & S. P. Borgatti (Eds.), *Social networks at work* (pp. 79–103). Routledge.

Mitchell, T. R., & James, L. R. (2001). Building better theory: Time and the specification of when things happen. *Academy of Management Review, 26*(4), 530–547.

Mollica, K. A., Gray, B., & Treviño, L. K. (2003). Racial homophily and its persistence in newcomers' social networks. *Organization Science, 14*(2), 123–136.

Mortensen, M., & Haas, M. R. (2018). Perspective—Rethinking teams: From bounded membership to dynamic participation. *Organization Science, 29*(2), 341–355.

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*(6), 860–875.

Oh, H., Labianca, G., & Chung, M. H. (2006). A multilevel model of group social capital. *Academy of Management Review, 31*(3), 569–582.

Park, S., Grosser, T. J., Roebuck, A. A. & Mathieu, J. E. (2020). Understanding work teams from a network perspective: A review and future research directions. *Journal of Management, 46*(6), 1002–1028.

Park, S., Mathieu, J. E., & Grosser, T. J. (2020). A network conceptualization of team conflict. *Academy of Management Review, 45*(2), 352–375.

Perry-Smith, J. E. (2006). Social yet creative: The role of social relationships in facilitating individual creativity. *Academy of Management Journal, 49*(1), 85–101.

Preacher, K. J., Curran, P. J., & Bauer, D. J. (2006). Computational tools for probing interaction effects in multiple linear regression, multilevel modeling, and latent curve analysis. *Journal of Educational and Behavioral Statistics, 31*(4), 437–448.

Quigley, N. R., Collins, C. G., Gibson, C. B., & Parker, S. K. (2018). Team performance archetypes: Toward a new conceptualization of team performance over time. *Group & Organization Management, 43*(5), 787–824.

Rogan, M. (2014). Executive departures without client losses: The role of multiplex ties in exchange partner retention. *Academy of Management Journal, 57*(2), 563–584.

Rowley, T., Behrens, D., & Krackhardt, D. (2000). Redundant governance structures: An analysis of structural and relational embeddedness in the steel and semiconductor industries. *Strategic Management Journal, 21*(3), 369–386.

Rulke, D. L., & Galaskiewicz, J. (2000). Distribution of knowledge, group network structure,

and group performance. *Management Science, 46*(5), 612–625.

Sasovova, Z., Mehra, A., Borgatti, S. P., & Schippers, M. C. (2010). Network churn: The effects of self–monitoring personality on brokerage dynamics. *Administrative Science Quarterly, 55*(4), 639–670.

Schriesheim, C. A., Tepper, B. J., & Tetrault, L. A. (1994). Least preferred co-worker score, situational control, and leadership effectiveness: A meta-analysis of contingency model performance predictions. *Journal of Applied Psychology, 79*(4), 561–573.

Shadish, W., Cook, T., & Campbell, D. (2002). *Experimental and quasi-experimental designs for generalized causal inference.* Houghton Mifflin.

Shah, N. P., Parker, A., & Waldstrøm, C. (2017). Individual performance benefits of multiplex relationships. *Management Communication Quarterly, 31*(1), 5–18.

Shipilov, A., Gulati, R., Kilduff, M., Li, S., & Tsai, W. (2014). Relational pluralism within and between organizations. *Academy of Management Journal, 57*(2), 449–459.

Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. Oxford University Press.

Sparrowe, R. T., & Liden, R. C. (2005). Two routes to influence: Integrating leader–member exchange and social network perspectives. *Administrative Science Quarterly, 50*, 505–535.

Sparrowe, R. T., Liden, R., Wayne, S., & Kraimer, M. (2001). Social networks and the performance of individuals and groups. *Academy of Management Journal, 44*(2), 316–325.

Staw, B. M., Sandelands, L. E., & Dutton, J. E. (1981). Threat rigidity effects in organizational behavior: A multilevel analysis. *Administrative Science Quarterly, 26*, 501–524.

Stogdill, R. M. (1950). Leadership, membership and organization. *Psychological Bulletin, 47*,

1–14.

Toegel, G., Anand, N., & Kilduff, M. (2007). Emotion helpers: The role of high positive affectivity and high self-monitoring managers. *Personnel Psychology, 60*(2), 337–365.

Tost, L. P., Gino, F., & Larrick, R. P. (2013). When power makes others speechless: The negative impact of leader power on team performance. *Academy of Management Journal, 56*(5), 1465–1486.

