

HOW DO THEY GET THERE? AN EXAMINATION OF THE ANTECEDENTS OF CENTRALITY IN TEAM NETWORKS

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Drawing on social exchange and similarity-attraction theories, we hypothesized that individuals' demographic characteristics, values, and personality influence their acquisition of central positions in their teams' social networks. Education and neuroticism predicted centrality five months later; individuals who were highly educated and low in neuroticism became high in advice and friendship centrality and low in adversarial centrality. Team members' values similarity to their teammates also predicted advice and friendship centrality; demographic similarity had limited effects.

The right social ties are advantageous. Within work units, individuals who have numerous positive social connections gain access to information and assistance that others lack. Their centrality within their units' informal advice and friendship networks yields substantial benefits, including influence, access to information, positive performance ratings, and pay raises (e.g., Baldwin, Bedell, & Johnson, 1997; Brass, 1984; Ibarra & Andrews, 1993). Centrality in a unit's adversarial network is detrimental, however; individuals whom others find to be difficult or adversarial suffer discomfort and dissatisfaction (Baldwin et al., 1997; Sparrowe, Liden, Wayne, & Kraimer, 2001).

How, then, do individuals acquire the most desirable positions within their work units' social networks? Theory and research addressing this question are limited. Network theorists and researchers have devoted greater attention to the consequences of network centrality than to the antecedents, as a number of scholars have noted

(Borgatti & Foster, 2003; Mehra, Kilduff, & Brass, 2001). Building on prior research on the topic, and drawing on theory and research regarding social exchange and similarity-attraction, we propose that individuals' enduring personal characteristics—their demographic characteristics, values, and personality—influence their acquisition of central positions in their units' advice, friendship, and adversarial networks. A unit member's enduring personal characteristics, we argue, influence the extent to which he or she is considered to be a likely source of valued rewards—insights and information, support and fun, predictability and validation—or instead a source of tension and animosity: more pain than gain. In this article, we present the results of a longitudinal study of the relationship between individuals' demographic characteristics, values, and personality and their centrality in their teams' advice, friendship, and adversarial networks.

INDIVIDUAL CHARACTERISTICS AND CENTRALITY

Centrality in Team Social Networks

Network scholars have identified an array of informal workplace networks, including communication, advice, influence, and friendship networks. We examine advice, friendship, and adversarial networks—three networks that reflect the diverse

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ties that link the members of a team. The *advice* network is “comprised of relations through which individuals share resources such as information, assistance, and guidance” (Sparrowe et al., 2001: 317). The *friendship* network describes the ties of affection and camaraderie that link team members (Baldwin et al., 1997). Finally, the *adversarial* network describes team members’ antagonistic ties. Labianca, Brass, and Gray argued that this network is important because “negative events and negative relationships have a greater impact on human attitudes, cognition, physiological response and behavior than do positive or neutral events” (1998: 58).

Scholars use a variety of constructs and measures to describe an individual’s centrality within a network (Wasserman & Faust, 1994). “In-degree centrality” captures the extent to which individuals in the network identify the focal actor as one of their contacts in the network (Kilduff & Krackhardt, 1994). Individuals with high in-degree advice centrality are sought after for their work-related input. Individuals with high in-degree friendship centrality are sought after for their companionship. And individuals with high adversarial in-degree centrality are regarded by their teammates as difficult and best avoided.

Enduring Personal Characteristics: Demographic Characteristics, Values, and Personality

An individual’s demographic characteristics, values, and personality are enduring characteristics—characteristics that remain largely or completely stable as the individual moves across settings. A wealth of research suggests that these characteristics influence an individual’s behavior as well as others’ perceptions of and responses to the individual. We preview these characteristics below, describing their predicted association with team network centrality in the following section.

Demographic characteristics. An individual’s gender, race, age, and education influence his or her social experiences, perceptions, attitudes, and status (e.g., Hambrick & Mason, 1984; Pfeffer, 1983). Further, observers’ expectations and impressions of the individual are a function of these demographic characteristics (e.g., Jackson, Brett, Sessa, Cooper, Julin, & Peyronnin, 1991). Individuals who share similar demographic characteristics are drawn to one another, finding their similarity a source of familiarity, predictability, comfort, and validation (e.g., Williams & O’Reilly, 1998).

