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WHO DEFERS TO WHOM AND WHY? DUAL PATHWAYS LINKING DEMOGRAPHIC DIFFERENCES AND DYADIC DEFERENCE TO TEAM EFFECTIVENESS

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We develop and test predictions about how demographic differences influence dyadic deference in multidisciplinary research teams, and how differential patterns of dyadic deference emerge to shape team-level effectiveness. We present a dual pathway model that recognizes that two distinct mechanisms—task contributions and social affinity—account for how team members' demographic attributes contribute to deference. Furthermore, we propose that the extent to which these different mechanisms are prevalent in a team has implications for the team's research productivity, with deference based on social affinity detracting from it and deference based on task contributions enhancing it. Using longitudinal data from a sample of 55 multidisciplinary research teams comprising 619 scientists, we found general support for our conceptual model. Our findings underscore the importance of accounting for multiple interpersonal mechanisms to understand the complex, multilevel nature of deference in teams.

> Throughout my twenty-year career, I have put together many research groups . . . brought together physicists, electrical engineers, biologists . . . always I do my best to bring together people who are the most competent and skilled—the brightest of them . . . yet I find that the dynamic that unfolds in my group is difficult to predict beforehand . . . sometimes a group can be amazingly productive and sometimes things just come apart even with the best people . . . What predicts the success of my team? I wish I knew the answer to that question.
>
> Bio-photonics laboratory leader, interview excerpt

Within teams performing complex mutually interdependent tasks, a fundamental process by which team members gain access to and capitalize on one another's expertise is deference—yielding to one another's opinions, beliefs, and decisions in the course of teamwork (Anderson, Willer, Kilduff, & Brown, 2012). When one team member defers to another who possesses the relevant skills needed for a given problem, project, or set of goals, the team is apt to combine diverse knowledge bases in effective ways (Bunderson, 2003). For example, in a research team working to develop cutting-edge laser technology to detect cancerous cells, a team member specializing in the study of cellular mechanisms may need to defer to a team member who specializes in image processing in order to resolve a pressing issue. Similarly, in a team developing algorithms to identify neuronal plasticity, a scientist specializing in neurophysiology may need to defer to a team member with expertise in mathematically modeling dynamical systems such as the human brain. These acts of dyadic deference serve as building blocks for task coordination and knowledge combination in teams (Anderson et al., 2012; Fragale, Sumanth, Tiedens, & Northcraft, 2012).

Organizations increasingly rely on teams for generating knowledge and accelerating innovations (Paruchuri, 2010; Wuchty, Jones, & Uzzi, 2007). Yet scholars across many different research traditions acknowledge that, while multidisciplinary teams offer the promise of advancing scientific discovery and innovation, the increasing specialization of scientific knowledge, combined with the need to co-

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ordinate across discrete expertise domains, often creates an intractable "mutual knowledge" challenge (Cummings, Kiesler, Zadeh, & Balakrishnan, 2013; Kotha, George, & Srikanth, 2013). In order to enhance innovation and solve complex scientific problems, team members need to reach across knowledge silos and develop a shared knowledge base. Doing so, however, requires curtailing the coordination losses that often accompany diversity in knowledge, skills, and expertise (Cummings et al., 2013; Kotha et al., 2013). In particular, leveraging diversity to develop mutual knowledge and achieve team goals necessitates, first and foremost, that team members can identify whose expertise they need to defer to or accept. Therefore, understanding who defers to whom, and why one person defers to another within a team, is critical for delineating how mutual knowledge develops in teams. But, the sources of deference and how patterns of deference emerge to shape effectiveness in multidisciplinary teams are not fully understood.

A vast literature shows that people often rely on noisy signals of expertise in discerning whose opinions or skills warrant deference in the course of accomplishing team tasks (e.g., Barton & Bunderson, 2014; Joshi, 2014; Littlepage, Schmidt, Whisler, & Frost, 1995; Thomas-Hunt, Ogden, & Neale, 2003). In identifying possible sources of deference, scholars have highlighted, in particular, that individual demographic attributes—such as gender, race and ethnicity, educational background, and tenure—operate as status markers that signal expertise across a variety of contexts (James, 1959; Shils, 1968; York & Cornwell, 2006) and predict the deference that individuals receive from others (Berger, Cohen, & Zelditch, 1972; Berger, Fiske, Norma, & Zelditch, 1977; Bunderson, 2003; Cohen & Zhou, 1991; Ridgeway, 1991). Underlying past research accounts of how individuals accrue status in teams is the basic assumption that demographics translate into deference because team members attribute an "expertise advantage" to those who have higher status based on their demographic characteristics (e.g., Berger et al., 1972; Ridgeway, 1991). In enduring work teams, however, another important mechanism—feelings of social affinity that develop among team members—might provide an additional and complementary explanation for how demographic attributes lead individuals to *give* deference to and *receive* deference from one another.

We offer a multilevel perspective on two pathways through which demographic differences translate into dyadic, interpersonal deference in teams, and we identify the team performance consequences of deference resulting from these two pathways. Many of the most highly regarded perspectives in management theory (e.g., Granovetter, 1985; Homans, 1950; Simon, 1945; Weick, 1969) emphasize that the interlocks, interactions, connections, or relationships that bind two people together form the cornerstone of *organizational* behavior. Yet, there remains relatively little empirical research that adopts a dyad-level perspective in explaining team dynamics (see Joshi, 2014, and Van der Vegt, Bunderson, & Oosterhof, 2006, for exceptions). Drawing on a multi-period study of 55 research teams employing more than 600 scientists and engineers, a multilevel approach focusing on dyadic deference enables us to identify how deference is driven by (a) demographic attributes of the team member, or partner, who is the recipient of deference; (b) attributes of the actor who confers deference; and, importantly, (c) the dyadic interaction between the actor's and the partner's demographic attributes (Kenny, 1994).

By adopting a multilevel approach to deference, grounded in dyadic processes, we contribute to the literature on teams in three interrelated ways. First, we build on and enrich existing theory on status in teams by identifying an additional overlooked mechanism through which demographic attributes shape deference—social affinity. A prevailing assumption in existing theories of status in teams is that the primary mechanism by which demographic differences translate into status hierarchies is via perceptions of task competence that individuals develop about one another—that is, demographic attributes serve as signals of expertise or competence (Barton & Bunderson, 2014; Berger et al., 1972; Berger et al., 1977; Ridgeway, 1991). But, as we noted above, demographic attributes are not just signals of competence—they are also a basis for social affinity. In enduring teams, especially, demographic similarity between two individuals can lead to liking, friendship, or an affective interpersonal connection (Ashforth & Mael, 1989; Kalkhoff & Barnum, 2000) that may translate into deference. For example, although a scientist who specializes neurophysiology should likely defer to a team member with a background in engineering mathematics to develop a neural network mapping algorithm, she may inadvertently defer instead to a team member with whom she shares a closer social tie—even if this person lacks knowledge about recent advances in modeling dynamical systems that could expedite the task. Similar dynamics may be

observed across a wide range of teams where individuals defer to each other not just because of perceptions of the teammate's task-related competence but also based on social affinity with that teammate. Therefore, we propose and test a dual pathway model that accounts both for perceptions of task competence and for feelings of social affinity as possible drivers of deference in teams.

Second, by expanding the conceptualization of deference to account for social affinity as a mechanism, we challenge the predominant view of deference in teams as purely an asymmetric process. Existing conceptualizations depict deference as flowing only from low-status to high-status team members (e.g., Berger et al., 1972). This asymmetric depiction follows from the predominant competence-based perspective on deference described above. A team member will defer to another team member whose demographic attributes signal relatively greater task competence. Thus, for example, a team member with a lower organizational rank will accept the opinions and inputs of a higher-ranking team member. The higher-ranking team member will be more likely to receive deference from others in the team rather than defer to other team members. If social affinity is a contributing mechanism for deference, however, there are likely symmetric flows of deference, as well. Based on social affinity, two demographically similar team members may mutually defer to one another's opinions or beliefs as a way to validate their own opinions and to enhance their self-esteem (Kalkhoff & Barnum, 2000; Oldmeadow, Platow, Foddy, & Anderson, 2003). For example, two similarly high-ranking team members working on a strategic initiative for the company may defer to one another because they believe that they share similar interests and objectives with respect to the company's business strategy, feel a mutual affinity based on similar rank, and because they would rather not challenge each other's status in the team (Fragale et al., 2012; Kalkhoff & Barnum, 2000). By examining demographic similarity and deference at the dyad level, we theorize about both asymmetric and symmetric patterns of deference in teams.

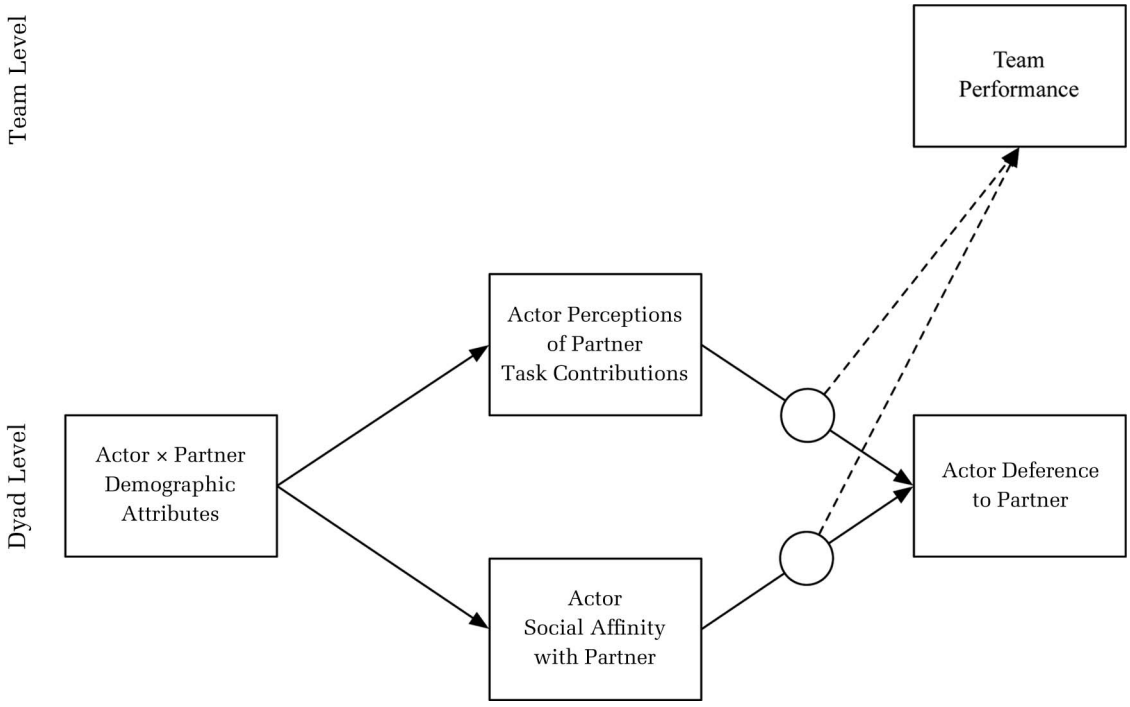
Third, by unpacking how deference emerges from two distinct mechanisms, we offer a novel explanation for why interactional processes underlying status hierarchies in teams are sometimes functional and, at other times, dysfunctional. Specifically, we suggest that deference arising from perceptions of task competence and deference arising from social affinity have different bottom-up implications for team effectiveness. Functionalist perspectives have argued that status hierarchies are not only inevitable but also beneficial for efficient expertise utilization and coordination within groups (Keltner, Van Kleef, Chen, & Kraus, 2008; Kwaadsteniet & Van Dijk, 2010; Magee & Galinsky, 2008). Yet, empirical findings regarding the benefits of status hierarchies for diverse work teams are mixed (Anderson & Brown, 2010; Bunderson & Reagans, 2011). We suggest that understanding why people defer to one another in work teams—that is, unpacking the underlying sources of deference—may help to resolve ambiguity in the literature regarding boundary conditions that shape the functionality of status hierarchies in teams. From the standpoint of research on knowledge combination in multidisciplinary teams (e.g., Kotha et al., 2013), we also hope to identify whether dyadic processes based on social affinity or perceptions of task competence are more likely to promote innovation and research productivity.

