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RESEARCH REPORT

Creative Benefits From Well-Connected Leaders: Leader Social Network Ties as Facilitators of Employee Radical Creativity

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Employee radical creativity critically depends on substantive informational resources from others across the wider organization. We propose that the social network ties of employees' immediate leaders assume a central role in garnering these resources, thereby fostering their employees' radical creativity both independent of and interactively with employees' own network ties. Drawing on data from 214 employees working in 30 teams of a public technology and environmental services organization, we find that team leaders' betweenness centrality in the idea network within their teams as well as among their peer leaders provides creative benefits beyond employees' own internal and external ties. Further, employees' and leaders' ties within and external to the team interactively predict employee radical creativity. Implications for theory and practice are discussed.

Keywords: employee radical creativity, social networks, leadership, teams

Employee radical creativity—the development of useful and novel ideas that deviate substantially from the status quo (Baer, 2010, 2012; cf. Amabile, 1996)—has become critical for organizational innovation and sustainability (Shalley, Zhou, & Oldham, 2004). A key insight from prior studies has been that generating creative ideas requires access to novel, nonredundant information and the recombination of this information in novel ways (Mumford & Gustafson, 1988). Because social relationships often serve as conduits for the flow of such information (Perry-Smith & Shalley, 2003), an emerging stream of research has focused on employees' social network ties both within and outside their proximal team as predictors of their creativity (Baer, 2010; Perry-Smith, 2006; Zhou, Shin, Brass, Choi, & Zhang, 2009). However, most prior

studies have examined creativity in general (rather than radical creativity) and focused solely on employees' ties, without examining whether the ties of critical *others*, especially their leaders, may also facilitate employee creativity.

New ideas that radically alter the status quo are not only resource intensive but also involve great uncertainty (Madjar, Greenberg, & Chen, 2011). Prior research (Mueller, Melwani, & Goncalo, 2012) suggests that uncertainty about whether creative ideas will be original, useful, error free, and reliable is extremely stressful to employees, in turn making them potentially averse to engage in their development. Developing radically creative ideas may therefore not only require access to diverse information that triggers the generative process (Amabile, 1996; Fleming, Mingo, & Chen, 2007), but may also demand an integrative understanding of the creative opportunities and constraints in existing team practices and procedures, as well as the broader strategic needs, priorities, and ongoing initiatives in the wider organization in order to reduce potential uncertainty about these ideas' usefulness and originality (e.g., Kanter, 1988; Tushman, 1977). Such a comprehensive understanding may also serve to ensure the actual usefulness and originality of employees' radically creative efforts.

We argue in this article that employee ties—although conducive—may be limited in their capacity to garner the extensive and diverse informational resources required for developing radically novel and useful ideas. Due to demands of their often-specialized jobs, employees may be unable to invest the considerable time and effort required in developing and maintaining diverse ties with employees at different levels both within and external to the team (Oh, Labianca, & Chung, 2006). As a result, employees might not have adequate access to big-picture information about how their

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work relates to that of the broader team, or to strategic organizational needs, emerging trends, and ongoing initiatives—information that we argue is critical for the development of radically novel, yet useful ideas.

In contrast, their team leaders—by virtue of their formal role as head of the team—are optimally positioned to regularly interact with team members from diverse functional and task backgrounds (Oh et al., 2006), as well as to occupy “linking-pin” positions connecting their team members with other leaders in the organization (Graen, Dansereau, & Minami, 1972). This provides them with a strategic vantage point to understand creative challenges and opportunities in light of team and organizational needs. If these team leaders occupy critical liaison positions within the informal networks of idea exchanges among their employees as well as among other leaders, they may be well equipped to guide their employees’ radically creative efforts by not only highlighting challenges and opportunities within their teams but also exposing their employees to broader organizational needs and priorities. Such critical information may ensure the usefulness of employees’ radically creative efforts.¹ However, the exclusive focus of the current literature on employees’ own ties leaves various questions related to the role of leader ties for radical creativity unanswered, such as: Does employees’ development of radically creative ideas benefit from their leaders’ network ties within and outside the team? And do leader ties interact with employee ties in facilitating employee radical creativity? If so, how?

In addressing these questions, this article contributes to the literature on social networks and creativity in three important ways. First, we extend prior research by investigating whether leader ties may offer important and unique benefits beyond employees’ own ties in facilitating employee radical creativity. We thus identify leader social networks as important contextual influences, thereby adding to the emerging multilevel perspective on employee creativity (Zhou & Shalley, 2008). Second, we examine the interplay of leader and employee ties in providing complementary versus redundant contributions to radical creativity. By doing so, we posit that the study of employee radical creativity is incomplete without consideration of how the effects of employee ties—the sole focus of past studies—may be further qualified by their leaders’ ties. Our third contribution is to the broader literature on leadership and creativity (e.g., Tierney, 2008). Much prior research has focused on specific leader behaviors directed at their employees (e.g., Zhang & Bartol, 2010). Our study extends this focus by showing how leaders’ ties with others across the organization benefit their employees’ radical creativity.

Theoretical Background

Rather than incrementally altering or reinforcing current products and services, radically creative ideas make existing knowledge about products and services obsolete (Baer, 2010). As a result, the development of such ideas entails greater risk and uncertainty about their future (Madjar et al., 2011). In reducing such uncertainty, employees may need to rely on extensive informational resources from within and outside their teams (cf. Ancona & Bresman, 2007).