Tulin, M., Mollenhorst, G., & Volker, B. (2021). Whom do we lose? The case of dissimilarity in personal networks. *Social Networks, 65*, 51–62.

Uhl–Bien, M. (2006). Relational leadership theory: Exploring the social processes of leadership and organizing. *Leadership Quarterly, 17*(6), 654–676.

Uzzi, B. (1996). The sources and consequences of embeddedness for economic performance of organizations: The network effect. *American Sociological Review, 61*(4), 674–698.

Uzzi, B. (1997). Social structure and competition in interfirm networks: The paradox of embeddedness. *Administrative Science Quarterly, 42*(1), 35–67.

Vinokur-Kaplan, D. (1995). Treatment teams that work (and those that don't): An application of Hackman's group effectiveness model to interdisciplinary teams in psychiatric hospitals. *The Journal of Applied Behavioral Science, 31*(3), 303–327.

Wageman, R., Hackman, J. R., & Lehman, E. V. (2005). The Team Diagnostic Survey: Development of an instrument. *The Journal of Applied Behavioral Science, 41*(4), 373–398.

Widmer, P. S., Schippers, M. C., & West, M. A. (2009). Recent developments in reflexivity research: A review. *Psychologie des Alltagshandelns, 2*(2), 2–11.

Wooldridge, J. (2002). *Econometric Analysis of Cross Section and Panel Data*. MIT Press.

Yammarino, F. J., Dionne, S. D., Chun, J. U., & Dansereau, F. (2005). Leadership and levels of analysis: A state-of-the-science review. *The Leadership Quarterly, 16*(6), 879–919.

Yang, S. W., Trincado, F., Labianca, G., & Agneessens, F. (2020). Negative ties at work. In D. Brass & S. P. Borgatti (Eds), *Social networks at work* (pp. 48–77). Routledge.

Zellmer-Bruhn, M., Waller, M. J., & Ancona, D. (2004). The effect of temporal entrainment on the ability of teams to change their routines. In Sally Blount (ed.), *Time in groups*. *Research on managing groups and teams*, Vol. 6. (pp. 135–158). Emerald Group Publishing Limited.

Table 1

Means, Standard Deviations and Correlations for Team-Level Variables[a]

	Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1.	Team performance Time 1	4.10	.51													
2.	Team performance Time 2	4.16	.51	.61**												
3.	Team performance Time 3	4.11	.79	.21	.27*											
4.	Technology service teams [b]	.10	.30	-.16	.11	.09										
5.	Legal service teams [b]	.02	.15	.09	.14	.12	-.05									
6.	Health service teams [b]	.04	.19	.01	.04	-.21	-.06	-.03								
7.	Other service teams [b]	.85	.36	.09	-.16	-.02	-.76**	-.37**	-.45**							
8.	Team size	4.08	1.79	.06	.08	.03	.03	-.10	-.12	.08						
9.	Team task interdependence	3.96	.67	-.04	-.02	.30**	.00	.03	.01	-.02	-.08					
10.	Team stability	4.16	.59	-.12	-.04	-.03	.14	-.09	.09	-.13	-.22*	.04				
11.	Density multiplex team ties	.15	.21	.16	.15	.24*	.14	.08	-.14	-.08	-.06	.14	.03			
12.	Team tenure	6.48	3.80	.07	.17	.37**	.08	.18	-.02	-.13	-.07	.13	.25*	.04		
13.	Team authority	1.71	.62	.01	-.05	.33**	.03	.07	-.08	-.01	-.13	.10	-.12	.20	.12	
14.	Leader external ties	10.75	3.80	.08	.11	.28*	.04	.01	-.21	.07	-.11	.12	.28*	.11	.29**	.15
15.	Leader gender [c]	.77	.42	.06	.19	.03	-.12	.08	.10	.00	.19	-.09	-.15	-.09	-.06	-.26*
16.	Leader age	44.04	7.16	-.05	.03	-.12	.05	-.02	.06	-.06	.06	-.04	.27*	-.07	.19	-.14
17.	Leader tenure	9.96	7.47	-.06	.03	.19	.07	-.01	-.09	-.01	-.15	.03	.10	.13	.39**	.07
18.	Adversarial density	.20	.17	.10	.09	-.19	-.04	.14	.19	-.12	-.03	.02	-.03	-.18	.14	.11
19.	Friendship density	.61	.14	.22*	.32**	.26*	.09	.10	-.05	-.09	-.07	.03	.11	.50**	.14	.11
20.	Leader simplex friendship centrality	57.40	30.90	.10	.15	.23*	.02	.09	.06	-.09	-.08	.02	.24*	.43**	.04	.15
21.	Leader simplex advice centrality	70.48	28.26	.13	.01	.22*	-.07	.03	-.26*	.18	-.08	-.08	-.13	.27*	.24*	.03
22.	Leader multiplex centrality	34.43	32.79	.20	.21	.45**	.09	.19	-.20	-.05	-.11	-.03	.10	.64**	.24*	.29**