Moreover, to date, researchers have focused predominantly on top-down or contextual boundary conditions around the functional perspective of social hierarchy—in line with the general trend of research on group and team dynamics (Kozlowski, Chao, Grand, Braun, & Kuljanin, 2013). Ours is, however, a bottom-up explanation: interpersonal deference processes at the dyad level compile to shape higher-level team outcomes. More specifically, we develop and test predictions about how processes of dyadic deference work as a bottom-up effect (e.g., Hitt, Beamish, Jackson, & Mathieu, 2007)—a process through which "individual characteristics and dynamic social interaction yield a higher-level property of the group" (Kozlowski et al., 2013: 4)—to influence the effectiveness of a team in leveraging team members' diverse expertise to perform at a high level.

A DUAL PATHWAY MODEL OF DEMOGRAPHIC EFFECTS ON DEFERENCE

Below, we develop a conceptual model of the antecedents and consequences of dyadic deference in teams. Our model (Figure 1) specifies two paths from demographics to deference. We begin by describing asymmetric effects of demographics on deference that are grounded in the fundamentals of status characteristics theory—one of the most influential perspectives on how demographic attributes shape deference processes in teams. We expand upon these arguments, however, by describing

FIGURE 1
Theoretical Framework



symmetric effects of demographics on dyadic deference that are grounded in the fundamentals of self-categorization theory—one of the most influential perspectives on how demographic attributes shape interpersonal relationships in teams.

Before developing the predictions in our model, a few notes on terminology. First, in our theorizing, we use the term *demographic status* to convey the status value associated with demographic attributes. Specifically, in line with prior theory and research, we expect that higher levels of education or tenure are associated with higher status value in this context, while lower levels of education or tenure are associated with lower status value (Bunderson, 2003). Further, research shows that, in the context of scientific research teams in the United States, such as the teams we studied, being White or male is also associated with higher status value than being female or belonging to an ethnic minority (see DiTomaso, Post, Smith, Farris, & Cordero, 2007). Notwithstanding important differences among demographic attributes (e.g., Barton & Bunderson, 2014), the mechanisms that we propose mediate the effects of demographic attributes on dyadic deference are agnostic regarding the nuances of these attributes. That is, whether the focal attribute is gender or education, we would argue that the same basic psychological processes shaping deference are in operation. Second, our focal unit of analysis is the dyad. We seek to better understand why one team member—whom we refer to as the *actor*—might or might not defer to another—whom we refer to as the *partner*. Our model specifies that it is the interplay among an actor's and partner's respective demographic attributes that shapes the actor's deference to the partner.

From Demographics to Dyadic Deference: The Asymmetric Path of Task Contributions

Status characteristics theory posits that demographic attributes serve as signals, or cues, that team members use to estimate one another's likelihood of making valuable contributions to team tasks. When there are decisions to make or disagreements to resolve, the opinions of team members who possess higher status attributes, such as higher education and tenure, and who are male and White in technical teams (Bunderson, 2003; Joshi, 2014), are likely to prevail (Berger et al., 1972; Berger et al., 1977; Carli, 1991; Ridgeway, 1991; Wagner & Berger, 1997). Over time, acts of deference from multiple actors to high demographic-status partners lead status to accrue to those team

members more than others because this dynamical is asymmetric—those who receive deference are presumed less likely to give it (Berger et al., 1977; Ridgeway & Smith-Lovin, 1999).

Two categories of demographic attributes shape deference in teams, according to status characteristics theory (Berger et al., 1977; Berger, Rosenholtz, & Zelditch, 1980; Ridgeway, 1991). *Specific cues*, such as education and tenure, are attributes that are directly relevant to team tasks; *diffuse cues*, such as gender and ethnicity, are attributes that, although not directly relevant to the task, are believed to convey general aptitude in a domain (Banaji & Prentice, 1994; Jackman, 1994; Jost, Banaji, & Nosek, 2004; Ridgeway, 1991; Ridgeway & Smith-Lovin, 1999). While the distinction between specific and diffuse cues is an important one, as specific cues may more strongly influence deference than diffuse cues (Bunderson, 2003), the same basic mechanism—expectations about individual task contributions—is at the heart of the status characteristics explanation for how an attribute leads to deference. Specific cues directly signal whether a person has the capacity to make valuable contributions to the team. Diffuse cues indirectly signal—through generalized expectations of competence—whether a person will add value to the team.

Research on demographic attributes and status in teams supports the basic principle of asymmetric deference that is central to status characteristics theory. Specifically, those who possess high demographic status receive more deference and accrue more status than those with low demographic status through expectations about and perceptions of their task expertise (Bunderson, 2003; Joshi, 2014). To date, the focus of existing research has largely been on this individual accrual of status, addressing the question "who emerges as particularly influential in teams?" Although research shows that the individual accrual of status falls in line with the basic predictions of status characteristics theory, relatively less is known about whose deference influential individuals receive, and, relatedly, to whom influential individuals might defer.

Answering such questions requires adopting a dyadic approach to deference. At the dyad level, status characteristics theory would suggest that an actor who possesses higher values of privileged demographic attributes is less likely to view a partner who possesses lower values of these attributes as worthy of deference. A relative evaluation of partner's demographic attributes will place the actor (rather than the partner) at an "expertise advantage" (Berger et al., 1977). Consider that, in a research team, someone with a doctorate is likely to receive deference from someone with only an undergraduate degree, or that a senior team member is more likely to receive deference from a newcomer to the team. But, does the team member with a doctorate defer to no one? And, whose opinions does the senior scientist yield to?

Recent research suggests that acts of deference are not just vertical enactments of a status hierarchy; acts of deference are also behaviors that team members use laterally to avoid competing with or threatening one another's position in the status hierarchy (Anderson, Srivastava, Beer, Spataro, & Chatman, 2006; Fragale et al., 2012); "deferential acts signal that one individual in a hierarchy does not intend to challenge another" (Fragale et al., 2012: 27). In contrast to experimental research on status and deference in social psychology, which relies upon forced choice research designs that require one person to either defer to another or not (e.g., Kalkhoff & Barnum, 2000), many real-world situations offer the potential to defer on some dimensions of a problem or question and not defer on others. Descriptions of lateral deference thus emphasize that, rather than a zero sum resource in groups and teams, status can be shared and deference can be both mutual and a matter of degree. Integrating this view with status characteristics theory suggests that those who possess high demographic status are likely to defer to others with high status through the core mechanism of perceptions of task contributions. Deference between individuals of high status is a way for those with high demographic status to validate one another's task contributions and avoid challenging or threatening one another's similar high status. Supporting this line of argument, research demonstrates that threats to status are less likely from those who have lower status; however, peers defer to others of similar rank—especially when concerned with potential loss of status—since threats to one's own status are more likely from others who have similar status (Anderson et al., 2012; Fragale et al., 2012; Kilduff, Elfenbein, & Staw, 2010; Overbeck, Correll, & Park, 2005).

A dyad-level approach enables unpacking these complex and nuanced effects of actor–partner demographics on deference through the perceived task contributions pathway. Although, at the individual level, the net effect of high status is likely asymmetric, as shown by prior research (Bunderson, 2003), at the dyad level, this asymmetry may

be tempered by lateral deference among high-status dyads. In other words, high-status individuals are more likely to receive rather than to give deference to others in the team overall, but high-status *dyad* members are also likely to mutually reciprocate deference through the perceived task contributions pathway. Stated formally, we pose the following partial mediation hypothesis regarding the asymmetric pathway from demographic attributes to dyadic deference:

Hypothesis 1. An actor's perception of a partner's task contributions partially mediates the interactive effects of actor–partner demographic attributes on dyadic deference such that (a) actors whose attributes convey low status value defer to partners whose attributes convey higher status value through perceptions of task contributions and (b) high-status actors defer to partners with similar demographic status through perceptions of task contributions.

From Demographics to Dyadic Deference: The Symmetric Path of Social Affinity

Demographic attributes likely serve not just as status cues, but also as triggers for other sociocognitive processes among team members. Membership in demographic categories can have a powerful influence on an individual's self-concept and the ways in which one individual perceives and relates to another based on demographic similarity. Below, we build upon and extend the status characteristics perspective by theorizing about an additional, symmetric path from demographics to deference—the social affinity path—that is grounded in the sociocognitive responses of demographically similar dyad members to one another.

A long line of theory and research suggests that individuals define themselves in terms of memberships in various demographic groups, and also relate to one another based on shared membership in these groups (Ashforth & Mael, 1989; Tajfel, 1981, 1982; Tajfel & Turner, 1986). Demographic similarity can serve as a basis for in-group/out-group categorizations between two team members. To enhance their self-esteem, individuals are more likely to assign positive value to the perspectives and rely on the opinions of in-group members (i.e., those who share observable demographic characteristics) (Kalkhoff & Barnum, 2000; Oldmeadow et al., 2003; Tajfel, 1981, 1982; Tajfel & Turner, 1986). Since individuals believe that in-group members are more likely to have attitudes and values similar to their own, it is also likely that they will view the contributions and opinions of in-group peers as more valuable. By favoring the contributions of their own in-group members, team members are thus more likely to confer deference on members of their own in-groups than on members of out-groups. Indeed, research suggests that, when individuals disagree with a fellow in-group member, they are likely to change their original viewpoint to defer to the in-group member in order to resolve discrepancies between the self and others who are classified as similar to the self (Hogg & Turner, 1987; Turner, 1991; Turner & Oakes, 1989). When individuals disagree with an out-group member, however, they are less likely to change their original position in deference to the out-group member (Hogg & Turner, 1987; Turner, 1991). Returning to an earlier example, a senior scientist working on a neural networking problem may thus defer to another team member with whom she has shared a long tenure in the team rather than yield to a newcomer (despite the relevance of the newcomer's skills for the problem) because she believes that the senior team member shares values and opinions similar to her own. By deferring to a fellow long-tenured team member, the senior scientist validates her own perspective, thus enhancing her own self-esteem (Kalkhoff & Barnum, 2000; Oldmeadow et al., 2003).