Employees who occupy critical network positions at the crossroads of idea exchanges among team members may have access to novel and diverse information that is particularly useful in spurring

creativity (cf. Burt, 2004). Employees’ betweenness centrality in the team’s idea-related interaction network, an index of liaising between diverse members, has therefore been regarded as important for creativity (Burt, Kilduff, & Tasselli, 2013). Outside of one’s immediate social circle (such as the proximal work team), ties tend to be weaker in terms of emotional closeness, duration, or frequency of interaction, but can be important sources of nonredundant information (Granovetter, 1973). In support of this “strength-of-weak-ties” hypothesis, various studies have shown that employee weak ties can also foster employee creativity (e.g., Baer, 2010; Perry-Smith, 2006; Zhou et al., 2009).

Reducing the uncertainty associated with developing radically novel ideas as well as ensuring the usefulness and originality of radically creative efforts likely requires a big-picture understanding of existing team processes, as well as strategic information about organizational needs, priorities, and ongoing initiatives. This may require maintaining liaison positions with team colleagues as well as having diverse ties to higher-ups, which may be difficult, considering the limited time and resources available to employees given their routine job demands (Oh et al., 2006). We therefore argue that their team leaders’ positions in the informal networks of idea-related discussions within the team as well as among other leaders are especially important for facilitating employee radical creativity, beyond the effects of employees’ own ties.

The Role of Leader Network Ties for Employee Radical Creativity

Teams are often composed of members of heterogeneous demographic and functional backgrounds (Oh et al., 2006; Tichy, 1973). This can restrict their effective and frequent exchange of information with each other as well as with employees in other teams (cf. Cronin & Weingart, 2007). Conversely, team leaders are uniquely positioned by virtue of their formal role and position to frequently engage in information exchanges with diverse employees in their team as well as with other leaders in other teams.

Inside the team, leaders assume the role of an “integrator” (e.g., Oh et al., 2006), integrating the many concerns, issues, resources, and contributions of team members as they strive toward achieving the team’s goals. In such situations, leaders who are able to occupy a critical liaison position in the informal network of idea-related interactions among diverse team members may be exposed to novel and nonredundant information that flows in the team (e.g., Burt et al., 2013; Flynn & Wiltermuth, 2010). Such a position, referred to as *betweenness centrality* (Borgatti, 2005; Freeman, 1979), is an index of the extent to which a focal leader falls on the interaction paths connecting any two unconnected team members in the team, thus serving as a critical hub for the transfer of novel information among these members (Burt et al., 2013). This, combined with the integrated perspective on team issues that their

¹ Our focus in this article is on ideas that radically alter the status quo and how leaders’ ties may be especially important for facilitating their development. Although we do not formally propose this, we expect that ideas that incrementally improve existing products and processes are not critically dependent on their leaders’ ties. In fact, employees might not even see the need to consult their leaders for more mundane endeavors. Because incremental ideas require fewer resources and are less uncertain (e.g., Baer, 2012; Madjar et al., 2011), they may not depend on additional big-picture information from their leaders.

formal role provides them with (and that lower level employees may not have), can help leaders identify and share information on constraints and opportunities for creativity within the team and provide insights into the causal relationships between different parts of the team task, thus guiding employees' development of not only radically novel but also useful ideas. Thus,

Hypothesis 1a: Controlling for employees' own network ties, leader betweenness centrality in the idea-related interaction network within the team is positively related to their employees' radical creativity.

The successful development of radical ideas that are both novel and useful also requires the identification of problems or creative opportunities that are in alignment with broader organizational needs as well as exposure to emerging trends (Amabile & Mueller, 2008). In this regard, idea-related interactions among team leaders, which may involve informal discussions about new ideas and proposals, problems faced by other teams, workable solutions or information about emerging trends and technologies, may be especially useful for their employees' radically creative efforts.

If leaders are able to occupy liaising positions (i.e., betweenness centrality) in such leader networks, this may provide them with novel information about potential opportunities for creative development (e.g., Burt, 2004), exposure to pockets of local expertise that can be tapped into by one's own team for dealing with specific problems or issues, and raise awareness of creative efforts already underway elsewhere. Such knowledge may in turn ensure that subordinates do not duplicate efforts, or "reinvent the wheel," but rather concentrate their energies on the development of ideas that are topical and necessary. In addition, leaders' betweenness centrality in the idea network of other leaders may also provide access to information about alignment of potential ideas with broader organizational needs, current constraints, and prerogatives, which may be crucial for the usefulness of their employees' creative efforts.

Hypothesis 1b: Controlling for employees' own network ties, leader betweenness centrality in the idea-related interaction network among their peer leaders is positively related to their employees' radical creativity.

Interactive Effects of Leader and Employee Network Ties

Beyond main effects, leader and employee ties may interact, such that the effectiveness of employees' own ties in garnering informational resources may depend on their leaders' ties. Specifically, employee and leader ties may combine interactively such that leader ties complement employee ties if they connect to different informational sources (i.e., within vs. external to the team), but offer redundant information if they connect to the same source.