Table 1 (continued)

	Variables	14	15	16	17	18	19	20	21
15.	Leader gender [c]	-.25*							
16.	Leader age	.31**	.15						
17.	Leader tenure	.20	-.07	.57**					
18.	Adversarial density	-.01	-.11	.18	.14				
19.	Friendship density	.16	.05	.02	.09	-.20			
20.	Leader simplex friendship centrality	.09	-.04	.06	.00	.02	.30**		
21.	Leader simplex advice centrality	-.04	-.01	-.21	.22*	-.15	.07	-.25*	
22.	Leader multiplex centrality	.04	-.01	-.06	.19	-.14	.34**	.62**	.47**

Note. [a] $n = 84$ teams. [b] dummy-coded variable. [c] 1 = female, 0 = male. * $p < .05$. ** $p < .01$

Table 2

Regression Analyses of Leader Simplex versus Multiplex Centrality on Team Performance over Time [a, b]

	Team Performance Time 1	Team Performance Change	Team Performance Time 1	Team Performance Change	Team Performance Time 1	Team Performance Change
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Intercept	4.10*** (.08)	.00 (.00)	4.12*** (.08)	.00 (.00)	4.12*** (.07)	.00 (.00)
Control variables						
Technology service teams [c]	-.01 (.05)	.01 (.00)	-.04 (.05)	.01* (.00)	-.03 (.05)	.01 (.00)
Legal service teams [c]	.03 (.04)	.00 (.00)	.00 (.03)	.00 (.00)	.00 (.04)	.00 (.00)
Health service teams [c]	.03 (.03)	.00 (.00)	.03 (.03)	.00* (.00)	.04 (.03)	.00 (.00)
Team size	.02 (.05)	.00 (.00)	.03 (.05)	.00 (.00)	.03 (.05)	.01* (.00)
Team task interdependence	-.06 (.05)	.01** (.00)	-.06 (.05)	.01** (.00)	-.05 (.05)	.01*** (.00)
Team stability	-.11 (.09)	.01 (.00)	-.09 (.08)	.00 (.00)	-.11 (.08)	.01 (.00)
Density multiplex team ties	.03 (.06)	.00 (.00)	.06 (.08)	.00 (.00)	-.02 (.08)	-.01 (.01)
Team tenure	.05 (.07)	.00 (.00)	.05 (.07)	.01 (.00)	.03 (.08)	.00 (.00)
Team authority	-.07 (.07)	.01* (.00)	-.09 (.07)	.01* (.00)	-.10 (.07)	.01 (.00)
Leader external ties	.08 (.06)	.00 (.00)	.07 (.07)	.01* (.00)	.08 (.06)	.01* (.00)
Leader gender [d]	.04 (.08)	.01* (.01)	.04 (.07)	.01* (.00)	.01 (.07)	.01** (.00)
Leader age	.01 (.06)	-.01** (.00)	.00 (.06)	-.02*** (.00)	.01 (.06)	-.01** (.00)
Leader tenure	-.04 (.08)	.01* (.01)	-.07 (.08)	.01** (.00)	-.09 (.08)	.01** (.00)
Main effects						
Adversarial density	.08 (.06)	-.01 (.00)	.09 (.06)	-.01 (.00)	.09 (.08)	.00 (.00)
Friendship density	.11* (.05)	.00 (.00)	.15** (.05)	.00 (.00)	.17* (.07)	.00 (.00)
Leader simplex friendship centrality (LSFC)			.03 (.07)	.01 (.00)		
Leader simplex advice centrality (LSAC)	.01 (.05)	.00 (.00)				
Leader multiplex centrality (LMC) (H1)					.10 (.09)	.02** (.00)
Two-way interactions						
LSFC × Adversarial density			.06 (.06)	.00 (.00)		
LSFC × Friendship density			-.01 (.06)	.00 (.00)		
LSAC × Adversarial density	-.06 (.05)	.00 (.00)				