Values. Values are “generalized, enduring beliefs about the personal and social desirability of conduct or end-states of existence” (Kabanoff, Walder-

see, & Cohen, 1995: 1076). They are “general in nature, stable, and central to the individual’s identity” (Dose, 1999: 21). Values guide individuals in deciding how they ought to behave (Meglino & Ravlin, 1998). In the interest of parsimony, we focus on three values likely to influence task-related and social interactions in teams. Individuals who are high in *activity preference* (Wollack, Goodale, Wijting, & Smith, 1971) have a strong work ethic and an ability to delay rewards. They dislike waste and prefer efficiency (Beit-Hallami, 1979). Individuals who are high in *hedonism* pursue personal pleasure and enjoyment (Ryckman & Houston, 2003). Finally, individuals who are high in *tradition* are respectful and accepting of authority and established customs and ideas (Ryckman & Houston, 2003). These three values may, we posit, influence an individual’s behaviors, goals, and attitudes and thus, their team network centrality. As individuals are attracted to others who share their demographic characteristics, so they are attracted to others who share their values (Meglino & Ravlin, 1998).

Personality. In the past decade, the five-factor model of personality has gained acceptance as a general taxonomy of personality traits (e.g., Judge, Bono, Ilies, & Gerhardt, 2002). The model suggests that five traits can be used to describe the most salient aspects of personality. These traits are, to a large extent, heritable (Jang, McCrae, Angleitner, Riemann, & Livesley, 1998), unaffected by external influences (Asendorpf & Wilpers, 1998), and stable throughout a person’s lifetime (McCrae & Costa, 1990). Conscientiousness refers to the tendency to be dutiful, persistent, responsible, careful, prepared, organized, and detail-oriented. Extraversion refers to the tendency to be outgoing, gregarious, energetic, assertive, active, and cheerful in outlook. Neuroticism is the tendency to be moody, anxious, depressed, insecure, hostile, and/or irritable. Agreeableness describes the tendency to be cooperative, compliant, sincere, gentle, and trusting. Finally, openness to experience is the tendency to be imaginative, intellectual, creative, open-minded, unconventional, nonconforming, and autonomous.

Relationship Benefits and Costs: Implications for Advice, Friendship, and Adversarial Centrality

Social exchange theory (e.g., Blau, 1964; Molm & Cook, 1995) suggests that individuals pursue relationships in a self-interested fashion, seeking to maximize the benefits and minimize the costs of their social relationships. We use this fundamental insight as the starting point for our theoretical model linking individuals’ demographic character-

istics, values, and personality to their advice, friendship, and adversarial network centrality.

Antecedents of advice network centrality. Individuals benefit from asking advice if, in return, they receive expert information and insights that they lack. But advice seeking has a cost for individuals if they suffer humiliation or embarrassment as a result of revealing their own ignorance and uncertainty. Supporting these assertions, Borgatti and Cross (2003) found that individuals were most likely to seek information from individuals who they believed could offer them work-related expert advice (benefit or “value”) and who they believed would not make them feel uncomfortable or excessively indebted as a result of their request for information (“cost”).¹ Hinds, Carley, Krackhardt, and Wholey (2000) found that, when selecting work partners, individuals favored others who had a reputation for being competent and hard-working. And Bunderson (2003) showed that valued functional expertise was significantly positively related to team work flow centrality.

On the basis of this work, we posit that individuals whose personal characteristics make them valued sources of information and insight gain positions of advice network centrality. One demographic characteristic—education—is an obvious source of knowledge and expertise. Thus,

Hypothesis 1. Education is positively related to centrality in a team advice network.

Further, individuals who have a strong work ethic, or activity preference value, are likely to work hard and to thus gain competence in and deep knowledge of work tasks.

Hypothesis 2. Activity preference is positively related to centrality in a team advice network.

Similarly, individuals who are high in conscientiousness are likely to be attentive and disciplined in their work. Their diligence is likely to result in task-relevant competence and knowledge. Thus,

Hypothesis 3. Conscientiousness is positively related to centrality in a team advice network.

Individuals are most likely, we posit, to seek advice from others who do not extract costs, intentionally or unintentionally, from their advice giving.

Individuals who are high in extraversion welcome social interaction and invite others' attention and interest. The perceived costs of asking an extraverted individual for advice are thus likely to be low. Accordingly,

Hypothesis 4. Extraversion is positively related to centrality in a team advice network.

Further, agreeable individuals are gentle and helpful to others. They are likely to respond kindly to requests for advice. Thus,

Hypothesis 5. Agreeableness is positively related to centrality in a team advice network.

Conversely, individuals who are high in neuroticism may respond to requests for advice with disrespect, annoyance, or insecurity. Thus,

Hypothesis 6. Neuroticism is negatively related to centrality in a team advice network.

Finally, individuals may benefit from asking advice if, in return, they receive information and insights that confirm their existing preferences and assumptions. Individuals are thus likely to seek advice from similar others who they believe are likely to hold priorities and perspectives similar to their own (Harrison, Price, Gavin, & Florey, 2002). Accordingly,

Hypothesis 7. Individuals whose demographic characteristics are similar to their teammates' are likely to gain centrality in their team advice network.