This reasoning, which is highly plausible in enduring work teams, offers a novel and additional perspective on how deference flows in teams. Whereas the perspective most dominant in existing research—the status characteristics perspective described above—highlights expertise advantages and an *asymmetric* flow of deference among team members (i.e., from low to high demographic status), we propose that demographic similarity might also shape deference in *symmetric* ways (i.e., mutually reciprocated among the members of the same demographic group). The additional mechanism that we propose is the feeling of social affinity that is likely to develop among demographically similar team members (i.e., in-group members). Social affinity is a mutual, or symmetric, interpersonal process that stems from the "social attraction hypothesis" of self-categorization theory, which posits that individuals are "socially" rather than "personally" attracted to in-group members for a number of reasons (Hogg, 2001). First, in-group members are perceived as representatives of a positive group

prototype. Therefore, a person who is demographically similar is likely to be seen as someone who possesses positively valued attributes. Second, based on this assessment, individuals feel that they share similar perceptions to other in-group members. Thus, individuals are more likely to feel perceptually assimilated with in-group members. Third, because in-group members are viewed as prototypic extensions of the self, individuals' liking of in-group members reflects liking of oneself, which is central to the self-esteem motive (Hogg, 2001; Hogg & Hains, 1996; Hogg & Hardie, 1991). For these reasons, a partner who receives deference from an actor due to feelings of social affinity is likely to also defer to that actor in return.

Overall, this suggests that an actor may defer to a partner who shares demographic attributes because, as in-group members, actors and partners are more likely to be socially connected to one another. Thus, we would expect that, in the context of work groups, having a strong social affinity tie to a demographically similar team member would increase the likelihood of respecting that person's opinions in decision making. However, an important caveat needs to be acknowledged. Like the tempering of the asymmetric effects of the task contributions pathway, the symmetric dyadic effects of the affinity pathway may also be nuanced and tempered by the demographic status of the dyads. Social affinity operates differently among high-status demographic groups versus among low-status demographic groups. Considerable research shows that individuals belonging to high-status demographic groups are more likely to engage in in-group favoring behavior than individuals belonging to low-status demographic groups. High-status team members (e.g., White, male, highly tenured or educated team members) tend to identify with their demographic category, since identifying with their in-group also enhances their self-esteem (Tajfel, 1981, 1982; van Knippenberg & Ellemers, 1993). Therefore, individuals belonging to high-status demographic groups are especially prone to defer to in-group members (Chattopadhyay, Tluchowska, & George, 2004; Tajfel, 1981, 1982). That is, although similarity-based social affinity is likely the norm across dyads, this effect may be particularly strong in high-status dyads. Stated formally, we posit the following partial mediation hypothesis regarding the symmetric pathway from demographic attributes to dyadic deference:

Hypothesis 2. An actor's social affinity with a partner partially mediates the effects of actor–partner demographic attributes on dyadic deference such that (a) actors defer to partners with similar demographic attributes through social affinity and (b) these effects are stronger among high-status dyads than among low-status dyads.

Bottom-Up Implications of Different Paths to Dyadic Deference for Team Performance

We now turn our attention to what these two pathways to dyadic deference mean for team performance. Functionalist perspectives have argued that unequal deference based on status differentials is inevitable in teams (Berger et al., 1977; Bunderson & Reagans, 2011; Magee & Galinsky, 2008). Further, researchers have found that the flow of deference from low- to high-status individuals has coordination and efficiency benefits. For example, Kwaadsteniet and Van Dijk (2010) noted that the general norm of deference—wherein low-status individuals defer to high-status individuals—is beneficial for tacit coordination. Keltner et al. (2008) argued that, by deferring to high-status individuals, low-status individuals avoid conflict and are better equipped to accomplish goals. And, the dominance complementarity view has demonstrated that social hierarchies provide important heuristics for allocating resources, executing plans, and assigning responsibilities in groups (Tiedens, Chow, & Unzueta, 2007; Tiedens & Jimenez, 2003).

Recent theory and research on status differentials and performance in work teams have qualified these views, however, by suggesting that there are contingencies that may weaken or strengthen the benefits of unequal patterns of deference in teams (Aime, Humphrey, DeRue, & Paul, 2014; Anderson & Brown, 2010; Bunderson & Reagans, 2011; Van der Vegt, de Jong, Bunderson, & Molleman, 2010). While these perspectives have highlighted aspects of the team's context as contingencies shaping the effects of unequal deference patterns, we highlight the origins of deference as an important boundary condition. We propose that, although unequal deference may be inevitable in teams, the source of deference—specifically, the degree to which dyadic deference in teams originates in perceptions of task competence or social affinity—has important bottom-up implications for team performance. We posit that deference stemming from perceptions of other team members' task contributions likely en-

hances team performance. In a study of technical teams, Bunderson (2003) found that teams performed best when interpersonal influence was aligned with specific cues, which are more veridical indicators of expertise than diffuse cues. We have suggested, above, that the interplay of an actor's and a partner's demographic status shapes deference, in part, through the perceptions that the actor holds about the partner's contributions to team tasks. In multidisciplinary teams, when team members defer to those who they expect will make valuable contributions to the task, we surmise that the team will combine diverse knowledge more effectively and benefit by advancing scientific discovery and innovation. The perceptions of task contributions mechanism is, we have argued above, but one route to deference in enduring teams. Team members also may defer to those with whom they feel social affinity. When an actor defers to a partner based on feelings of social affinity, the team may be exposed to suboptimal opinions and perspectives. Rather than following the direction of the person whose expertise is most relevant, an actor who defers to a partner due to social affinity yields to someone who may possess little to no expertise relevant to the task at hand. In teams assembled to advance scientific innovation, this alignment of deference with affinity likely impedes the team's ability to combine and use knowledge effectively, detracting from team performance.

Hypothesis 3. The degree to which deference is based on perceptions of task contributions in a team will be positively related to team performance.

Hypothesis 4. The degree to which deference is based on social affinity in a team will be negatively related to team performance.

METHODS

Hypotheses were tested using multi-period surveys and archival data from 55 laboratories in a research center within a large public university.[1] Research teams in this center represent many different disciplines, such as bioengineering, cell and molecular biology, computer science, electrical engineering, material sciences, and chemical engineering. The center's mission is to advance interdisciplinary research across barriers between traditional scientific and technological disciplines. The teams included in the study were primarily funded by the National Science Foundation (NSF) and the National Institutes of Health (NIH), both of which recognize the value of interdisciplinary research. For example, the NSF's mission statement notes that "NSF has long recognized the value of interdisciplinary research in pushing fields forward and accelerating scientific discovery. Important research ideas often transcend the scope of a single discipline or program" (NSF, n.d.). Similarly, specific divisions within the NIH are devoted to funding interdisciplinary research in the areas of biomedical and behavioral sciences. To pursue such aims, the teams included in the study brought together individuals from multiple disciplines to work on common problems, such as the biological functioning of the human brain involved in language, speech, attention, and memory; enhancing human–computer machine interface design; and integrative imaging science.

Study participants were faculty members, graduate students (master's and doctoral), and post-doctoral employees funded through various grants and affiliated with specific research laboratories within the center ($n = 725$). The members of a given team, or lab, were collocated in a common physical space, which housed equipment needed to conduct research (e.g., a wet lab) and basic office space for lab members. Members met face to face at least once a week to review the progress of ongoing projects and to obtain and provide feedback on papers and projects. Team performance in this context is based primarily on disseminating findings through journal articles, conference presentations and proceedings, and, to a lesser extent, filing patents.

We collected survey data at two points in time and archival performance data at an additional, third time point. In the Time 1 survey (response rate, 82%), we gathered data on team members' demographic attributes (i.e., education level, team

[1] This research is part of a larger National Science Foundation-funded project aimed at unpacking the effects of diversity in multidisciplinary scientific teams. The data collected for this larger research project span multiple research centers, and was collected between 2009 and 2012 in multiple waves. Another article that is funded by the grant, and is part of this larger research initiative, was recently published by the first author (Joshi, 2014). The demographic variables and the round-robin data collection approach overlap across these two studies.

tenure, gender, ethnicity). In the Time 2 survey (response rate, 100% of those participating in the Time 1 survey), which was administered roughly 2 months after the Time 1 survey, we collected data on team members' interpersonal perceptions of and relationships with their fellow team members (i.e., deference, perceptions of task contributions, and social affinity ties). Finally, approximately 18 months after the Time 2 survey, we compiled archival records of the number of publications and conference presentations produced by the teams, to assess team performance.

In our Time 2 survey, we used a roster approach to measure interpersonal perceptions and relationships. Such roster-based approaches to data collection are prevalent in interpersonal perceptions and social networks research (Kenny, 1994; Wasserman & Faust, 1994). Because roster-based surveys are exceedingly time consuming, researchers routinely use single-item measures of friendship, advice, and interpersonal perceptions (e.g., Bunderson, 2003; Cohen & Zhou, 1991; Klein, Lim, Saltz, & Mayer, 2004; Labianca, Brass, & Gray, 1998; Schulte, Cohen, & Klein, 2012; Sparrowe, Liden, Wayne, & Kraimer, 2001)—an approach we similarly took in measuring task contributions, social affinity, and deference. However, to assuage concerns about the reliability of the single-item measures used in our field sample, we compared these items to multi-item scales using a separate online sample (n = 178). Specifically, we asked a separate online sample of survey respondents to think of someone with whom they had worked on a group-based task in the workplace and respond to items (listed below) about deference, social affinity, and perceptions of task-based contributions.

Measures

Demographic attributes. We examine two specific cues (i.e., education and tenure) and two diffuse cues (i.e., gender and ethnicity) that have featured prominently in prior theory and research on status and deference in teams (Barton & Bunderson, 2014; Berger et al., 1977; Berger et al., 1980; Bunderson, 2003; Ridgeway, 1991). Team members responded to questions about their demographic attributes at Time 1. Team members provided their highest *education level* according to six ordered categories—high school degree (1), two-year college (2), undergraduate (3), master's (4), doctorate (5), or post-doctorate (6). Team members provided their *team tenure* by indicating how many years and months they had worked in their lab, which we combined into a single metric of team tenure in years. Team members also provided their *gender* ("0" = female, "1" = male) and *ethnicity*, which, given our hypotheses and in line with prior research on the relationship between demographics and status in technical teams (e.g., Bunderson, 2003), we coded as "0" = non-White and "1" = White.[2]

Perceptions of task contributions. At Time 1, we measured dyadic perceptions of task contributions using an item based on Bunderson (2003) and Cohen and Zhou (1991): "This person makes valuable work-related contributions to the lab." Respondents rated each other team member using a five-point scale ranging from "1" (*strongly disagree*) to "5" (*strongly agree*). As described above, we validated this item with an online sample, administering it alongside a three-item measure of overall perceptions of task contributions of co-workers. Items included "This person delivers high-quality work outputs," "This person is a high performer," and "This person adds real value at work." The single-item measure was strongly, positively related to the three-item scale score (r = 0.74, $p < 0.001$).