Employee and Leader Betweenness Centrality in the Team Idea Network

If leaders occupy central liaison positions (i.e., betweenness) in the team idea-related interaction network, they are exposed to novel and nonredundant information from diverse team members

(Krackhardt & Brass, 1994). By virtue of their formal role as head of the team, leaders are also predisposed to bring a more reliable and authoritative perspective on the causal relationships among various team processes (cf. Liden, Sparrowe, & Wayne, 1997). This may serve to guide employees in understanding the creative opportunities and constraints in existing team practices and procedures for their development of radically creative ideas. Thus, in situations in which a leader occupies a critical liaison position in the team's informal idea network, employees' own liaison position may not add substantially beyond the (likely more reliable and authoritative) information provided by their leader. In other words, the relationship between employees' betweenness centrality and their radical creativity will be less strong if their leader's betweenness centrality is high.

However, if leaders are unable to informally liaise across different parts of the team and provide important information in guiding radically creative efforts, employees may themselves need to develop idea-related interactions with team colleagues in order to procure such information. Thus, employees' own betweenness centrality in the team idea network may play a significant role in affecting their radical creativity if leader betweenness centrality is low.

Hypothesis 2a: Employee and leader betweenness centrality in the team idea-related interaction network interact such that employee centrality more strongly predicts radical creativity if leader centrality is low.

Employee Betweenness Centrality in the Team Idea Network and Leader Betweenness Centrality in the Peer Leader Idea Network

Conversely, if employees and their leaders garner important information from different or complementary sources, this may accentuate employee radical creativity. Employees with high betweenness centrality within the team likely gain access to novel and nonredundant information from diverse team members. Leader ties across the wider organization and external to the team may complement this knowledge base with relevant information from other teams, as well as qualitatively different information on broader emerging trends, organizational needs, and priorities. Such complementary information can further enhance the effects of employees' own position in the team by situating novel information and knowledge about intrateam opportunities in the broader context of the relevance and appropriateness of creative efforts that are not only novel but also useful.

Hypothesis 2b: Employee betweenness centrality in the team idea-related interaction network interacts with leader betweenness centrality in the peer leader idea-related interaction network such that employee centrality is more strongly related to their radical creativity if leader centrality is high.

Employee Weak Ties External to the Team and Leader Betweenness Centrality in the Team Idea Network

In a similar vein, we argue that employees' weak ties outside the team and leaders' betweenness centrality in the idea-related inter-

action network within the team complement each other in predicting employee radical creativity. Weak ties to others outside their own teams may provide employees with access to novel and diverse information that broadens their knowledge base (Granovetter, 1973; Perry-Smith, 2006) and enhances their ability to combine different pieces of information to make unusual connections (Mumford & Gustafson, 1988; Simonton, 1999). If such novel external information is supplemented with information about creative opportunities and constraints within existing team processes, employee radical creativity may be enhanced. Thus, if leaders occupy critical liaison positions within the team, they can provide integrative information regarding internal constraints and opportunities that complement novel information garnered by employees' own weak external ties in generating truly original ideas.

Hypothesis 3a: Employee weak external ties interact with leader betweenness centrality in the team idea-related interaction network such that employee ties are more strongly related to their radical creativity if leader centrality is high.

Employee Weak Ties External to the Team and Leader Betweenness Centrality in the Peer Leader Idea Network

We further propose that employees' weak ties external to their team interact with their leaders' betweenness centrality in the peer leader idea network, such that employees' external weak ties more strongly predict their creativity if their leaders do not occupy critical positions in their peer network. Leaders holding such positions (i.e., betweenness) in the idea-related interaction network among their peer leaders are likely exposed to novel and diverse information regarding problems faced by other teams, emerging trends, organizational priorities, and needs that may benefit their employees' development of truly original, yet useful ideas. As a result, employees' own weak external ties that may serve to provide some of this information may return little additional informational benefits. This is also the case because of the greater accuracy and reliability of information about organizational needs provided by leaders by virtue of their position in the hierarchy (cf. Liden et al., 1997).

However, if leaders are not well connected, employees may lack critical information regarding the appropriateness, timeliness, and necessity for the development of radically creative ideas, which requires them to actively gather such information themselves. In such instances, employees' own weak external ties may provide informational benefits that can impact their radical creativity, potentially even compensate in part (though not completely) for the absence of critical information available from their leaders.

Hypothesis 3b: Employee weak external ties interact with leader betweenness centrality in the idea-related interaction network among their peer leaders such that employee ties are more strongly related to their radical creativity if leader centrality is low.

Method

Sample and Procedure

Hypotheses were tested with data from employees in the main division of a mid-sized public technology and service organization

in Spain, which develops and provides environmental protection services to the local community. This division operated 30 nature parks that functioned as independent teams and reported to 18 team leaders. These teams were in charge of the conservation and maintenance of parks in addition to conducting basic research and development activities related to the sustainability of each park's ecology.

All 30 teams and their leaders agreed to participate in the study. We sent out separate "employee" and "leader" surveys to all team members and their leaders. Out of 218 full-time employees, 214 (98%) provided complete responses. Average team size was 7.27 ($SD = 2.20$). Fifty-one (24%) respondents were women, average age was 39.77 years ($SD = 8.68$), and 93 (44%) had a bachelor's degree or higher. All 18 leaders returned completed surveys. The average time leaders had spent in their current position was 7.64 years ($SD = 3.16$), four leaders were women, and the average age was 46.47 years ($SD = 8.84$). All leaders had a bachelor's degree or higher.