Hypothesis 8. Individuals whose values are similar to their teammates' are likely to gain centrality in their team advice network.

Antecedents of friendship network centrality. Individuals benefit from seeking friendship if, in return, they gain friends who provide them with support, comfort, and companionship and with whom they have fun (Fehr, 2004). But friendship seeking has costs if individuals' attempts at friendship are met by indifference, rejection, or excessive demands for attention and intimacy. These themes are consistent with social exchange theory and are reinforced by recent research in which individuals were asked to describe the traits they sought in a friend (Sprecher & Regan, 2002). Respondents indicated that they sought to form friendships with others who were “warm and kind” and who had “a sense of humor” and “an exciting personality.” Further, in keeping with similarity-attraction theory, respondents reported that they preferred friends with whom they shared “similar attitudes and val-

¹ In correlational analyses, Borgatti and Cross (2003) found that both perceived value and perceived cost predicted information seeking. In a simultaneous regression including multiple predictors, perceived value was significantly related to information seeking, but perceived cost was not.

ues” and “similar interests and leisure activities” (Sprecher & Regan, 2002).

In view of this work, we propose no simple effects of demographic characteristics on network centrality as there is little reason to expect age, gender, race, or education per se to predict friendship centrality. Values and personality may be predictive, however. We expect individuals who are high in hedonism to propose fun activities for their teams and for team members to turn to these individuals for amusement, entertainment, and friendship. Accordingly,

Hypothesis 9. Hedonism is positively related to centrality in a team friendship network.

Extraverted team members like attention and cultivate social interaction. Gregarious and energetic, they are likely to welcome others' friendship. Thus,

Hypothesis 10. Extraversion is positively related to centrality in a team friendship network.

Agreeableness is associated with a longing for intimacy and close relationships (Graziano, Jensen-Campbell, & Hair, 1996). Agreeable individuals are also likely to welcome overtures of friendship. Thus,

Hypothesis 11. Agreeableness is positively related to centrality in a team friendship network.

Finally, team members who are high in neuroticism are likely to be “high-cost” friends. They anger easily and often express moodiness, sadness, or insecurity. Thus,

Hypothesis 12. Neuroticism is negatively related to centrality in a team friendship network.

Finally, theory and research regarding similarity-attraction and network “homophily” suggest that individuals are likely to turn to similar others for friendship. Thus,

Hypothesis 13. Individuals whose demographic characteristics are similar to teammates' are likely to gain centrality in a team friendship network.

Hypothesis 14. Individuals whose values are similar to teammates' are likely to gain centrality in a team friendship network.

Antecedents of adversarial network centrality.

Interaction with some individuals is difficult, offering fewer benefits than costs. These individuals offer neither valued information and insights, nor

support and fun. In some social settings, such individuals may be shunned or ignored. In a team setting, requiring daily interaction among team members, avoidance may be impossible, however (Labianca et al., 1998: 55). Given the paucity of prior research and theory on the antecedents of adversarial centrality, we posit simply that individuals whose presence on a team offers few benefits and substantial costs are likely to develop central positions within their teams' adversarial networks.

As adversarial network centrality is strongly negative, indicative not of mere indifference to an individual but of antipathy to him or her, we pose no hypotheses regarding the relationship of race, gender, and age to adversarial network centrality. Race, gender, and age seem unlikely to predict adversarial centrality. Education, activity preference, and personality may be predictive, however. Individuals who perform their tasks poorly—because they are either incompetent or simply unwilling to work hard—may hinder their teammates from completing their own work (Sparrowe et al., 2001) and may thus cause resentment, tension, and conflict. Accordingly,

Hypothesis 15. Education is negatively related to centrality in a team adversarial network.

Hypothesis 16. Activity preference is negatively related to centrality in a team adversarial network.

Hypothesis 17. Conscientiousness is negatively related to centrality in a team adversarial network.

Individuals who are high in neuroticism also present substantial costs to their teams. Their poor performance under stress and expressions of negative emotions (e.g., anger, irritation, anxiety, dissatisfaction, insecurity) are likely to discomfit their teammates. Thus,

Hypothesis 18. Neuroticism is positively related to centrality in a team adversarial network.

Conversely, individuals who are high in agreeableness are good-natured, courteous, and sympathetic. Accordingly,

Hypothesis 19. Agreeableness is negatively related to centrality in a team adversarial network.