LSAC × Friendship density	.03 (.07)	.00 (.00)				
LMC × Adversarial density (H2)					-.03 (.09)	.01** (.00)
LMC × Friendship density (H3)					.01 (.06)	-.01** (.00)
Adversarial density × Friendship density	-.10 (.06)	.01* (.00)	-.08 (.05)	.01** (.00)	-.03 (.08)	.00 (.00)
Three-way interactions						
LSFC × Adversarial density × Friendship density			.10 (.05)	-.01 (.00)		
LSAC × Adversarial density × Friendship density	-.10 (.06)	.00 (.00)				
LMC × Adversarial density × Friendship density (H4)					.06 (.06)	-.01** (.00)
R^2	.24	.55	.25	.57	.25	.64
F	2.35**	7.53***	3.24***	8.14***	1.74	18.34***

Note. [a] n = 84 teams. Regression coefficients are reported, standard errors in parentheses. Standard errors are adjusted for clustering within 57 line managers.
[b] Team Performance outcome variables are intercept and slope derived from empirical Bayes Estimates of team performance regressed on time.
[c] Dummy-coded variable.
[d] 1 = female, 0 = male.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Figure 1

Theoretical Model

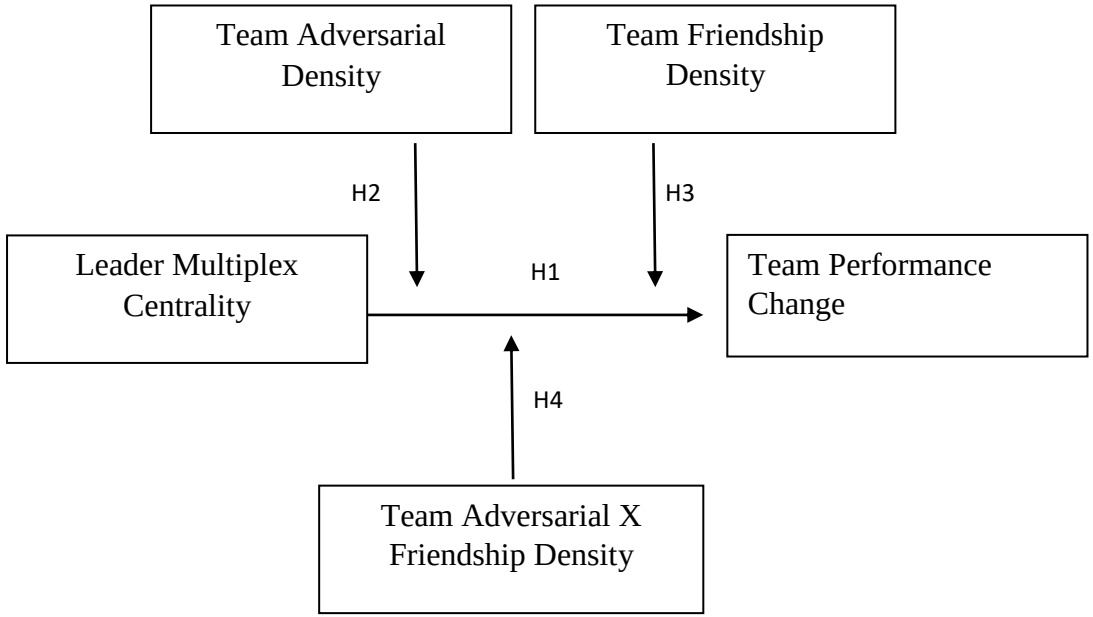


Figure 2

The Interaction of Leader Multiplex Centrality and Team Adversarial Density on Team performance Change