An organizational liaison person provided information on the organizational structure, the way the teams worked together, and the current team and leader rosters. On the basis of this information, we designed the initial surveys in English. We then used standard translation-back-translation procedures (cf. Brislin, 1980) to translate the survey to Spanish. Upon completion, surveys were returned to the researchers via sealed envelopes.

Measures

The employee survey consisted of a network questionnaire with a roster of names of all team members and the leader and other questions assessing our control variables. The leader survey included two network questionnaires with team and peer team leader rosters respectively, as well as a form to assess the creativity of their direct reports. Participants were asked to answer specific questions about each person only if they knew them currently. We used UCINET (version 6.289; Borgatti, Everett, & Freeman, 2002) to calculate the network measures.

Leader and member betweenness centrality in team idea network. Betweenness centrality is an index of liaising between two unconnected individuals (Borgatti, 2005; Freeman, 1979) and indicates an individual's exposure to diverse information (Burt et al., 2013) that flows within the team network. In order to calculate this, we asked each team member (and leader) to respond about all team members (and leader) to the following question (Baer, 2010): "On average, how frequently have you provided this person with new information or insights about work-related problems or issues?" ranging from 1 (*Never*) to 5 (*Several times a day*). We transposed the resulting matrix (indicating how frequently a focal person *received* new information from others about work issues) and used it as input for the betweenness centrality routine in UCINET. Because this routine required binary data, we dichotomized the responses in each cell such that responses with a "1" were coded as zero and all other responses were coded as "1." This provided the betweenness centrality scores for the team members as well as leaders.

Employee external weak ties. We slightly adapted the measure used by Perry-Smith (2006) to measure external weak ties, using a free-recall question. Specifically, we asked respondents, "Thinking back over the past 6 months, please write down up to 15 names, nicknames, or initials of all people within [organization] but outside

your team, with whom you have dealt with on work-related matters.” Employees were then asked to indicate the nature of their personal relationship with each person on this list using a 5-point scale (Gibbons & Olk, 2003) with the response categories 1 (*Do not know socially*), 2 (*Acquaintance*), 3 (*Casual friend*), 4 (*Good friend*), and 5 (*Close personal friend*). In line with prior research (Marsden & Campbell, 1984), we considered acquaintances, distant colleagues (do not know socially), and casual friends to be weak ties. Our final measure consisted of a count of the number of weak ties.

Leader betweenness centrality in peer leader idea network. This was calculated in the same way as the member and leader centrality in the team network measures above. However, in this case, leaders answered questions about all other team leaders in the organization.

Employee radical creativity. This was measured with Baer’s (2010, 2012) three-item scale, derived from Subramaniam and Youndt (2005). Team leaders indicated the extent to which each of the three statements was characteristic of their employees in the past 6 months, ranging from 1 (*Not at all characteristic*) to 7 (*Extremely characteristic*). An example item was, “Developed ideas that make existing knowledge about current products/services obsolete.”²

Control variables. Due to structural reasons, some leaders oversaw more than one team. In line with this three-level nested data structure, we controlled for well-established predictors of creativity as well as potential confounds at the employee (Level 1), team (Level 2), and leader (Level 3) levels. At Level 1, we controlled for employees’ gender, age, and education level (e.g., Mumford & Gustafson, 1988; Zhou & Shalley, 2008). Because employees’ weak ties are a central variable in our analysis, we also controlled for their strong ties. Using the same Gibbons and Olk (2003) measure used for measuring weak ties, we counted the number of times that a focal employee chose Categories 4 (*Good friend*) or 5 (*Close personal friend*). Intrinsic motivation was measured using the seven-item scale by Tierney et al. (1999), ranging from 1 (*Not at all*) to 7 (*Exactly*). A sample item is, “I enjoy coming up with new ideas for projects.” Openness to experience was measured using an eight-item scale from Goldberg (1999). A sample item is, “I am curious about many things.” Finally, we controlled for employees’ dyadic tenure with their leader (“How long have you worked with your team leader?”) and the quality of leader–member exchange (LMX) using the LMX7 scale from Graen and Scandura (1987). A sample item is, “My team leader understands my problems and needs,” ranging from 1 (*Strongly disagree*) to 5 (*Strongly agree*).

At Level 2, we controlled for team size and team leaders’ radical creativity (to account for possible role modeling by the leader; Bandura, 1986). Team members rated their leader’s radical creativity using the same Baer (2010, 2012) measure that we used to measure employee radical creativity. Responses were aggregated at the team level. We also controlled for the extent to which leaders were generally liked or disliked in the team. Positive ties were measured using the Gibbons and Olk (2003) scale described above. Negative ties were measured using a question adapted from Chua, Ingram, and Morris (2008), “To what extent would you describe the relationship with this person as being difficult?” ranging from 1 (*Not at all*) to 5 (*Very much*). The valued in-degree measure of centrality was calculated for both these measures (e.g., Bono & Anderson, 2005). Finally, we controlled for team functional back-

ground diversity, which has been associated with employee creativity (Richter, Hirst, van Knippenberg, & Baer, 2012) by calculating Blau’s (1977) index based on the categorical differences in the professional background of team members.