METHODS

Sample

We collected survey data from a residential, team-based, ten-month long national service pro-

gram. Over the course of the program, each team was assigned to a number of diverse service projects (examples were tutoring, building houses, and repairing parks and recreational areas). Teams often worked in difficult conditions (for instance, in disaster sites or remote areas of state or national parks) and were thus rewarded for demonstrating adaptability, hard work, cooperation, and a positive outlook. Participants received an educational grant and a modest stipend in return for their service. Teams in the program ranged in size from 9 to 12 members. We gathered data at time 1 (within the first two weeks following team formation) and at time 2 (five months later). Surveys measuring demographic variables, personality, and values were completed at time 1 by 1,056 members from 102 teams (the response rate was 98 percent). Surveys measuring network relationships, among other variables, were returned by 867 team members from 100 teams at time 2 (the response rate was 87 percent). For the analyses reported here, we included teams from which we had at least six matched time 1 and time 2 responses. Our analyses are based on a sample of 900 individuals from 96 teams.²

In our sample, 31.4 percent of the team members were male, and 68.6 percent were female. Their ages ranged from 17 to 25. Team members' racial/ethnic backgrounds were 87.3 percent white/Caucasian, 4.79 percent African American; 4.79 percent Hispanic/Latino; 3.11 percent Asian, 0.5 percent Indian/Native American, and 4.4 percent "other." Individuals were randomly assigned to teams, but teams were structured to ensure fairly comparable levels of gender and race/ethnicity diversity in all teams.

Measures

Personality. We used the International Personality Item Pool (IPIP) to measure personality in the time 1 survey (Goldberg, 1992). The IPIP is a 50-item instrument with ten items for each factor of the five-factor model (that is, extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience). The full set of items can be obtained from a Web site, <http://ipip.ori.org/ipip/ipip.html>. Participants rated how much they agreed with each item on a five-point scale in

which 1 was "strongly disagree" and 5 was "strongly agree."

Values. We measured values at time 1. We used the eight-item subscale of the Survey of Work Values (Wollack et al., 1971) to measure activity preference. Participants rated how much they agreed or disagreed with the statements using a five-point scale (1, "strongly disagree"; 5, "strongly agree"). A sample item is "A person should try to stay busy all day rather than try to find ways to get out of doing work." To measure tradition, we used an eight-item subscale of the Smith, Grojean, and Dickson Values Scale (Smith, Grojean, Dickson, & Hanges, 2002). Participants were asked to "rate each statement on how important it is as a guiding principle in your life," using the response scale "very unimportant" (1) to "very important" (5). Items include "being respectful of tradition" and "living by a strict moral code." We used five items of the Smith et al. (2002) values scale to measure hedonism. Items include "enjoying life to the fullest," and "having a good time." We calculated value similarity between a respondent and the other members of his or her team by taking the square root of the summed squared differences between the individual's value (activity preference, tradition, or hedonism) and the value of every other individual in the team, divided by the total number of respondents in the team. This Euclidean distance measure is common in studies of demographic and value similarity (e.g., Dose, 1999; Tsui, Egan, & O'Reilly, 1992). We multiplied the distance measure by -1 to reverse the scale so that larger numbers indicated similarity.

Demographic characteristics. Respondents reported their age in years and their education on a six-point scale on which 1 was "some high school (grades 9–11)" and 6 was "graduate degree (master's, Ph.D., J.D., M.D., etc.)." Respondents reported their sex (0, "male,"; 1, "female") and their race/ethnicity (0, "white"; 1, "nonwhite"). We calculated Euclidean distance to measure individuals' demographic similarity to their teammates, multiplying the distance measure by -1 to reverse the scale so that larger numbers indicated similarity.

Network centrality. In the time 2 survey, team members were provided with a list of their teammates and asked to answer, for each team member: (1) "Do you go to this person for work-related advice?" (2) "Is this person a good friend of yours, someone you socialize with during your free time?" and (3) "Do you have a difficult relationship with this person?" Respondents answered by indicating yes or no to each question. The wording of the three questions was adapted from Baldwin et al. (1997). In-degree centrality is simply a count of the number

² Because team members provided the network ratings that determined an individual's network centrality, it was possible for an individual to be included in the sample if he or she completed the time 1 survey but not the time 2 survey.

of individuals in a team who indicate that a focal individual is someone they go to for advice (advice centrality), someone they consider a friend (friendship centrality), or someone with whom they have a difficult relationship (adversarial centrality).