Social affinity. At Time 1, we measured the social affinity tie between two individuals using an item adapted from Klein et al. (2004): "I spend time socially with this person outside the lab/office." Respondents indicated their social affinity with each other member of the team using a scale ranging from "1" (*never*) to "5" (*very often*). We used the online sample described above to validate this item. The single item was strongly and positively related to the scale score from a three-item measure of overall social affinity with co-workers (r = 0.75, $p < 0.001$). Items included were "This person is a friend of mine," "I feel interpersonally connected to this person," and "I like this person."

Deference. Deference has been measured in multiple ways in field and experimental settings. For example, in a field setting, Fragale et al. (2012) measured deference using archival electronic communications, qualitatively coding language for tone (e.g., polite or unassertive) and the use of disclaimers and hedges in the text. In lab-based research,

[2] Including the full breakdown of ethnic categories in our analyses does not change the results that we report below, nor does including all categories reveal other significant patterns of effects.

deference has been operationalized as changes in one's initial choice or decision based on another team member's choice or decision while completing an artificial task (e.g., Anderson et al., 2006). Since we were studying intact field teams, but did not have access to verbal or electronic communications among team members, we used a survey item to measure deference: "I defer to this person's work-related opinions and inputs in the lab." At Time 2, participants provided a response to this item for each of their teammates using a five-point scale, ranging from "1" (*never*) to "5" (*always*). Again, we validated this item using the online sample described above. Items in the online survey included "I respect this person's point of view," "When we disagree, I yield to this person's perspective," and "I go along with this person's recommendations." The single item was strongly and positively related to the scale score from the three-item measure ($r = 0.79$, $p < 0.001$).

Team performance. Consultations with stakeholders of these research labs, and reviews of metrics of productivity for such labs (e.g., Fiore, 2008; Wuchty et al., 2007), indicated that team performance is primarily a function of the extent to which teams publish top peer-reviewed articles and present their work at prominent professional conferences. Accordingly, we measured performance as the quantity of refereed journal articles, books and book chapters, and conference presentations. Given that different fields emphasize different outlets for scholarship, we calculated the sum total of publications across these different outlets. Of the 55 teams that participated in the survey portion of the research, we were able to obtain detailed information through archives and additional contact with the lead investigators from 46 teams (i.e., yielding an 84% response rate at the team level).

Controls. In predicting deference, we controlled for team member formal role ("0" = lab member, "1" = lead investigator), to account for the fact that members may be formally required to defer to the decisions of individuals playing a lead role on a project. Role was assigned using the roster of principal investigators compiled at the initiation of the study. In predicting team performance, we controlled for lab size and the discipline of the lab's principal investigator, compiled at the initiation of the study, as well as measures of central tendency for each of the demographic attributes that we studied.

Analyses

To test our hypotheses, we used Kenny's social relations model (SRM) (Kenny, 1994). The SRM is a conceptual and analytical framework designed for the purpose of studying how people interact with or perceive one another (Kenny, 1994; Kenny, Kashy, & Cook, 2006; Kenny, Mohr, & Levesque, 2001). It is a multilevel model that focuses explicitly on interpersonal, or dyadic, outcomes. Conceptually, there are three levels of analysis in the SRM: the group level, the individual level, and the dyad level (Snijders & Kenny, 1999). Statistically, the SRM decomposes the variance in directed dyadic outcomes—such as individuals' deference to their teammates—into these different levels of analysis, thereby reducing the threat of non-independence among dyadic observations (Kenny, 1994; Kenny et al., 2001). Because the SRM was specifically developed for studying relationships among and perceptions between people in groups, it is a valuable framework for unpacking the drivers of dyadic deference in groups.

At the individual level, there are two types of effects—the actor effect and the partner effect. The actor effect describes how people tend to view or relate to others, in general; it is "the tendency for a person to exhibit a consistent level of response across all interaction partners" (Kenny et al., 2006: 192). For example, some actors may generally tend to defer more to their teammates than do others. The partner effect describes how individuals tend to be viewed or rated by others, in general; that is, "the degree to which multiple partners respond in a similar way to a particular individual" (Kenny et al., 2001: 129). For example, some partners may generally attract more deference from their teammates than do others. At the dyad level, idiosyncratic combinations of actor and partner attributes, such as similarity in demographic attributes, explain "the unique way in which a person behaves with a particular partner" (Kenny et al., 2001: 130). That is, in addition to any residual, dyadic variance is the result of the interaction between an actor and a partner, or the component that remains after extracting group-level, individual-level actor and individual-level partner variance.

Kenny and colleagues initially specified the SRM as an analysis of variance (ANOVA)-based model, which relied upon a two-stage procedure for estimating and then explaining actor, partner, and dyad variance. However, Snijders and Kenny (1999) showed that the SRM can be represented

and estimated as a general multilevel model—also referred to as a hierarchical linear model, random coefficient model, or random effects model (e.g., Gelman & Hill, 2007; Hofmann, 1997; Raudenbush & Bryk, 2002)—which offers several advantages to the initial ANOVA-based formulation. A multilevel modeling approach easily accommodates missing data, different group sizes, and enables researchers to simultaneously estimate and explain group, actor, partner, and dyad variance through the use of random effects for the group, the actor, and the target and fixed effects for any predictor variables. In estimating the SRM using multilevel modeling approach, the random effects for the actor and the partner are allowed to covary to estimate what Kenny (1994) called *generalized reciprocity*, which, in our study, represents the extent to which team members who tend to give deference to others also tend receive deference from others. In addition to generalized reciprocity, the structure of the within-dyad residual provides an estimate of *dyadic reciprocity*, or the extent to which there is reciprocal deference within a given pair of team members (Kenny, 1994). Examining these two different types of reciprocity provides insight into the nature of the three interpersonal processes that we examined in our study.

RESULTS

Table 1 provides descriptive statistics for and intercorrelations among study variables. Because these correlations are based on non-independent observations at the dyad level, we report only the magnitude of correlations, not levels of statistical significance. In line with our expectations, there were positive correlations between deference and partner education ($r = 0.28$) and partner tenure ($r = 0.17$). Further, partners were slightly more likely to receive deference when male ($r = 0.10$) and, to a much lesser extent, White ($r = 0.02$). In accordance with our expectations of interpersonal mechanisms as mediators of deference, both perceptions of task contributions ($r = 0.60$) and social affinity ($r = 0.22$) were positively related to deference.

Variance Decomposition and Reciprocity of Interpersonal Processes

Prior to testing our hypotheses, we first used null models to decompose the variance in perceptions of task contributions, social affinity, and deference into team, actor, partner, and dyad components. Table 2 presents the results of this variance decomposition. The dyad-level component, which is a combination of systematic dyadic variation and residual, was sizeable for deference (37%), perceptions of task contributions (41%), and social affinity (44%). In line with prior research, individual-level dynamics also contributed to variance in deference (actor = 38%, partner = 18%), perceptions of task contributions (actor = 36%, partner = 22%), and social affinity (actor = 31%, partner = 10%).

Table 2 also provides results regarding the degree of reciprocity—that is, asymmetry or symmetry—in each of the three interpersonal processes that we studied. Consistent with our expectations and with status characteristics theory, results showed deference to be an asymmetric phenomenon at the indi-

TABLE 1
Descriptive Statistics and Intercorrelations Among Study Variables

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11	12
1. Actor role	0.14	0.35												
2. Actor education	4.20	1.40	0.13											
3. Actor tenure	2.21	2.00	0.09	0.21										
4. Actor gender—male	0.68	0.47	−0.02	0.18	0.04									
5. Actor ethnicity—White	0.50	0.50	0.04	−0.18	0.06	−0.09								
6. Partner role	0.14	0.35	−0.02	0.00	0.02	0.00	0.02							
7. Partner education	4.20	1.40	0.00	0.28	0.11	0.11	−0.11	0.13						
8. Partner tenure	2.21	2.00	0.02	0.11	0.10	−0.01	0.00	0.09	0.21					
9. Partner gender—male	0.68	0.47	0.00	0.11	−0.01	0.12	−0.12	−0.02	0.18	0.04				
10. Partner ethnicity—White	0.50	0.50	0.02	−0.11	0.00	−0.12	0.11	0.04	−0.18	0.06	−0.09			
11. Task contributions	3.90	0.91	0.04	−0.07	−0.06	0.01	0.04	0.09	0.21	0.12	0.07	0.03		
12. Social affinity	2.13	1.14	0.00	0.27	0.11	0.03	−0.16	0.07	0.20	0.11	0.05	−0.07	0.19	
13. Deference	3.41	1.02	−0.05	−0.04	−0.06	0.02	0.01	0.10	0.28	0.17	0.10	0.02	0.60	0.22

Note: $n = 55$ labs, 619 individuals, 9430 directed dyadic ratings.

TABLE 2
Social Relations Model Variance Decomposition Results

	Deference			Perceptions of Task Contributions			Social Affinity		
	B	*SE*	%	B	*SE*	%	B	*SE*	%
Team	0.08	0.04	6.88	0.01	0.02	1.75	0.20	0.08	14.82
Actor	0.41	0.04	37.73	0.31	0.03	36.08	0.43	0.04	31.22
Partner	0.20	0.02	18.12	0.19	0.02	21.61	0.13	0.02	9.70
Dyad	0.37	0.01	37.26	0.30	0.01	40.56	0.26	0.01	44.26
Generalized reciprocity	−0.06	0.02	−0.23	−0.05	0.02	−0.20	0.09	0.02	0.39
Dyadic reciprocity	0.04	0.01	0.10	0.05	0.01	0.14	0.34	0.02	0.56

Note: $n = 55$ labs, 619 individuals, 9430 directed dyadic ratings. B = unstandardized coefficient from SRM. % = variance component; entries in this column for reciprocity are the reciprocity correlations.

vidual level—the generalized reciprocity correlation for deference was negative ($r = -0.23$), indicating that people on a team who receive deference from their colleagues tend not to defer to others, and vice versa. Similarly, we observed negative generalized reciprocity for perceptions of task contributions ($r = -0.20$), indicating that those who view their colleagues as making valuable contributions tend not to be viewed by their colleagues as high contributors. In contrast to these asymmetric individual-level effects, we observed positive generalized reciprocity for social affinity ($r = 0.39$), which is consistent with prior theory and research (e.g., Kenny & La Voie, 1982; Newcomb, 1961).