At Level 3, we controlled for leaders’ positions in the affect-based (i.e., friendship and avoidance) networks among their peers, in order to take into account that leaders’ influence with other leaders may be due to their affective relationships with them (e.g., Brass, 1985). We used the same measures we described above, this time calculated on the basis of the leader roster.

Analytical Approach

Employees were nested in teams, some of which shared a leader. To account for this three-level nested nature, we used hierarchical linear modeling 3 (HLM3) with restricted maximum likelihood in running our model. Thirty-eight percent of the variance in radical creativity resided between leaders (ICC [1] = .38), suggesting the relevance of leader level variables. Moreover, we found significant variance in the randomly varying Level 1 employee betweenness centrality ($\tau_{90} = .01$), $\chi^2(17) = 30.62, p < .001$, and employee weak ties slopes ($\tau_{100} = .01$), $\chi^2(17) = 16.24, p < .05$, thus justifying the examination of cross-level interactions (Hofmann, 1997).

Results

Table 1 provides descriptive statistics and correlations among study variables at Levels 1, 2, and 3. To test our hypotheses, we specified an intercept-and-slopes-as-outcome model (Raudenbush & Bryk, 2002; Table 2). We group-mean centered our Level 1 variables and grand-mean centered variables at Level 2 and Level 3 (Enders & Tofghi, 2007). As a conservative test (as well as a robustness check) of our cross-level interaction hypotheses, we conducted the omnibus test proposed by Aguinis (2004, pp. 134–135) and included all six possible two-way interaction terms among leader and employee idea network variables³ (see Table 2).

Hypothesis 1 posits that leader betweenness centrality within the team (1a) and among peer team leaders (1b) predicts employee radical creativity. As Table 2 illustrates, leader centrality in the

² We conducted in-depth interviews with seven higher level managers in order to collect examples and rich descriptions of radically creative ideas developed by employees. Examples of such ideas developed by employees at the time of this study included the development of special services to make the parks more attractive to visitors (e.g., “visits by night” during summer; guided theme initiatives, such as park exhibitions and tourist attractions related to the time of Roman occupation of the area; customized programs for special customer groups such as students and retired people; “photography rallies,” i.e., photo exhibitions on various themes; educational programs and adventure activities for children, etc.) and a novel Internet-based advertising campaign. Further, to assess whether supervisors had a common understanding of employee radical creativity, we asked six of the leaders to rate detailed descriptions of 13 creative ideas developed by employees (which we had previously collected from the interviews with higher level managers) using Baer’s (2010, 2012) Radical Creativity scale. Interrater agreement was high ($Rwg [j] = .83$), and a one-way analysis of variance revealed no significant differences among the six leaders ($F = .73, p = .60$). These findings suggest that leaders did have a shared understanding of employee radical creativity.

³ We would like to thank our reviewers for this suggestion. We also replicated our results in a model without the two interaction terms we did not hypothesize.

Table 1
Means, Standard Deviations, and Bivariate Correlations Among Study Variables

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11
Level 1: Individual level													
1. Gender ^a	0.76	0.43	—										
2. Age	39.77	8.68	.26**										
3. Education ^b	0.43	0.50	-.48**	-.29**	—								
4. Tenure with leader	5.53	3.65	.03	.13	-.19**	—							
5. Intrinsic motivation	5.18	1.03	-.20**	-.20**	.32**	.02	(.88)						
6. Openness to Experience	3.81	0.47	-.19**	-.12	.28**	-.09	.48**	(.76)					
7. LMX	3.39	0.93	.00	.10	.06	.14*	.20**	.01	(.91)				
8. Strong ties	1.61	2.26	-.12	-.12	.06	.10	.09	.20**	.02	—			
9. Betweenness centrality in team idea N/W	2.15	4.08	.05	.11	.04	.18**	.06	-.11	.16*	-.14*	—		
10. Weak ties	6.17	4.07	-.21**	-.15*	.30**	-.02	.23**	.14*	.06	-.09	.16*	—	
11. Radical creativity	4.05	1.23	-.27**	-.13	.34**	-.12	.29**	.21**	.04	.06	.05	.23**	(.80)
Level 2: Team level													
1. Team size	7.27	2.20	—										
2. Func. backgrd diversity	0.62	0.07	-.26	—									
3. Leader radical creativity	3.12	0.93	-.03	-.23	(.89)								
4. Leader centrality in friendship N/W	21.07	9.48	.89***	-.52*	.21	—							
5. Leader centrality in negative N/W	10.60	4.54	.41*	.43*	-.42*	.34	—						
6. Leader betweenness centrality in team idea N/W	2.42	3.79	.31	.30	-.11	.36	.13						
Level 3: Leader level													
1. Centrality in friendship N/W	50.28	7.30	—										
2. Centrality in negative N/W	21.22	3.51	.48*	—									
3. Betweenness centrality in peer idea N/W	0.22	0.65	.36	.24	—								

Note. *N* employees = 214, *N* teams = 30, *N* leaders = 18. LMX = leader-member exchange; N/W = network; Func. = Functional; backgrd = background. Cronbach's alpha appears in parentheses.

^a Dummy coded: 1 = Male, 0 = Female. ^b Dummy coded: 0 = no college degree, 1 = college degree.

* $p < .05$. ** $p < .01$. *** $p < .001$.

team idea network ($\gamma_{060} = .08, p < .05$) and leader centrality in the peer leader idea network ($\gamma_{003} = .62, p < .001$) predicted significant variance in employee radical creativity above the effects of employee ties. Thus, Hypothesis 1a and Hypothesis 1b were supported.