Analyses

We used random coefficient modeling (RCM, also known as hierarchical linear modeling, or HLM) to test our hypotheses. RCM allows one to test the relationships between individual-level independent and dependent variables within a team, providing a summary of the average overall relationship between the independent and dependent variables *within teams*. This capability is critical because traditional individual-level analyses do not control for the nested structure of data and may misrepresent the within-team effects (Klein, Danse-*re*au, & Hall, 1994). We group-mean-centered the predictor variables, with the exception of race and sex, because we sought to predict only within-team, not between-teams, variability in advice, friendship, and adversarial centrality (Hofmann & Gavin, 1998). In this way, we also controlled for variability in the size of the teams. Because intercepts are meaningful in RCM analyses (intercepts may vary from team to team), we report unstandardized regression coefficients (*b*'s), not standardized coefficients (β s). Further, in testing our hypotheses regarding demographic and values similarity, we first controlled for the simple effects of demographic characteristics and values, because Euclidean distance scores and the simple or direct scores on which they are based can be confounded.

RESULTS

Table 1 shows the means, standard deviations, reliabilities, and correlations among the measures. Advice centrality and friendship centrality are significantly, positively correlated. Further, both are significantly, negatively related to adversarial centrality. With a few exceptions, the predictors are modestly intercorrelated. Sex and sex similarity are highly and positively correlated, and race and race similarity are highly, negatively correlated. These correlations indicate that women are more likely than men to be of the same sex as their teammates and that whites are more likely than nonwhites to be of the same race as their teammates.

Antecedents of Advice Network Centrality: Hypotheses 1–8

The results of our tests of Hypotheses 1–8 appear in Table 2. As predicted in Hypothesis 1, education

is significantly, positively related to advice centrality ($b = 0.78, p \leq .001$). Race is significantly, negatively related to advice centrality ($b = -0.60, p \leq .01$): Nonwhites are significantly lower in advice centrality than are whites. As predicted in Hypothesis 2, activity preference is significantly, positively related to advice centrality ($b = 0.74, p \leq .001$). Contrary to Hypotheses 3, 4, and 5, conscientiousness, extraversion, and agreeableness are not significantly related to advice centrality. However, consistently with Hypothesis 6, neuroticism is significantly, negatively related to advice centrality ($b = -0.47, p \leq .001$). Sex similarity is significantly, positively related to advice centrality ($b = 2.68, p \leq .05$), but race, age, and education similarity are not significant predictors. These results provide limited support for Hypothesis 7. Supporting Hypothesis 8, hedonism similarity ($b = 0.99, p \leq .05$) and tradition similarity ($b = 0.72, p \leq .05$) are significantly, positively related to advice centrality. In model 6 of Table 2, we tested the combined effects of all of the predictors on advice centrality. The results suggest that highly educated ($b = 0.70, p \leq .001$), nonwhite ($b = -0.97, p \leq .01$), older individuals ($b = 0.14, p \leq .05$) who are high in activity preference ($b = 0.39, p \leq .05$), low in neuroticism ($b = -0.40, p \leq .001$), and similar to their teammates in gender ($b = 2.49, p \leq .05$), hedonism ($b = 0.97, p \leq .05$), and tradition ($b = 0.66, p \leq .05$) are most likely to gain central positions in their team's advice network.

Antecedents of Friendship Centrality: Hypotheses 9–14

The results of our tests of Hypotheses 9–14 appear in Table 3. We found, but had not predicted, that education ($b = 0.47, p \leq .001$) and gender ($b = 0.42, p \leq .01$) are each significantly, positively related to friendship centrality. (Women are higher than men in friendship centrality.) Contrary to Hypothesis 9, hedonism is not significantly related to friendship centrality. We found, but again had not predicted, that activity preference is significantly, positively related to friendship centrality ($b = 0.58, p \leq .001$). Contrary to Hypothesis 10, extraversion is not significantly related to friendship centrality. Supporting Hypothesis 11, agreeableness is significantly, positively related to friendship centrality ($b = 0.55, p \leq .001$). Consistently with Hypothesis 12, neuroticism is significantly, negatively related to friendship centrality ($b = -0.26, p \leq .05$). Further, openness to experience is significantly, negatively related to friendship centrality ($b = -0.38, p \leq .01$). Contrary to Hypothesis 13, none of the four demographic similarity indexes (education,