While the generalized reciprocity correlations for perceptions of task contributions and deference were negative, the *dyadic* reciprocity correlations for these processes (and for social affinity) were positive. Thus, if an actor views a given partner as a high task contributor, that partner is more likely to view the actor as a high contributor ($r = 0.14$). And, within a given dyad, if an actor confers deference on a specific partner, he/she is more likely to receive deference from that partner ($r = 0.10$). As expected, given prior research (e.g., Kenny & La Voie, 1982), dyadic reciprocity for social affinity was far stronger ($r = 0.56$) than either deference or task contributions. These results regarding reciprocity show the complexity of dyadic deference in work teams, with potentially different dynamics at the individual and dyad levels of analysis.

Results of Analyses Testing a Dual Pathway Model to Dyadic Deference

Our conceptual model, depicted in Figure 1, posits that the interplay of an actor's and a partner's demographics influences deference through perceptions of task contributions and social affinity. To test these hypotheses, we followed a three-step process. First, we examined how demographic attributes influence deference directly. Second, we examined how these demographic attributes influence perceptions of task contributions and social affinity, respectively. Third, we examined the indirect effects of demographic attributes on deference through task contributions and social affinity.

Before reporting the results testing how demographic attributes influence deference through task contributions and social affinity, we first describe the direct relationships between demographics and deference. Table 3 presents the results of social relations analyses used to examine the influence of demographic attributes on dyadic deference. As can be seen in Model 2 of Table 3, there were significant actor and partner effects for education and tenure, but not for gender or ethnicity. Actor education was negatively related to deference ($B = -0.09$, $p < 0.01$), indicating that highly educated actors are less likely, on average, to defer to others in the team. In contrast, partner education ($B = 0.22$, $p < 0.001$) and partner tenure ($B = 0.06$, $p < 0.001$) were positively related to deference, indicating that partners high in education and tenure were likely to receive deference from other team members. There were significant dyad-level interactions for three of the four demographic attributes that we examined—education ($B = 0.02$, $p < 0.05$), gender ($B = 0.26$, $p < 0.001$), and ethnicity ($B = 0.19$, $p < 0.001$). Below, we describe the pattern of these interactions, through the pathways of task contributions and social affinity, in testing our formal hypotheses. Table 4 presents the results of social relations analyses used to examine the relation-

TABLE 3
Social Relations Analysis Predicting Deference

	Model 1		Model 2		Model 3		Model 4		Model 5	
	B	***SE***	**B**	***SE***	**B**	***SE***	**B**	***SE***	**B**	***SE***
Intercept	3.47	0.06***	3.38	0.10***	3.42	0.09***	3.35	0.09***	3.40	0.09***
Actor role			−0.19	0.10+	−0.19	0.10+	−0.18	0.10+	−0.18	0.10+
Actor education			−0.09	0.03**	−0.06	0.03*	−0.09	0.03**	−0.07	0.03*
Actor tenure			−0.02	0.02	−0.01	0.02	−0.02	0.02	−0.01	0.02
Actor gender—male			−0.12	0.09	−0.04	0.09	−0.08	0.09	−0.02	0.09
Actor ethnicity—White			−0.02	0.08	0.00	0.08	0.02	0.08	0.02	0.08
Partner role			0.11	0.06+	0.05	0.04	0.07	0.05	0.04	0.04
Partner education			0.22	0.02***	0.08	0.01***	0.20	0.02***	0.09	0.01***
Partner tenure			0.06	0.01***	0.03	0.01***	0.05	0.01***	0.03	0.01***
Partner gender—male			−0.04	0.06	−0.05	0.04	−0.02	0.06	−0.04	0.04
Partner ethnicity—White			0.02	0.05	0.00	0.04	0.08	0.05	0.03	0.04
Actor education × Partner education			0.02	0.01*	0.01	0.01	0.01	0.01	0.00	0.01
Actor tenure × Partner tenure			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Actor male × Partner male			0.26	0.06***	0.15	0.05**	0.21	0.06***	0.13	0.05**
Actor White × Partner White			0.19	0.05***	0.12	0.04**	0.13	0.05*	0.10	0.04*
Partner task contributions					0.82	0.04***			0.73	0.04***
Dyad task contributions					0.53	0.02***			0.49	0.02***
Partner affinity							0.52	0.07***	0.16	0.05**
Dyad affinity							0.13	0.02***	0.06	0.01***
Team	0.08	0.04	0.07	0.04	0.06	0.03	0.06	0.03	0.06	0.03
Actor	0.41	0.04	0.41	0.04	0.40	0.04	0.42	0.04	0.40	0.04
Partner	0.20	0.02	0.10	0.01	0.02	0.00	0.07	0.01	0.02	0.00
Dyad	0.37	0.01	0.36	0.01	0.28	0.01	0.35	0.01	0.28	0.01
Generalized reciprocity	−0.06	0.02	−0.03	0.02	−0.02	0.01	−0.03	0.01	−0.02	0.01
Dyadic reciprocity	0.04	0.01	0.04	0.01	0.02	0.01	0.03	0.01	0.02	0.01
LL	7983.70		7767.50		6712.20		7384.20		6540.90	
AIC	7995.70		7779.50		6724.20		7396.20		6552.90	

Note: n = 55 labs, 619 individuals, 9430 directed dyadic ratings. B = unstandardized coefficient from SRM; *SE* = standard error of parameter estimate.

***, $p < 0.001$
**, $p < 0.01$
*, $p < 0.05$
+, $p < 0.10$

ships between these interactive effects of actor and partner demographic attributes and each of the hypothesized mediators.

The task contributions pathway. In our first hypothesis, we proposed that an actor's perceptions of a partner's task contributions would be one pathway through which demographic attributes lead to deference. Specifically, we posited that, through perceptions of task contributions, low-status actors would defer to high-status partners (Hypothesis 1a) and that the members of high-status dyads would defer to each other (Hypothesis 1b). To test this hypothesis, we examined the interactive effects of actor and partner demographic attributes on perceptions of task contributions. The results of this analysis, which are presented in Model 2 of Table 4, largely mirrored the results reported above for deference. Actor education was negatively (B = −0.10, $p < 0.001$) and partner education was positively (B = 0.18, $p < 0.001$) related to perceptions of task contributions; and, similarly, actor tenure was negatively (B = −0.03, $p < 0.10$) and partner tenure was positively (B = 0.03, $p < 0.05$) related to perceptions of task contributions. These results for education and tenure are in line with our predictions grounded in status characteristics theory. There were no significant individual-level actor or partner effects for gender or ethnicity.

Model 2 of Table 4 shows, however, that there are relevant dyad-level dynamics that influence perceptions of task contributions, which is consistent with Hypothesis 1. Actor education interacted with partner education (B = 0.01, $p < 0.05$); actor gender interacted with partner gender (B = 0.16, $p < 0.01$);

TABLE 4
Social Relations Analysis Examining Dual Pathways to Deference

	Perceptions of Task Contributions				Social Affinity			
	M1		M2		M3		M4	
	B	*SE*	B	*SE*	B	*SE*	B	*SE*
Intercept	3.96	0.04***	3.87	0.08***	2.32	0.08***	2.56	0.12***
Actor role			0.11	0.09			−0.12	0.10
Actor education			−0.10	0.03***			0.17	0.03***
Actor tenure			−0.03	0.02+			0.03	0.02
Actor gender—male			−0.11	0.08			−0.29	0.10**
Actor ethnicity—White			−0.02	0.07			−0.48	0.09***
Partner role			0.09	0.06			0.15	0.07*
Partner education			0.18	0.02***			0.09	0.02***
Partner tenure			0.03	0.01**			0.02	0.01
Partner gender—male			−0.02	0.06			−0.22	0.08**
Partner ethnicity—White			0.05	0.05			−0.22	0.06***
Actor education × Partner education			0.01	0.01*			0.08	0.01***
Actor tenure × Partner tenure			0.00	0.00			0.01	0.00**
Actor male × Partner male			0.16	0.06**			0.39	0.08***
Actor White × Partner White			0.09	0.05+			0.42	0.07***
Team	0.01	0.02	0.02	0.02	0.20	0.08	0.08	0.05
Actor	0.31	0.03	0.31	0.03	0.43	0.04	0.40	0.04
Partner	0.19	0.02	0.12	0.01	0.13	0.02	0.14	0.02
Dyad	0.30	0.01	0.30	0.01	0.26	0.01	0.27	0.01
Generalized reciprocity	−0.05	0.02	−0.03	0.01	0.09	0.02	0.10	0.02
Dyadic reciprocity	0.05	0.01	0.05	0.01	0.34	0.02	0.30	0.02
LL	7414.30		7282.70		8771.90		8574.40	
AIC	7426.30		7294.70		8783.90		8586.40	

Note: n = 55 labs, 619 individuals, 9430 directed dyadic ratings. B = unstandardized coefficient from SRM; *SE* = standard error of parameter estimate.

***, $p < 0.001$
**, $p < 0.01$
*, $p < 0.05$
+, $p < 0.10$

and actor ethnicity interacted with partner ethnicity (B = 0.09, $p < 0.10$). To understand the patterns of these interactions, we examined simple effects (Aiken & West, 1991). With respect to education, results showed a pattern of effects consistent with both Hypothesis 1a and Hypothesis 1b. There were large simple intercept differences, showing that team members who were less educated (B = 4.0, *SE* = 0.09) deferred more, in general, than highly educated team members (B = 3.72, *SE* = 0.09). However, the relationship between partner education and perceptions of task contributions was stronger for highly educated actors (B = 0.20, *SE* = 0.02, $p < 0.001$) than less educated actors (B = 0.16, *SE* = 0.02, $p < 0.001$). The larger slope for highly educated partners indicates that there was lateral deference among highly educated team members. That is, although the dominant pattern of deference was such that less educated actors deferred to highly educated partners, asymmetry in deference was tempered among highly educated team members, who tended to defer to one another. With respect to gender and ethnicity, results were in line with Hypothesis 1b, but not Hypothesis 1a. With no significant main effects of actor or partner gender or ethnicity, the simple intercept for men (B = 3.76, *SE* = 0.07) was roughly the same as that for women (B = 3.86, *SE* = 0.08), as was the simple intercept for Whites (B = 3.85, *SE* = 0.08) and non-Whites (B = 3.86, *SE* = 0.08). Women did not defer more, in general, than men; and non-Whites did not defer more, in general, than Whites. However, simple slopes analysis revealed that the relationship between partner gender (female = "0", male = "1") and perceptions of task contributions was positive for men (B = 0.14, *SE* = 0.05, $p < 0.01$), but not significant for women (B = −0.02, *SE* = 0.06, *ns*). And, similarly, the relationship

between partner ethnicity (non-White = 0, White = 1) and perceptions of task contributions was positive among Whites (B = 0.15, *SE* = 0.05, $p < 0.01$), but non-significant for non-Whites (B = 0.05, *SE* = 0.05, *ns*).[3] These results indicate that the members of high-status groups (i.e., male, White) favor the task contributions of fellow high-status team members, relative to that of low-status team members. Low status team members, on the other hand, are not influenced by gender or ethnicity when perceiving task contributions. These interaction patterns do not support Hypothesis 1a—there is no evidence of women and non-Whites viewing the contributions of men and Whites more favorably—but they do support Hypothesis 1b.