Hypothesis 2a predicted that leaders' and employees' betweenness centrality in the idea network within the team will interact such that employee centrality would be more strongly related to creativity if leader centrality is low. As Table 2 indicates, this interaction term was significant ($\gamma_{950} = -.01, p < .05$). Simple slopes tests (Aiken & West, 1991; Preacher, Curran, & Bauer, 2006) indicated that the relationship between employee centrality and creativity was positive and significant if leaders were less central in the team idea network ($\gamma = .05, p < .01$), but nonsignificant if leaders were more central ($\gamma = -.01, p > .05$). Figure 1 illustrates this finding at low (mean -1 *SD*) versus high (mean $+1$ *SD*) leader centrality (Aiken & West, 1991). Thus, Hypothesis 2a was supported. Hypothesis 2b predicted that employees' betweenness centrality in the idea network within the team will interact with leaders' betweenness centrality in the peer leader idea network, such that employee centrality would be more strongly related to creativity if leader centrality is high. This interaction was significant ($\gamma_{903} = .07, p < .01$). Simple slopes tests indicated that the relationship between employee centrality and creativity was positive and significant if leaders were central in their peer leader idea network ($\gamma = .10, p < .001$), but not significant if leaders were not central ($\gamma = .01, p > .05$). Figure 2 illustrates this relationship at low (mean -1 *SD*) versus high (mean $+1$ *SD*) leader centrality. Thus, Hypothesis 2b was supported.

Hypothesis 3a predicted that employees' external weak ties interact with leaders' betweenness centrality in the idea network within the team, such that employee weak ties would be strongly related to their creativity if leader centrality were high. However, this was not supported ($\gamma_{1050} = .01, p > .05$). Hypothesis 3b predicted that leaders' betweenness centrality in the peer leader idea network will interact with employees' weak external ties, such that weak ties will be strongly related to creativity if leader centrality is low. As Table 2 indicates, this was significant ($\gamma_{1003} = -.07, p < .05$). Simple slopes tests indicated that the relationship between weak ties and creativity was significant if leaders were not central in their peer idea network ($\gamma = .06, p < .01$), but not significant if leaders were more central ($\gamma = -.03, p > .05$). Figure 3 illustrates this relationship at low- versus high-leader centrality. Thus, Hypothesis 3b was supported.⁴

Discussion

We set out to examine whether team leaders' position in the idea-related interaction networks within their teams and among other peer leaders in the organization facilitate their employees' development of radically novel ideas. As hypothesized, we found that leaders' betweenness centrality in these idea networks within the team as well as among their peer leaders positively affected their employees' development of radically creative ideas, over and above employees' own network ties. We also found that employee and leader network ties combined interactively to predict em-

⁴ We also controlled for employees' weak ties *within* the team in all our analyses reported in Table 2. This did not change the results.

Table 2
HLM Analysis on Employee Radical Creativity

Variable	Employee radical creativity	
	Coefficient	SE
Intercept (γ_{000})	4.15***	.10
Level 1 Variables		
Gender ^a (γ_{100})	-.20	.13
Age (γ_{200})	-.00	.01
Education ^b (γ_{300})	.64**	.18
Tenure with leader (γ_{400})	.03*	.02
Intrinsic motivation (γ_{500})	.13*	.06
Openness to Experience (γ_{600})	-.02	.12
LMX (γ_{700})	.11	.07
Strong ties (γ_{800})	-.00	.03
Member centrality in team idea network (γ_{900})	.04	.02
Member weak ties (γ_{1000})	.03	.03
Member Weak Ties \times Member Centrality in Team Idea N/W (γ_{1100})	.00	.01
Level 2 Variables		
Team size (γ_{010})	.08	.13
Leader radical creativity (γ_{020})	-.22	.14
Team functional diversity (γ_{030})	-.88	1.72
Leader centrality in friendship network (γ_{040})	-.06	.03
Leader centrality in negative networks (γ_{050})	-.03	.03
Leader centrality in team idea network (γ_{060})	.08* (H1a)	.03
Level 3 Variables		
Leader centrality in friendship network (γ_{001})	-.01	.02
Leader centrality in negative affect networks (γ_{002})	-.17**	.04
Leader centrality in peer idea network (γ_{003})	.62** (H1b)	.18
Cross-Level Interaction		
Member Centrality in Team Idea N/W \times Leader Centrality in Team Idea N/W (γ_{950})	-.01* (H2a)	.01
Member Centrality in Team Idea N/W \times Leader Centrality in Peer Idea N/W (γ_{903})	.07** (H2b)	.02
Member Weak Ties \times Leader Centrality in Team Idea N/W (γ_{1050})	.01 (H3a)	.00
Member Weak Ties \times Leader Centrality in Peer Idea N/W (γ_{1003})	-.07* (H3b)	.03
Leader Centrality in Team Idea N/W \times Leader Centrality in Peer Idea N/W (γ_{053})	.20*	.09
Model deviance	452.99	

Note. N at Level 1 = 214, Level 2 = 30, Level 3 = 18. Model deviance is a measure of overall model goodness of fit in HLM analyses. The larger the model deviance, the worse is the model goodness of fit (e.g., Liu, Chen, & Yao, 2011). The above model provides a better fit than the null model, which has a model deviance of 634.11. HLM = hierarchical linear modeling; LMX = leader-member exchange; N/W = network; H = hypothesis.