TABLE 1
Descriptive Statistics and Correlations^a

Variable	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. Advice centrality	4.64	2.42																					
2. Friendship centrality	5.71	2.27	.59																				
3. Difficulty centrality	1.16	1.48	-.34	-.38																			
4. Education	3.12	0.85	.33	.13	-.10																		
5. Race	0.17	0.38	-.08	.01	.02	-.08																	
6. Sex	0.69	0.46	.06	.08	-.02	.09	-.06																
7. Age	20.81	1.93	.29	.06	-.05	.78	-.04	.02															
8. Activity preference	3.83	0.44	.11	.08	-.01	.10	-.13	.22	.09	(.72)													
9. Hedonism	3.76	0.51	-.05	.03	-.02	-.10	.04	.02	-.07	-.11	(.65)												
10. Tradition	3.09	0.63	-.01	.00	-.01	-.05	.11	.11	-.03	.20	.09	(.81)											
11. Conscientiousness	3.53	0.57	.10	.05	-.02	.14	.01	.16	.12	.35	-.03	.28	(.83)										
12. Extroversion	3.39	0.67	.02	.03	.09	.00	-.09	.02	-.04	.06	.21	.06	-.06	(.88)									
13. Neuroticism	2.63	0.66	-.13	-.11	.14	-.07	.01	.07	-.02	-.14	-.02	-.07	-.21	-.23	(.88)								
14. Agreeableness	4.16	0.44	.06	.09	-.06	.10	-.09	.24	.06	.32	.06	.17	.20	.27	-.18	(.76)							
15. Openness to experience	3.77	0.46	.04	-.06	.07	.14	-.05	-.08	.13	.09	-.03	-.08	.06	.26	-.10	.26	(.76)						
16. Education similarity	1.13	0.32	-.03	-.08	.03	.10	.00	-.02	.11	-.02	.00	.00	-.08	.01	.00	-.05	.00						
17. Race similarity	0.43	0.27	-.02	-.09	.00	.09	-.72	.05	.05	.05	-.04	-.06	.02	.07	-.03	.06	.03	.05					
18. Sex similarity	0.63	0.14	.10	.11	-.04	.09	-.03	.87	.02	.21	.03	.12	.13	.02	.07	.22	-.09	-.02	.04				
19. Age similarity	2.57	0.64	.02	.04	.01	.22	.06	.00	.14	.01	-.07	.05	.00	-.08	-.04	-.05	.00	.41	-.02	-.01			
20. Activity preference similarity	0.55	0.22	.02	.01	.00	.03	-.04	.08	.02	.04	-.01	.00	.08	.02	.03	.02	-.07	.03	.07	.09	-.06		
21. Hedonism similarity	0.63	0.25	.05	.09	-.02	-.02	.01	.01	.01	-.04	.17	.09	.05	.04	-.01	.07	-.01	.02	.07	.03	.00	.13	
22. Tradition similarity	0.76	0.30	.11	.10	-.06	.01	.03	.05	.00	.01	.03	.19	.08	.03	-.08	-.03	-.13	-.03	.03	.04	-.02	.13	.15

^a Reliabilities (alphas) appear in parentheses on the diagonal. Correlations with an absolute value of .07 are significant at $p < .05$; n ranged from 840 to 900.

TABLE 2
Results of the HLM Analyses for Advice Centrality

Variable	Model 1: Demographic Characteristics	Model 2: Values	Model 3: Personality Traits	Model 4: Demographic Similarity	Model 5: Values Similarity	Model 6: Full Model
Intercept	4.52	4.55	4.56	6.35	4.55	6.12
Education	0.78***			0.74***		0.70***
Race	-0.60**			-1.02**		-0.97**
Sex	0.18			-0.48		-0.40
Age	0.12			0.13*		0.14*
Activity preference		0.74***			0.76***	0.39*
Hedonism		-0.20			-0.28	-0.14
Tradition		-0.14			-0.21	-0.09
Conscientiousness			0.18			-0.04
Extraversion			-0.12			-0.03
Neuroticism			-0.47***			-0.40***
Agreeableness			0.12			-0.14
Openness to experience			0.25			0.01
Education similarity				-0.09		-0.16
Race similarity				-0.94		-1.00
Sex similarity				2.68*		2.49*
Age similarity				0.11		0.08
Activity Preference similarity					-0.88	-0.85
Hedonism similarity					0.99*	0.97*
Tradition similarity					0.72*	0.66*
R^{2a}	.17	.03	.02	.17	.04	.20

^a Explained within-team variance in advice centrality.

* $p < .05$

** $p < .10$

*** $p < .01$

race, age, and sex similarity) is significantly related to friendship centrality. Finally, as predicted in Hypothesis 14, hedonism similarity is significantly and positively related to friendship centrality ($b = 0.93$, $p < .01$). Model 6 of Table 3 shows our test of the combined effects of all of the predictors on friendship centrality. The results suggest that highly educated ($b = 0.42$, $p \leq .001$) individuals who are high in activity preference ($b = 0.40$, $p \leq .05$), low in neuroticism ($b = -0.28$, $p \leq .01$), and low in openness to experience ($b = -0.43$, $p \leq .01$) and who are similar to their teammates in hedonism ($b = 0.93$, $p \leq .01$) are most likely to gain central positions in team friendship networks.