To determine whether perceptions of task contributions partially mediates the relationship between demographics and deference, we added the perceptions of task contributions variable, at both the individual and dyad levels, to our SRM predicting deference. The results of this analysis are presented in Model 3 of Table 3. In line with Hypothesis 1, the dyad-level relationship between perceptions of task contributions and deference was positive and significant (B = 0.53, $p < 0.001$), indicating that actors defer to those partners seen as high contributors. To provide a direct test of Hypothesis 1a and 1b, we calculated the conditional indirect effects of partner education on deference, through perceptions of task contributions, for highly educated (i.e., +1 *SD*) and less educated (i.e., −1 *SD*) actors, as well as for male versus female and White versus non-White actors. To do so, we used the bootstrapping approach outlined by Preacher, Rucker, and Hayes (2007), which we modified to draw 5,000 bootstrap samples for entire teams, rather than for individuals or dyads. Table 5 presents the results of these analyses. The indirect effect of partner education on deference, through perceptions of task contributions, was more positive for highly educated actors (B = 0.10, $p < 0.01$) than less educated actors (B = 0.08, $p < 0.01$). Similarly, the conditional indirect effect of partner gender on deference was positive for men (B = 0.07, $p < 0.01$), but not significant for women (B = −0.00, *ns*); and the conditional indirect effect of partner ethnicity on deference was positive for Whites (B = 0.08, $p < 0.05$), but not significant for non-Whites (B = 0.02, *ns*).

To summarize our findings regarding the task contributions pathway, our findings support Hypothesis 1a for education and Hypothesis 1b for education, gender, and ethnicity. Low-status (i.e., less educated) actors deferred to high-status partners; high-status (i.e., highly educated, male, White) actors deferred to other high-status partners through perceived task contributions. Importantly, because of the significant and sizeable individual-level actor and partner effects for education and tenure, our results do not suggest that high-status team members defer to other high-status team members *more* than do low-status team members. Rather, the dyadic effects that we observe temper, or moderate, the purely asymmetric individual-level effects shown in prior research on deference.

The social affinity pathway. In our second hypothesis, we proposed that social affinity is an additional mechanism that transmits the effects of demographics to deference. Specifically, in Hypothesis 2, we predicted that actor and partner demographic attributes would interact to predict deference through an actor's social affinity with a partner, such that actors defer to partners who share similar demographic attributes (Hypothesis 2a), and that the effects of demographic similarity through social affinity are stronger among high-status dyads (Hypothesis 2b). Model 4 of Table 4 presents the results of social relations analyses testing the relationships between demographic attributes and social affinity. Each of the posited interactions between actor and partner demographic attributes was significant—education (B = 0.08, $p < 0.001$), tenure (B = 0.01, $p < 0.01$), gender (B = 0.39, $p < 0.001$), and ethnicity (B = 0.42, $p < 0.001$). As above, we examined simple effects to probe the pattern of these interactions and determine whether they conformed to what we predicted in Hypothesis 2. For education, we found results consistent with homophily in support of Hypothesis 2a; the relationship between partner education and social affinity was positive for highly educated actors (B = 0.20, *SE* = 0.03, $p < 0.001$), but negative for less educated actors (B = −0.04, *SE* = 0.02, $p < 0.10$). Further, in support of Hypothesis 2b, the effect was far stronger—the slope was roughly five times larger—among highly educated actors than less educated actors. This in-

[3] We examined these simple effects for each of the specific racial and ethnic categories (i.e., African American, Asian American, Hispanic American, Native American) to test whether ethnic similarity among non-White Americans predicted perceived task contributions. The overall pattern in the results remains non-significant for each of these four other ethnic groups. To conserve space, we report the overall finding for non-Whites.

TABLE 5
Results of Conditional Indirect Effects Analyses Predicting Deference

	Conditional Indirect Effects Through Task Contributions				Conditional indirect Effects Through Social Affinity			
	Actor Low on Attribute		Actor High on Attribute		Actor Low on Attribute		Actor High on Attribute	
	B	*SE*	B	*SE*	B	*SE*	B	*SE*
Partner education	0.08	0.01**	0.10	0.01**	−0.00	0.00	0.01	0.00**
Partner tenure	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
Partner gender—male	−0.00	0.01	0.07	0.01**	−0.02	0.01*	0.02	0.01**
Partner ethnicity—White	0.02	0.01	0.08	0.03*	−0.01	0.01**	0.02	0.00**

Note: n = 55 labs, 619 individuals, 9430 directed dyadic ratings. B = unstandardized coefficient from multilevel model; *SE* = bootstrapped standard error. Actor Low on Attribute = −1 *SD* for education and tenure, 0 for male and White. Actor High on Attribute = + 1 *SD* for education and tenure, 1 for male and White.

**, $p < 0.01$

*, $p < 0.05$

dicates that, while less educated team members tend to feel social affinity with other less educated team members and highly educated team members tend to feel social affinity with other highly educated team members, the tendency towards homophily is especially strong among highly educated members. With respect to tenure, we found support for Hypothesis 2b, but not Hypothesis 2a. Simple slopes analyses showed homophily only for high tenure actors (B = 0.03, *SE* = 0.01, $p < 0.05$); the relationship between tenure and social affinity was non-significant for low tenure actors (B = 0.01, *SE* = 0.01, *ns*). With respect to gender and ethnicity, we found support for Hypothesis 2a, but not Hypothesis 2b. The relationship between partner gender (which was coded female = "0," male = "1") and social affinity was positive for male actors (B = 0.20, *SE* = 0.06, $p < 0.01$) and negative for female actors (B = −0.21, *SE* = 0.07, $p < 0.01$), but of roughly equal magnitude. This indicates that men formed stronger social bonds with other men, while women formed stronger social bonds with other women; however, the tendency towards homophily was not stronger among men than women. Similarly, the relationship between partner ethnicity (which was coded non-White = "0," White = "1") and social affinity was positive for White actors (B = 0.22, *SE* = 0.06, $p < 0.01$) and negative for non-White actors (B = −0.22, *SE* = 0.06, $p < 0.01$). Again, the opposite-sign slopes were of equal magnitude, in contrast to our prediction in Hypothesis 2b. A similar pattern was observed when we treated each of the other four racial and ethnic categories as the focal ethnic group.

To test whether social affinity is a mechanism that partially mediates the effects of demographic attributes on deference, we added the social affinity variable, at both the individual and dyad levels, to our SRM predicting deference. As shown in Model 4 of Table 3, dyad-level social affinity was positively related to deference (B = 0.13, $p < 0.001$). To directly test Hypothesis 2, we used the same approach described used for the task contributions pathway, examining the conditional indirect effects of partner demographics on deference, through social affinity, for actors high and low in education and tenure, for male versus female actors, and for White versus non-White actors. As shown in Table 5, the indirect effect of partner education on deference through social affinity was positive for highly educated actors (B = 0.01, $p < 0.01$), but negative for less educated actors (B = −0.00, *ns*). Unexpectedly, the conditional indirect effects for tenure, through social affinity, were not significant. However, as predicted, the indirect effect of partner gender on deference through social affinity was positive for men (B = 0.02, $p < 0.01$), but negative for women (B = −0.02, $p < 0.05$). Similarly, the indirect effect of partner ethnicity on deference through social affinity was positive for White actors (B = 0.02, $p < 0.01$), but negative for non-White actors (B = −0.01, $p < 0.01$). In sum, the effects of gender-, ethnicity-, and educational-level similarity on deference are partially mediated by social affinity.

Summarizing our findings regarding the social affinity pathway, the results provide support for Hypothesis 2a but limited support for Hypothe-

sis 2b. Actors tend to defer to partners through social affinity in a symmetric way, yielding to the opinions and perspectives of those with whom they share common demographic attributes regardless of whether they belong to high-status or low-status dyads. Although, among non-White and female actors, similarity to partners did not predict deference through perceived task contributions, gender and ethnic similarity did predict deference through social affinity. Importantly, as shown in Model 5 of Table 3, the social affinity pathway predicts unique variance in deference above and beyond the more well-studied pathway of perceived task contributions. Both pathways help to explain who defers to whom in teams.

Pathways to Deference and Team Performance

We proposed in Hypotheses 3 and 4 that the extent to which dyadic deference is influenced by perceptions of task contributions and social affinity, respectively, shapes team performance. Specifically, we proposed in Hypothesis 3 that the degree to which deference is based on perceptions of task contributions enhances performance. In Hypothesis 4, we proposed that the degree to which deference is based on social affinity detracts from team performance. To test these hypotheses, we ran models allowing the relationships between task contributions and social affinity, respectively, and deference to vary across teams. Then, we extracted the Bayes estimators from these models for the effects of task contributions and social affinity. Extracting Bayes estimators and using them in subsequent models is one approach used to examine bottom-up effects in teams (e.g., Chen, 2005; Knight, in press). The Bayes estimators provide a measure, for each team, of the relationship between each of these predictors and deference. Conceptually, the Bayes estimators are akin to a correlation coefficient for the relationship *within each team* between task contributions and affinity, respectively, and deference.

Table 6 presents descriptive statistics for and intercorrelations among the team-level variables that we examined in our study. A number of interesting correlations warrant mention. First, as expected, task-based deference was positively (r = 0.22) and affinity-based deference was negatively ($r = -0.41$) associated with team performance. Second, average education was positively associated with task-based deference ($r = 0.24$) and negatively associated with affinity-based deference ($r = -0.44$). Third, task-based deference and affinity-based deference were negatively related to each other ($r = -0.18$).