^a Dummy coded: 1 = Male, 0 = Female. ^b Dummy coded: 0 = no college degree, 1 = college degree.

* $p < .05$. ** $p < .01$. *** $p < .001$.

ployee creativity such that they complemented each other if employees assumed critical liaison positions within their team, and leaders assumed critical liaison positions within their peer leader network (i.e., employees and leaders had network connections to different sources of information). However, if leader and employee ties targeted the same source (either within or external to the team), employees' ties were predictive of their radical creativity only if their leaders did not occupy critical liaison positions. Taken together, these findings contribute significantly to social networks and leadership research on employee creativity.

Theoretical Contributions

First, the current article extends the prior focus on employee social networks and creativity (e.g., Perry-Smith, 2006) by demonstrating the importance of team leaders' social network ties in facilitating their employees' development of radically creative ideas (unlike most prior studies that have focused mainly on employees' own ties). Developing useful ideas that significantly alter the status quo and make existing knowledge about products and services obsolete may require access not only to diverse knowledge but also to substantial big-picture information regard-

ing creative opportunities and constraints in existing work processes and how they may be aligned with strategic organizational needs, priorities, and novel initiatives across the wider organization. In the absence of such integrative information, the uncertainty associated with radical creativity (Madjar et al., 2011) may make employees less motivated to engage in such creative efforts (Mueller et al., 2012), or render their ideas less useful or original. Given that employees in lower rungs of the hierarchy may find it challenging (although not impossible) to access all this information by themselves, these employees may rely on their leaders, who, by virtue of their position, may have easier access to such information. Along these lines, our results demonstrate that leaders' network ties both within and external to the team play an important role above and beyond employees' own ties in facilitating their employees' development of radically novel ideas. Research in the networks-creativity domain would be well served to examine the effects of others' (especially leaders') network ties on employee creativity.

Second and related, our results show how leader ties may qualify the effects of employee ties on their radical creativity. Specifically, our findings suggest that leaders who assume a crit-

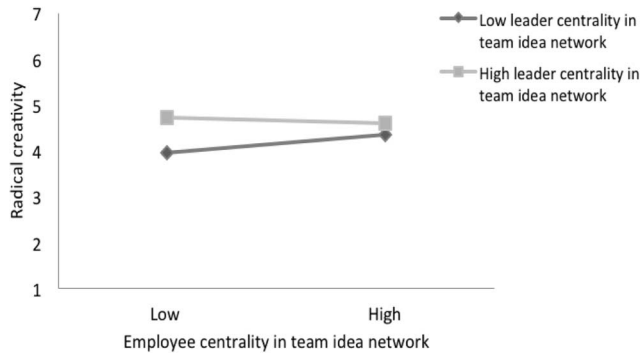


Figure 1. The interaction of employees' and leaders' betweenness centrality in the team idea-related interaction network.

ical liaison position among their peers can complement employees who assume a critical liaison position within the team in facilitating employee radical creativity. However, in case of garnering information from the same source (internal or external to the team), employee ties affect radical creativity *only* if leaders do not assume central liaison positions within such networks. Because novel ideas that substantially alter existing products and processes may require more accurate and integrative information from different sources, employees might be relying more on well-connected leaders for such information, which might be more reliable, thereby rendering their own ties less important. However, if leaders are less central, employees may have no other option than to rely on their own connections to access such information. Thus, these findings illustrate how leader ties can qualify the effect of employees' own ties on their radical creativity in differential ways. It is important to note here that, although Hypothesis 3a was not supported, the pattern of this interaction was in our proposed direction. Additional analyses revealed that this term became significant when the two additional unhypothesized two-way interaction terms in our model were removed, thus suggesting that this interaction was possibly not robust enough to be detected, possibly due to low power in our sample.

However, taken as a whole, these findings suggest that leader ties within and outside the team play important and independent

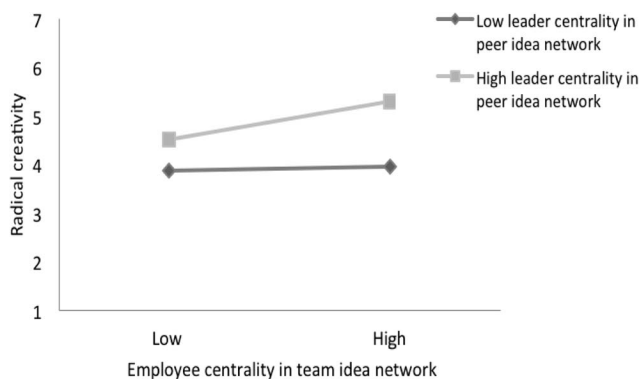


Figure 2. The interaction of employees' betweenness centrality in the team idea-related interaction network and leaders' betweenness centrality in their peer idea-related interaction network.