Antecedents of Adversarial Network Centrality: Hypotheses 15–19

The results of our tests of Hypotheses 15–19 appear in Table 4. As predicted in Hypothesis 15, education is significantly, negatively related to adversarial centrality ($b = -0.25$, $p \leq .05$). Contrary to Hypotheses 16 and 17, activity preference and conscientiousness are not significantly related to adversarial centrality. Consistent with Hypotheses 18 and 19, neuroticism is significantly, positively

related ($b = 0.32$, $p \leq .001$), and agreeableness is significantly, negatively related ($b = -0.31$, $p \leq .05$) to adversarial centrality. In addition, extraversion ($b = 0.29$, $p \leq .001$) and openness to experience ($b = 0.27$, $p \leq .05$) are both significantly, positively related to adversarial centrality. Model 6 of Table 4 shows the combined effects of the predictors. The results suggest that team members who are low in education ($b = -0.23$, $p \leq .05$) and agreeableness ($b = -0.30$, $p \leq .05$) and high on extraversion ($b = 0.33$, $p \leq .001$), neuroticism ($b = 0.31$, $p \leq .001$), and openness to experience ($b = 0.27$, $p \leq .05$), and whose support for the value of upholding tradition differs from their teammates' ($b = -0.54$, $p \leq .05$), are the most likely to become central in the adversarial network.

DISCUSSION

In keeping with the structuralist heritage of social network analysis, researchers and theorists have devoted considerable attention to the consequences that individuals experience as a result of their centrality in organizational and team networks (Borgatti & Foster, 2003). In contrast, analyses of the enduring personal characteristics associ-

TABLE 3
Results of the HLM Analyses for Friendship Centrality

Variable	Model 1: Demographic Characteristics	Model 2: Values	Model 3: Personality Traits	Model 4: Demographic Similarity	Model 5: Values Similarity	Model 6: Full Model
Intercept	5.29	5.56	5.57	6.77	5.56	6.30
Education	0.47***			0.42**		0.42***
Race	−0.09			−0.36		−0.29
Sex	0.42**			−0.10		−0.02
Age	−0.07			−0.06		−0.04
Activity preference		0.58***			0.60***	0.40*
Hedonism		0.22			0.14	0.14
Tradition		−0.20			−0.23*	−0.20
Conscientiousness			−0.10			−0.23
Extraversion			−0.02			−0.03
Neuroticism			−0.26*			−0.28**
Agreeableness			0.55***			0.30
Openness to experience			−0.38**			−0.43**
Education similarity				−0.14		−0.22
Race similarity				−0.58		−0.67
Sex similarity				2.10		1.55
Age similarity				0.12		0.14
Activity preference similarity					−0.37	−0.46
Hedonism similarity					0.93**	0.90**
Tradition similarity					0.30	0.23
R^{2a}	.04	.05	.02	.03	.05	.10

^a Explained within-team variance in friendship centrality.

* $p < .05$

** $p < .01$

*** $p < .001$

ated with individuals' acquisition of their network positions (e.g., Burt, Jannotta, & Mahoney, 1998; Mehra et al., 2001) have remained relatively rare. Our findings add to the still limited, but growing, evidence that individuals' demographic characteristics, values, and personality influence their acquisition of central positions in their teams' advice, friendship, and adversarial networks. Our findings are at once promising and cautionary: We found full or partial support for approximately 60 percent of our hypotheses. Further, the predictors explained significant, but fairly modest, amounts of variance in centrality. Thus, although the individual characteristics we studied do appear to play a role in determining individuals' locations in their team networks, they clearly do not tell the entire story.

Predictors of Centrality across the Networks

Two variables, education and emotional stability, emerged as key predictors of centrality in all three networks: Highly educated individuals with low neuroticism are high in advice centrality, high in friendship centrality, and low in adversarial centrality. These individuals, we suspect, present a

good bargain to their teammates; they offer benefits (education) at a low cost (low neuroticism). Four other predictors—activity preference, openness to experience, tradition similarity, and hedonism similarity—were significantly related to centrality in two of the three networks we studied. Activity preference was positively related to advice and friendship centrality, suggesting that teammates who are hard-working and engaged in a team's tasks also present a valued benefit to the team. Openness to experience was negatively related to friendship centrality and positively related to adversarial centrality. These results suggest that team members find their open colleagues an irritation. Perhaps these individuals challenge expectations for conformity to team or organizational norms and routines.