We tested the relationship between the sources of deference and team performance using a quasi-Poisson regression model. Poisson regression is an appropriate analytical approach for understanding the relationship between predictor variables and a count-based criterion variable, such as our measure of the sum total of teams' journal articles, books and book chapters, and conference presentations. However, a key assumption underlying Poisson regression—and one that is often not met—is that the variance of the dependent variable is equal to its mean. When this is not the case, there is overdispersion and standard errors estimated by the Poisson model are biased downward. We tested for

TABLE 6
Correlations Among Team-Level Study Variables

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11
1. Lab size	7.87	5.08											
2. Discipline—engineering	0.57	0.50	−0.05										
3. Discipline—science	0.17	0.38	0.15	−0.52									
4. Discipline—psychology	0.17	0.38	−0.17	−0.52	−0.21								
5. Discipline—other	0.09	0.28	0.12	−0.35	−0.14	−0.14							
6. Average education	4.47	0.73	−0.27	0.23	0.14	−0.34	−0.13						
7. Average tenure	2.45	1.32	−0.10	−0.20	0.03	0.29	−0.07	0.31					
8. Percent male	0.61	0.24	0.12	0.45	0.02	−0.41	−0.26	0.09	−0.14				
9. Percent White	0.48	0.28	−0.01	−0.50	0.08	0.41	0.23	−0.30	0.09	−0.33			
10. Task-based deference	1.11	0.14	−0.06	0.26	0.00	−0.21	−0.19	0.24	0.03	0.05	0.02		
11. Affinity-based deference	0.83	0.12	0.03	−0.02	−0.17	0.17	0.03	−0.44	−0.21	0.08	0.14	−0.18	
12. Lab performance	19.02	17.82	0.33	−0.06	0.06	−0.01	0.04	0.09	0.13	0.03	−0.03	0.22	−0.41

Note: n = 46 labs.
For correlations $\geq |0.25|$, $p < 0.10$; for correlations $\geq |0.29|$, $p < 0.05$, two-tailed.

overdispersion in our data by comparing the fit of a negative binomial model to the fit of a Poisson model (Long, 1997), and found that, indeed, the variance of the dependent variable was significantly greater than the mean. Accordingly, we used a quasi-Poisson model, which incorporates an overdispersion parameter and appropriately estimates standard errors for a count-based criterion with overdispersion (Wedderburn, 1974). Due to our relatively simple, directional hypotheses, and our relatively small team-level sample size, we used one-tailed tests of statistical significance in evaluating our hypotheses.

Table 7 presents the results of these analyses. To estimate the effects of task-based deference and affinity-based deference on team performance, we first controlled for team-level aggregates of the demographic attributes we studied and two other variables—the number of people working in the lab and the principal investigator's primary field—that may influence a team's publication frequency (Model 1). Adding task-based deference to this initial model (Model 2) increased the pseudo R^2 from 0.13 to 0.25. In support of Hypothesis 3, the results indicated that task-based deference was positively related to team performance (B = 2.05, $p < 0.05$). The more positive the relationship between perceptions of task contributions and deference in a team, the higher the team's performance. Standardizing and exponentiating the coefficient for task-based deference indicated that a one standard deviation increase in task-based deference increased publication rate by a factor of 1.34. In contrast, as shown in Model 3, affinity-based deference was negatively related to team performance (B = −2.26, $p < 0.05$); affinity-based deference increased the pseudo R^2 from the control model to 0.26. In support of Hypothesis 4, the more positive the relationship between social affinity and deference in a team, the lower the team's performance. Again, standardizing and exponentiating the coefficient for affinity-based deference showed that a one standard deviation increase in affinity-based deference decreased publication rate by a factor of 0.76. Model 4 reports the results of a model including both task-based and affinity-based deference. As shown in Model 4, the direction of the coefficients remained the same, although the magnitude of the coefficients decreased slightly. With both variables in the model, the pseudo R^2 increased to 0.32, indicating that each type of deference helps to understand team performance.

DISCUSSION

The most challenging social and scientific problems of our time, ranging from developing environmentally sustainable electricity grids to mapping

TABLE 7
Sources of Deference and Team Performance

	Model 1		Model 2		Model 3		Model 4	
	B	***SE***	**B**	***SE***	**B**	***SE***	**B**	***SE***
Intercept	0.68	1.25	−1.39	1.86	3.79	2.04	1.74	2.44
Lab size (no. of people)	0.07	0.03*	0.07	0.03*	0.05	0.03*	0.05	0.03*
Lab discipline—psychology	0.41	0.58	0.72	0.59	0.35	0.54	0.47	0.57
Lab discipline—sciences	0.03	0.38	0.18	0.38	−0.10	0.37	0.61	0.56
Lab discipline—other	0.28	0.58	0.58	0.60	0.24	0.55	0.04	0.38
Average lab education	0.32	0.26	0.25	0.26	0.06	0.28	0.02	0.28
Average lab tenure	0.05	0.12	0.06	0.12	0.04	0.11	0.04	0.11
Percent lab male	0.12	0.72	0.30	0.70	0.24	0.69	0.39	0.68
Percent lab White	−0.14	0.63	−0.46	0.63	−0.06	0.61	−0.33	0.62
Task-based deference			2.05	1.11*			1.69	1.07+
Social affinity-based deference					−2.26	1.09*	−1.96	1.09*
Dispersion parameter	16.30		15.70		14.73		14.47	
Deviance	589.66		534.86		523.73		486.71	
Degrees of freedom	37		36		36		35	
Pseudo R^2	0.17		0.25		0.26		0.32	

Note: $n = 46$ labs. B = unstandardized coefficients from quasi-Poisson regression analysis; *SE* = standard error of parameter estimate. Reference category for lab discipline is engineering.

*, $p < 0.05$

+, $p < 0.10$, one-tailed

the human genome, are increasingly being addressed by teams that bring together people with diverse expertise and knowledge (Fiore, 2008; Paruchuri, 2010; Wuchty et al., 2007). Such teams offer the potential to generate new insights and develop important innovations by combining team members' unique knowledge; however, such teams also face difficult coordination challenges (Cummings et al., 2013; Kotha et al., 2013). We identify a key coordinating process—the dyadic exchange of deference—that is essential for developing mutual knowledge in teams that rely on individuals with diverse expertise. It is generally assumed that deference flows from individuals whose demographics convey low status to individuals whose demographics reflect high status, and that this can be explained based on low-status team members' perceptions of high-status team members' task competence. The theoretical model and empirical findings offered in this paper challenge this account of deference in several ways. Where prior theory and research have emphasized asymmetry in deference, we propose that asymmetry is tempered by lateral deference and supplemented by an additional, symmetric interpersonal process. Where prior theory and research have emphasized beliefs about task competence as the lone mediating mechanism that connects demographic attributes to deference, we propose an additional mediating mechanism—social affinity—that links demographics to deference. Accounting for nuanced multilevel dynamics is critical for understanding why deference sometimes helps and sometimes hinders team performance.

Multiple Paths to Deference: Asymmetric and Symmetric Demographic Effects

The dominant narrative in existing theory and research on deference is that deference is an asymmetric process—those who receive deference are unlikely to give it to others (Bunderson & Barton, 2010). This depiction of deference is predicated largely on the presumption that an expertise advantage lies at the heart of why one person defers to another (Berger et al., 1972). By examining the multilevel factors that shape deference, and the multiple paths through which demographics can influence deference, a noteworthy contribution of this study is that we identified distinct patterns of deference at different levels and through different mechanisms.

At the individual level of analysis, we found that deference is largely an asymmetric interpersonal process—as depicted by existing theory and research. As evidenced by the negative generalized reciprocity correlations for deference and perceived task contributions, team members who are viewed as high contributors and receive deference tend to view their teammates' contributions less positively and, hence, defer less to others. While we observed strong individual-level effects of some demographic attributes, which explained these dynamics, other demographic attributes did not significantly shape deference at the individual level. Specifically, commensurate with past research, both education and tenure predicted asymmetric deference at the individual level, which suggests that these specific cues function as powerful signals of competence in multidisciplinary research teams. Highly tenured and educated team members were more likely to receive deference and less likely to defer to other team members. However, contrary to past status-based views of demographic effects in teams, gender and ethnicity did not function as powerful status cues and did not directly predict deference at the individual level of analysis. Thus, although past research has viewed gender and ethnicity as diffuse status cues (Berger et al., 1972; Cohen & Zhou, 1991), White or male partners in our study did not receive more deference than non-White or female partners, controlling for both education and tenure. These findings suggest that demographic attributes that are directly relevant to the task, such as education and tenure, are a more salient and reliable basis for asymmetric deference due to expectations about task competence in naturally occurring work teams (Bunderson, 2003). And, yet, as we discuss below, these surface-level, categorical demographic attributes may operate as powerful triggers of self-categorization processes, indirectly leading to deference through a social affinity pathway.

At the dyad level of analysis, we found that asymmetry in deference is tempered in a few ways. As shown by the positive dyadic reciprocity correlation for deference, we found a slight tendency towards mutual dyadic deference (after accounting for individual-level effects). This suggests that there are dyadic factors that influence deference, above and beyond the stable individual-level cues emphasized by prior theory and research. We proposed and found support for the idea that demographic attributes have dual effects on deference at the dyad level through two different interpersonal processes—perceptions of task contributions and social affinity.

First, with respect to the task contributions pathway, we proposed and found nuanced dyadic effects of education, gender, and ethnicity on deference through perceived task contributions, above and beyond the individual-level effects examined in prior research. Specifically, we found that, in addition to receiving deference from less educated team members, highly educated team members receive deference from other highly educated team members. In fact, partner educational status was a stronger predictor of deference among highly educated actors than among less educated actors. We found similar patterns of effects for gender and ethnicity, with members of high-status groups deferring to one another, qualifying the purely asymmetric depiction of deference in existing theory. Our findings are generally in line with research suggesting that high-status actors may engage in lateral deference with partners of a similar status in order to protect their own status and to avoid status threats from other high-status team members (Anderson & Brown, 2010; Fragale et al., 2012). Accounting for such lateral deference enriches conceptualizations of how deference flows among team members.

Second, with respect to the social affinity pathway, we proposed and found dyadic effects of demographics on deference that aligned with our predictions of symmetric deference grounded in self-categorization processes. Actors reported greater social affinity with partners who shared similar educational level, gender, and ethnicity. And, these feelings of social affinity contributed to deference—above and beyond perceived task contributions. Education level, gender, and race and ethnicity are all attributes that may be a basis for in-group affiliation, manifesting in social affinity-based ties between actors and partners and mutual deference due to these feelings of social affinity. Our findings of mutual deference between demographically similar team members provides some support for arguments that status can be a shared resource in groups, rather than a zero sum outcome of interactional processes (Anderson et al., 2012). Our findings for gender and ethnicity also contradict the notion that social affinity is less likely among low-status groups such as women or non-Whites (e.g., Chattopadhyay et al., 2004). Although, as we discuss below, the net effect of similarity is likely to favor high-status groups because both the task contributions and the social affinity pathways operate among demographically similar high-status dyads, low-status dyads do defer to each other based on social affinity. Accounting for how demographic attributes can trigger such categorization processes, which contribute to deference, expands existing theory about how and why deference flows among team members.

Although these two pathways each have significant dyadic elements, our results show they differ in important ways. These differences are particularly evident in the amount of variance explained by demographics at the individual and dyad levels of analysis. To estimate variance explained, we compared the random effect parameter estimates from models with and without the predictors of interest. We found that the task contributions pathway operates relatively more as an individual-level phenomenon, while the social affinity pathway operates more as a dyad-level phenomenon. Demographic characteristics explained 35% of the explainable individual-level (partner) variation in perceived task contributions and 3% of the dyad-level variation. In contrast, demographics explained 7% of the individual-level (partner) variation in social affinity and 13% of the dyad-level variation. Consistent with the idea that these mechanisms both shape deference, demographics explained 51% of the explainable variation in individual-level (partner) deference and 13% of the dyad-level variation. We suspect that one reason for this difference between perceived task contributions and social affinity is that demographic indicators of task competence (e.g., education, tenure) are a more reliable signal, used consistently across team members, and are thus more stable cues used by different team members (Bunderson & Barton, 2010). Social affinity is an inherently relational process, requiring researchers to account for the ways that two individuals' demographic attributes combine to trigger self-categorization processes. In sum, our analyses reveal that perceptions of task contributions and social affinity represent qualitatively different processes in teams; they differ in the levels of analyses at which they operate, the demographic attributes that predict them, and the nature of their flow between team members.