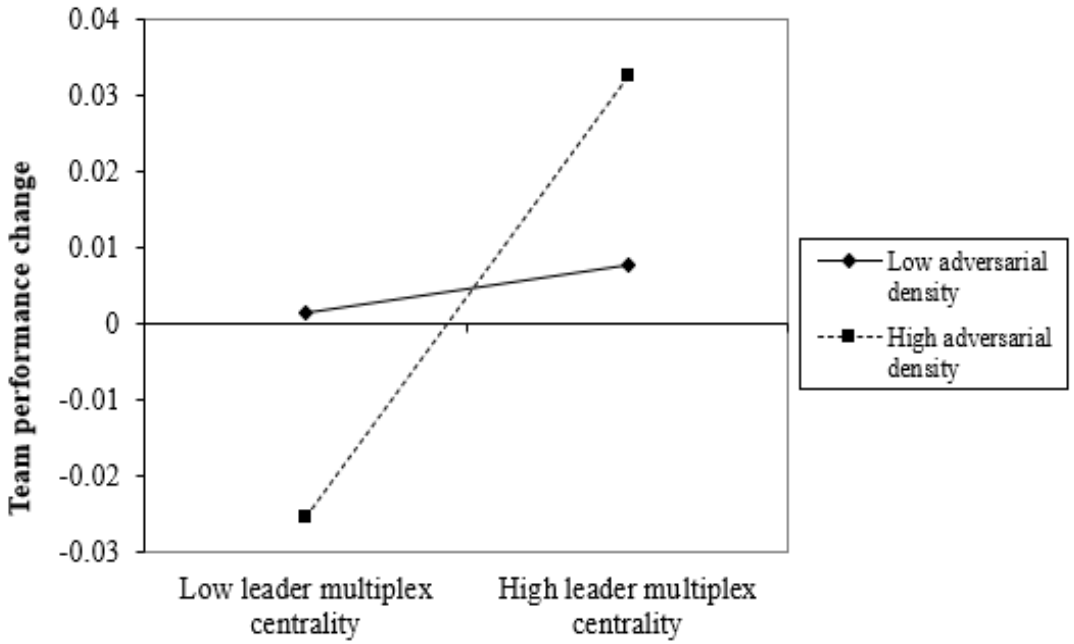


Figure 3

The Interaction of Leader Multiplex Centrality and Team Friendship Density on Team performance Change