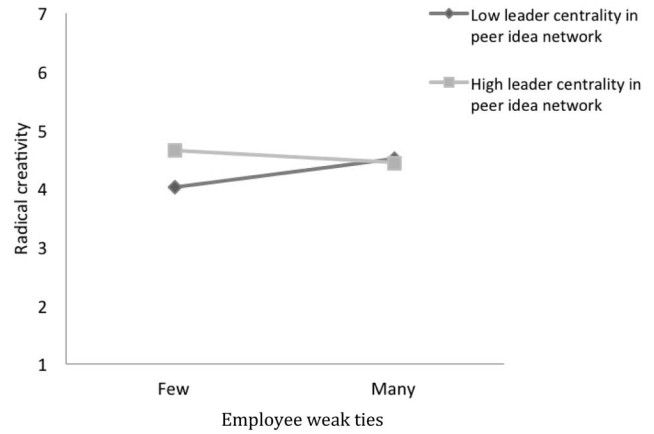


Figure 3. The interaction of employees' weak external ties and leaders' betweenness centrality in their peer idea-related interaction network.

incremental as well as *qualifying* roles (in addition to employees' own ties) for employee radical creativity. Specifically, they indicate that the utility of employees' own ties for their development of ideas that substantially alter the status quo should not be judged without consideration of their leaders' ties,⁵ a finding that calls for substantial extensions as well as refinements of current theoretical perspectives on the social network–creativity relationship, that has focused mainly on employee ties (e.g., Baer, 2010, 2012; Burt et al., 2013; Perry-Smith & Shalley, 2003; Zhou et al., 2009). As our findings regarding the unique interplay between employee and leader ties indicate, employee and leader ties are not fully interchangeable. Thus, a network perspective on employee radical creativity that does not take into consideration leader ties likely presents an incomplete picture of the creative benefits that social networks may offer.

Third, our study contributes to the body of research concerned with leadership influences on creativity (for reviews, see Shalley & Gilson, 2004; Tierney, 2008). However, in contrast to most prior studies, we did not focus on leaders' behavior or relationships that are directed at employees. Our study instead highlights the importance of leaders' relationships with others for employee radical creativity. As such, our findings suggest that a proper understanding of creativity-fostering leadership needs to embrace a broader and more encompassing perspective on leadership activities that include leaders' connections with others across the wider organization (cf. Mumford, Scott, Gaddis, & Strange, 2002). In highlighting the importance of leader ties, the current article not only adds a new and powerful group of variables to the menu of contextual influences on creativity (George, 2007; Shalley et al., 2004) but also extends recent leadership research that has revealed that leaders' embeddedness in broader leadership networks in the organization can have important implications for employee outcomes (e.g., Mehra, Dixon, Brass, & Robertson, 2006; Sparrowe & Liden, 2005; Venkataramani, Green, & Schleicher, 2010).

⁵ We also examined whether leader ties facilitated employees' development of more mundane or incremental (as opposed to radical) ideas. As we expected, none of our interactions neared significance. This suggests that leader ties, which provide big-picture information, may not be crucial in facilitating the development of incremental ideas, but are critical for radically creative ideas.

Limitations and Directions for Future Research

Our study has some limitations that point to interesting avenues for future research. First, due to its cross-sectional design, we cannot make definitive claims about the causal direction of the proposed relationships. For example, it is possible that other leaders may seek out specific team leaders with creative employees (thus affecting their centrality) because they are a good source of new insights. However, the differential (i.e., complementary vs. compensatory) pattern of our interactions cannot be completely explained by reverse causal arguments. Nonetheless, it would be useful for future research to replicate our findings through the use of longitudinal or experimental designs that are stronger with respect to specification of cause and effect.

A second limitation of the study is that our leader and team-level samples were small (18 and 30, respectively). Prior research indicates that reduced statistical power due to small sample sizes may prevent detection of interactions of small or moderate strength (Kreft & De Leeuw, 1998; Mathieu, Aguinis, Culpepper, & Chen, 2012). In this context, it is important to note that we did detect significant interaction effects despite small sample sizes in our study, which suggests that the effects reported in this article are particularly strong. Nonetheless, we urge future research to examine this issue conducting research in larger organizations with larger sample sizes at higher levels of nesting.

Third, an implicit assumption in our arguments relates to the actual information circulating in the team and leader networks (e.g., information about organizational needs, strategic priorities, etc.), which—similar to other network studies (e.g., Perry-Smith, 2006)—we have not measured explicitly due to the already time-consuming nature of the network data collection methodology. However, the specific pattern of our interactions suggests that these assumptions about the unique nature of information provided by leader ties may not be inaccurate. Nonetheless, this would be an interesting area for future research to pursue.

Practical Implications

Due to horizontal differentiation within teams, employees may not have optimal and frequent exchanges of information and ideas with all their teammates. In such cases, leaders may need to share their understanding of different perspectives, constraints, and ideas of various team members with their team in helping employees see the bigger picture, thereby fostering their employees' radically creative efforts. Similarly, leaders need to make conscious efforts to network with their peers via idea-related interactions in order to be exposed to diverse information, strategic priorities, and concerns, which are critical in guiding their employees to generate radically creative ideas.

At their end, employees need to ensure that they interact with a diverse group of organizational employees both within and outside their immediate teams regarding work-related ideas (e.g., Tushman & Scanlan, 1981). The results we presented suggest that employees cannot simply rely on their leaders to garner all the informational resources needed for their radically creative endeavors. Employees should be aware of their leaders' connections within and outside the team in order to be able to compensate for their leaders' lack of critical liaison positions in the team and peer leader networks, and if needed, to leverage their own connections.

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