Our conceptual model also suggests that these two pathways—perceptions of task contributions and social affinity—shape deference in an additive way. And, indeed, we found no significant interaction between these two mechanisms predicting deference. Putting together our findings regarding the indirect effects of demographics through task contributions and social affinity provides a number of insights into why some individuals emerge as in-

fluential in work teams. With respect to gender and ethnicity, we observed lateral deference among high-status team members (i.e., high education, men, and Whites) through the perceived task contributions pathway and also through the social affinity pathway. In contrast, low-status team members (i.e., women, non-Whites) received deference only through the social affinity pathway. By deferring to one another, high-status members may be able to consolidate their own status within a team. In line with past social network research in organizations (e.g., Ibarra, 1992), this suggests that, for men and Whites, influence accrues through multiple task-based and affinity-based mechanisms. Overall, these results suggest that males and Whites accrue status not because they asymmetrically receive deference from women or non-Whites, but, rather, through a symmetric process of deferring to one another. This has important implications for future research on status and social categorization in teams because it highlights that high-status demographic groups do not accumulate status via the out-group favoring responses of low-status demographic groups as posited in past research (e.g., Jost et al., 2004), but, rather, through in-group favoring deference processes among high-status group members.

Bottom-Up Effects of Dyadic Deference on Team Performance

Recent critiques of functionalist perspectives of status in teams have noted that, although hierarchies are ubiquitous in teams, they are not necessarily functional (Anderson & Brown, 2010). Our multilevel approach, focused on dyadic processes, highlights how demographic differences shape deference and sheds lights on boundary conditions that might shape the functionality of status-related processes in teams. In general, our results suggest that task-based deference enhances team performance, while social affinity-based deference diminishes team performance. These "bottom-up" team processes are thus critical for the performance of work teams. The emergence of status differences based on differential deference accorded to team members is inevitable in most teams. Even in teams where individuals have had no prior social contact (e.g., juries or newly formed taskforces), studies have shown that status differences are pervasive (Bunderson & Reagans, 2011; Magee & Galinsky, 2008; York & Cornwell, 2006). Recently, some scholars have noted that status differences are not inherently detrimental, but that the nature of differences and the context of the team can mitigate the effects of status differences on team learning and performance (Bunderson & Reagans, 2011; Van der Vegt et al., 2010). Further, prior research indicates that, when intra-group influence stems from task-relevant characteristics, rather than task-irrelevant demographic characteristics, team performance is enhanced (Bunderson, 2003). Our findings extend this work by identifying the interpersonal mechanisms that account for these effects and showing how they emerge from dyadic building blocks. Specifically, we find that whether deference is task based (i.e., produced by perceptions of task contributions) or social affinity based (i.e., produced by social tie strength) matters for team performance. Teams that rely on task-based deference perform better than those that rely on social affinity-based deference. Thus, while disparity in deference may be a fact of team life (Magee & Galinsky, 2008), deferring to other team members based on an evaluation of their task-based contributions, rather than feelings of social affinity, may benefit team outcomes.

Overall, by focusing on the dyad as a basic unit of analysis, we delineate how the process of deference serves as an emergent mechanism that links diversity to performance in multidisciplinary teams. As such, our approach contributes to the study of deference as well as demographics attributes in teams. In multidisciplinary teams, accurately identifying whose opinions and inputs are important for decision making is a critical aspect of developing mutual knowledge and coordinating across diverse bases of expertise (e.g., Kotha et al., 2013; Paruchuri, 2010). At the dyad level, since actual expertise may not be immediately apparent, members may rely on demographic attributes to decide whose inputs are most valuable for accomplishing team goals. As a point of departure from past research on deference in teams, our analyses reveal that deference is reciprocal among high-status team members and can be explained through reciprocal social affinity among similar team members. Past research on how demographics affect individual- and team-level outcomes has yielded inconsistent and mixed findings (Riordan, 2000; van Knippenberg & Schippers, 2007). In response, researchers have begun to acknowledge the role of cross-level, contextual, and top-down effects on diversity outcomes (e.g., Joshi & Roh, 2009). However, the effects of demographics as bottom-up or emergent phenomena have yet to be systematically exam-

ined. Our findings show that the study of diversity effects as emergent phenomena is ripe with theoretical and empirical possibilities, and we join recent calls (e.g., Kozlowski et al., 2013) for more research on how demographic differences shape deference and other processes by applying a "bottom-up" lens.

Strengths, Limitations, Practical Implications, Future Directions

Our field-based study of 55 research and development teams has many strengths and some limitations. One notable strength of our empirical study is our longitudinal research design, in which we collected individual characteristics, interpersonal perceptions and relationships, and team performance data at three separate time periods over the course of two years. Although our study is not experimental, and thus we cannot draw firm conclusions regarding causality, this temporal separation between our independent variables, mediating mechanisms, and team outcomes increases confidence in the extent to which our results support our theoretical model. A second notable strength is our objective measure of team performance, compiled from archival records of research team journal articles, books and book chapters, and conference presentations. By linking patterns of deference to these substantive performance indicators, we have greater confidence in our ability to derive implications for practice based on our study.

Our conclusions, however, must be viewed in light of the limitations of our study. First, our team-level sample size, while on par with other published studies of teams in the field, was relatively small. As such, we had reduced statistical power for detecting effects at the team level. For example, particularly with respect to gender effects, with a larger team-level sample, future research may examine whether social affinity- or task-based paths to deference vary based on a full range of gender composition ranging from all male, balanced, to all female teams. Second, we relied upon single-item measures for examining dyadic perceptions of (a) task contributions, (b) social affinity, and (c) deference. Although prior studies of interpersonal perceptions, relationships, and influence have also relied on single-item measures, and we used an online sample to ensure correspondence between our single-item measures and multi-item scale scores, our research would have benefited from multi-item scales to increase the reliability of these variables. Third, we focused on a select set of task-relevant and demographic attributes to examine predictions derived from status characteristics and self-categorization theories. It is possible that our findings would differ had we examined a broader range of attributes. On a related note, we did not find consistent effects of tenure on deference at the dyad level through either the task contributions pathway or the social affinity pathway. Since our context is an academic one—rather than a corporate one—it is possible that the effects of education level trumped team tenure as a specific cue that team members used to assess one another's expertise or to form social affinity ties. Future research should consider whether other task-specific status cues (e.g., technical specialization) might function in a similar way to predict deference.

Beyond addressing these limitations of our empirical study, our theoretical contributions and empirical findings suggest a number of future research directions. First, our research underscores the value of taking a fine-grained, dyad-level approach to understanding patterns of deference in teams. Our dyad-level integration of status characteristics theory and self-categorization theory identified distinct interpersonal mechanisms through which each operates in shaping deference. Future research on the effects of diversity in teams may similarly benefit from dropping down to the dyad level in theory and analyses to generate and test predictions with greater fidelity to the conceptual level of analysis. Exploring the dyadic, relational mechanisms of prominent composition theories may reveal nuanced explanations for how and why diversity influences group processes and outcomes. For example, our results call for further appraisals of demographic effects in teams at multiple levels of analysis and nuanced theoretical approaches that account for both status-based and social affinity-based perspectives. Particularly with respect to our findings on gender effects at the dyad level, it is possible that social affinity among men may lead to a better understanding of one another's nuanced knowledge, which leads to more positive appraisals of task competence. While women do display more social affinity toward other women, among women, it appears that gender is not a basis for making attributions of task competence. Future research should aim at unpacking whether social affinity and perceptions of task competence overlap or correlate differently among men and among women, or, more generally, among high-status versus low-status demographic groups.

Second, we conceptualized and found bottom-up effects of deference on team performance. Specifically, we found that high-performing teams were those in which dyadic deference tended to be driven by task-based differences, while relatively low-performing teams were those in which dyadic deference was driven more heavily by social affinity. And, yet, we did not explore in this study *why* these differences in teams might emerge. Bunderson's (2003) research suggests that the alignment of intra-group influence with task-relevant characteristics is driven, in part, by how long a team has been operating and by team centralization. Future research is needed, however, to document the range of compositional, contextual, and leadership factors that may lead some teams to align patterns of deference with perceptions of task contributions rather than with social affinity. We also recommend that future research develop process-based models of deference as an emergent phenomenon. While we examined intact work teams, future research might track teams from the time of their inception to eventual delivery of product/services and identify whether specific trajectories of deference develop in teams over time and whether some trajectories are more optimal from a performance standpoint than others.

Our findings also offer insights to managers and team leaders looking to derive the benefits of knowledge diversity in teams. To begin with, our message to team leaders who face the challenges exemplified by this paper's opening quote would be to remain mindful of dysfunctional interactional processes that might be triggered after the team has been assembled. Specifically, given the performance benefits of task-based deference, our results suggest that managers and team leaders should strive to heighten the salience of specific cues, such as education and tenure, and work to decrease the salience of diffuse cues—such as ethnicity and gender. Our research indicates that, at the interpersonal level, these cues form the basis of deference patterns that are based on likely task contributions-versus self-categorization-driven feelings of social affinity. Our results also highlight the importance of separating task-relevant decision making in groups from the informal social structure that emerges over time due to self-categorization processes. We found that deference that is based in social affinity hinders team performance, while deference grounded in task contributions enhances team performance. This finding is particularly relevant in teams characterized by cliques based on demographic similarity, which may struggle to exploit knowledge diversity across demographic differences. In such a context, team leaders could focus on structural interventions that require knowledge sharing across gender and ethnic differences as a way to facilitate task-based rather than affinity-based interactions. Overall, we encourage managers and leaders to proactively intervene in instances where intra-team influence is grounded in affinity, seeking instead to promote influence patterns grounded in task expertise.

CONCLUSIONS

Who defers to whom and why? Our research indicates that the answer to this question is far more complex than acknowledged in past research on status and deference in teams. While demographic attributes have primarily been viewed as status cues, in enduring work teams, we find that they also operate as a basis for affinity and mutual deference. While demographic attributes such as educational level, tenure, gender, and ethnicity certainly serve as status signals, they also predict reciprocal social affinity and deference at the dyad level of analysis. Although deference can be a product of various demographic attributes, deference due to beliefs about task contributions enhances, while deference due to social affinity detracts from, team performance. By taking a multilevel approach to deference, with a focus on dyadic deference as a building block of status differences in teams, we shed new light on and highlight several lines of future research on "bottom-up" demographic effects in work teams. We hope that our theoretical and empirical approach informs future research on the complex effects and critical implications of demographics for knowledge combination and innovation in teams.

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