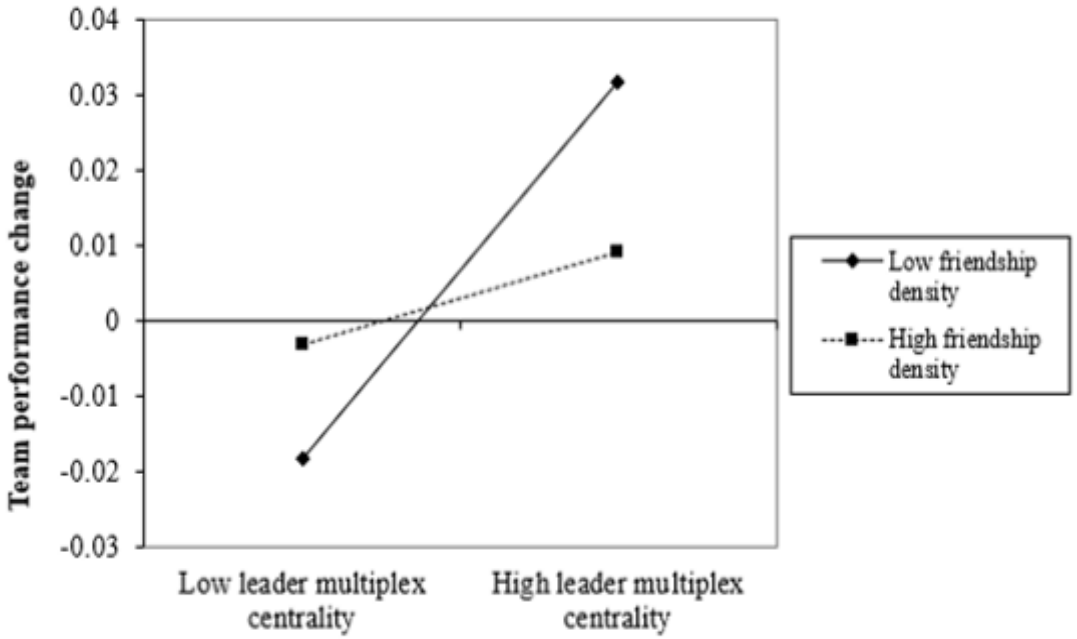
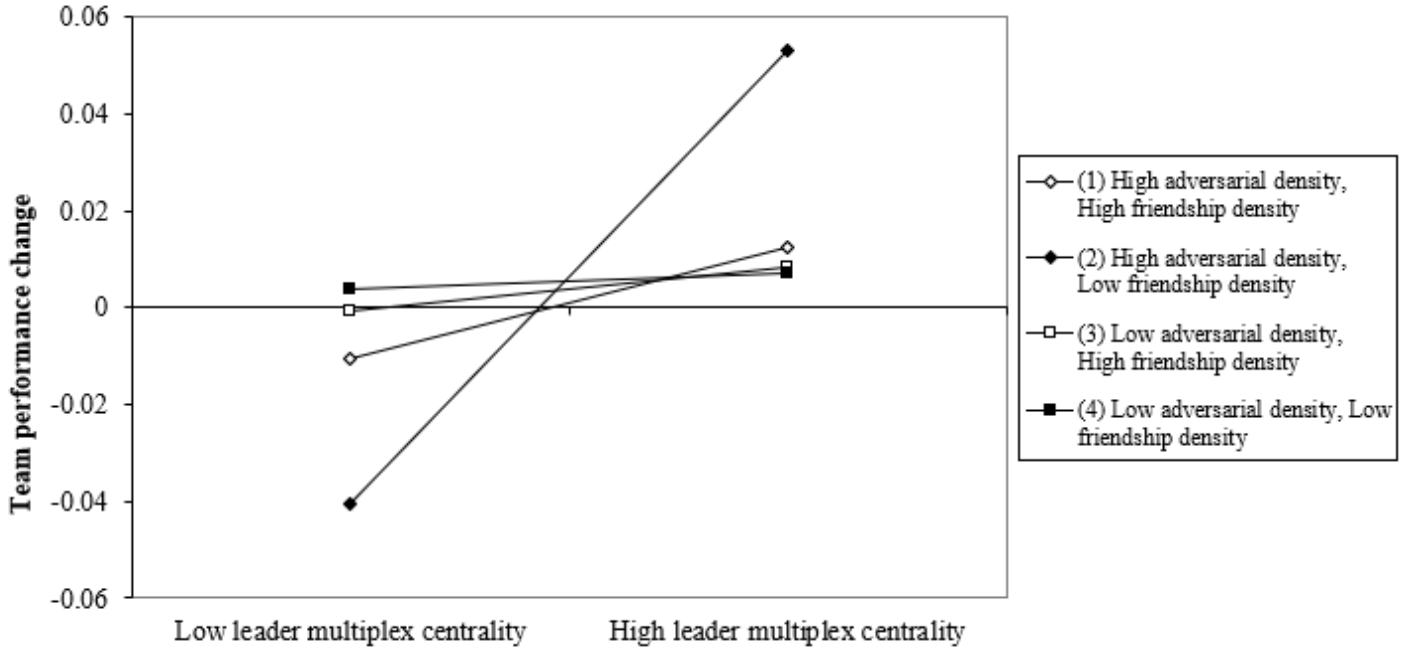


Figure 4

The Interaction of Leader Multiplex Centrality, Team Adversarial Density, and Team Friendship Density, on Team Performance Change



[i] During the two-year study period, there was no turnover among participating team leaders. But in 18 of the 84 teams in our sample, one or more team member either joined or left the team. Further inquiries pointed to this being due to temporary maternity coverage in many cases.

[ii] In order to corroborate this observation, we empirically examined time as a fixed effect predicting team performance in a regression model that controlled for clustering within line managers. In line with expectations, time did not have a significant effect on team performance (coefficient = -.00, p = .92). Apart from not being significant, the p value approaching 1 indicates that time in and of itself had a negligible effect.

[iii] We replicated the same pattern of results reported in the manuscript with mixed effect models.

[iv] It is not advisable to control for leader centrality in advice and friendship ties in models that contain leader multiplex centrality. From a feasibility perspective, including advice or friendship centrality substantially increases multicollinearity and removes essential variance from the leader multiplex measure, which is based on a matrix of ties that are both advice and friendship. Moreover, in a model that controls for advice or friendship centrality, the interpretation of leader multiplex centrality would diverge from its conceptualization as centrality in a network of *both* advice and friendship. When controlling for leader advice centrality, leader multiplex centrality needs to be interpreted as a measure more similar to friendship centrality, as variance related to advice centrality has been withdrawn. Likewise, when controlling for leader friendship centrality, leader multiplex centrality needs to be interpreted as a measure more similar to advice centrality. In either case, a model controlling for leader advice or friendship centrality would change the interpretation of the leader multiplex centrality coefficient from how the construct has been conceptualized in this paper.