Consistently with similarity-attraction theory and with evidence of network homophily, we found that similarity in values—specifically, similarity to teammates in support for the values of hedonism and of tradition—predicted advice and friendship centrality. In contrast, we found little evidence of demographic similarity effects. Our findings are consistent with recent observations that the effects of demographic, or *surface*, similarity are inconsistent and may be overshadowed by

TABLE 4
Results of the HLM Analyses for Adversarial Centrality

Variable	Model 1: Demographic Characteristics	Model 2: Values	Model 3: Personality Traits	Model 4: Demographic Similarity	Model 5: Values Similarity	Model 6: Full Model
Intercept	1.17	1.15	1.16	0.32	1.15	0.34
Education	-0.25*			-0.23*		-0.23*
Race	0.07			0.17		0.23
Sex	-0.05			0.24		0.28
Age	0.05			0.05		0.04
Activity preference		-0.03			-0.04	0.06
Hedonism		-0.00			0.03	-0.04
Tradition		-0.04			-0.00	-0.03
Conscientiousness			0.14			0.15
Extraversion			0.29***			0.33***
Neuroticism			0.32***			0.31***
Agreeableness			-0.31*			-0.30*
Openness to experience			0.27*			0.27*
Education similarity				0.24		0.32
Race similarity				0.18		0.25
Sex similarity				-1.13		-1.09
Age similarity				0.06		0.04
Activity preference similarity					0.04	-0.06
Hedonism similarity					-0.43	-0.40
Tradition similarity					-0.49*	-0.54*
R^2 ^a	.02	.00	.04	.02	.00	.06

^a Explained within-team variance in adversarial centrality.

* $p < .05$

*** $p < .001$

the effects of *deep* similarity in values and attitudes (Harrison et al., 2002).

Network-Specific Predictors

Some enduring characteristics, as we have noted, proved predictive of centrality in two or three of the team networks that we studied. And yet our results highlight differences among the three networks. The predictors explained more within-team variance in advice centrality than in friendship or adversarial centrality. Education was significantly related to centrality in all three networks but was most predictive of advice centrality, as one might expect. Further, age was significantly and positively related to advice centrality, in the full model, and was not significantly related to either friendship or adversarial centrality. Given that our sample consisted of young adults, it is perhaps not surprising that we found that these team members turned to their older colleagues for advice. More troubling is the significant effect for race: Even after controlling for all of the other predictors, we found that non-whites were lower in advice centrality than whites.

We were less successful in predicting within-team variance in friendship centrality. Education, activity preference, neuroticism, openness to experience, and hedonism similarity were significant

predictors in the full model. We were surprised that extraversion was not a significant predictor of friendship centrality (nor of advice centrality). Perhaps the effects of extraversion on network centrality depend in part on the size and duration of the social network. In a relatively small, constrained, and ongoing social network, such as a team of individuals working together over time, extraversion may not be highly predictive; even the most introverted team members are likely to form and maintain social ties as a result of repeated interactions among a relatively small group of people.

Finally, our results highlight the influence of personality on adversarial centrality. Although the variance explained is modest, the influence of personality is striking. Four personality characteristics are significantly related to adversarial centrality: neuroticism, agreeableness, openness, and extraversion. Neurotic, disagreeable individuals are high in adversarial centrality. This is hardly surprising. More surprising are the effects of openness and extraversion. Our findings suggest that, at close range and with repeated interactions, a teammate's openness (non-conformity, autonomy, and intellectualism) and extraversion (talkativeness, seeking attention assertiveness) may be a source of annoyance.

Strengths, Limitations, and Directions for Future Research

Our study examines antecedents of network centrality in a large sample of individuals randomly assigned to teams, shedding new light on a topic that has been the object of little prior research. Our longitudinal design and multisource data, eliminating concerns of single-source bias, enhance confidence in our research conclusions. But, like all research, this study is limited. We did not measure team members' perceptions of each other's value and "cost." Taking such measures would be a useful next step in future research on the antecedents of network centrality; Borgatti and Cross's (2003) recent study illustrates one strategy for assessing such perceptions. Further, the teams we studied differ from the teams in many other work organizations. Research is needed to determine the generalizability of our results.

We have examined the effects of demographic characteristics, values, and personality on network centrality, but numerous other predictors may also be important, including individuals' ranks, team tenures, and functional expertise (e.g., Bunderson, 2003), the proximity of their work spaces to others on their teams (e.g., Rice & Aydin, 1991), and their ties outside the teams. Further, we encourage research examining the antecedents of differing network positions as the characteristics and motivations that predict in-degree centrality, "betweenness" centrality, and out-degree centrality may differ. Finally, shifting up a level of analysis, we recommend further examination of the antecedents of team network structures. What explains between-team differences in advice or friendship density? What are the impacts of team composition and turnover among team members on team network structure?

Conclusion

Our goal in this study was to shed new light on the antecedents of network centrality. Our results suggest that the effects of enduring personal characteristics, while modest, play a significant role in determining who becomes central in team advice, friendship, and adversarial networks. Clearly, enduring personal characteristics do not tell the whole story. Thus, we hope that our findings and suggestions for future research spur further investigations of this neglected, but important, topic.

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