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STRUCTURAL BASES OF INTERPERSONAL INFLUENCE IN GROUPS: A LONGITUDINAL CASE STUDY*

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I examine the relationship between interpersonal power and influence during the resolution of an issue in an organization. Controlling for elementary bases of power (rewards, coercion, authority, identification, and expertise), I investigate three bases of power that arise from the structure of social networks (cohesion, similarity, and centrality). An analysis of longitudinal data on actors' bases of social power, frequency of interpersonal communications, and interpersonal influences indicates that cohesion, similarity, and centrality have significant effects on issue-related influence net of the elementary power bases. The effects of the structural bases are mediated by the frequency of issue-related communication. The primary structural determinant of the frequency of issue-related communication is network cohesion.

In the prototypic representation of interpersonal power, actor O's influence over actor P depends on O's possession or control of resources that are valued by P (Cartwright 1965; Coleman 1973; Emerson 1962). I examine additional *structural* bases of power—features of actors' positions in networks of interpersonal communication—that contribute to an actors' influence on others.

The theoretical status of various structural bases of interpersonal power is controversial because the mechanisms underlying these structural effects have not been confirmed (Burt 1987; Friedkin 1984; Mizruchi 1990; Marsden and Friedkin 1993). That is, research has not aimed at a "Lazarsfeldian" elaboration of structural effects (Rosenberg 1968). Such elaboration is crucial because actors' resources may shape the structure of a communication network while also directly affecting interpersonal influence. Moreover, structural effects on interpersonal influence may be mediated by other variables.

To examine these issues, I study the process of issue resolution in a public school. Longitudinal data on teachers in this school are used to disentangle the effects of actors' structural bases of social power at time 1 on their influences on the issue at time 2, and to explain such effects. I examine five resource-based sources of power as well as the effects of the frequency of issue-related interpersonal communication within the group, as such communication may provide a key mechanism by which power is converted into interpersonal influence on a particular issue.

STRUCTURAL PERSPECTIVES ON POWER

My analysis focuses on three structural features of interpersonal communication networks—structural cohesion, similarity, and centrality—that can affect actors' influences on issues. I define these structural characteristics in terms of a *historical* network of interpersonal communications (i.e., actors' past discussion, advice, and friendship relations) so that these structural characteristics are antecedents of specific issue-related communications and influences.

These three structural features affect two key components of social influence—*interpersonal visibility* and *salience*. Actor O's influence on actor P depends on P's knowledge of O's opinions; invisible opinions cannot be directly in-

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fluent.¹ Once P knows O's opinion, then O's influence on P depends on the salience or value of O's opinion for P; irrelevant or valueless opinions cannot directly influence P. I indicate how each of the three structural variables affect the probability that P is aware of, and attaches some weight to, O's opinion on a particular issue.

Structural Cohesion

Since Cooley, Durkheim, and Tönnies wrote about the essential bonds of society, the concept of cohesion has been associated with strong interpersonal ties like kinship and friendship. A cohesive group has been defined as a clique in which each member is strongly tied to all other members. However, many structural theorists have discarded this classical approach in favor of a more general conceptualization that grounds cohesion in a network of heterogeneous interpersonal ties. In this broader approach, it is not an oxymoron to refer to a cohesive "secondary" group in which a substantial proportion of the possible interpersonal ties are weak or absent.

Key elements of cohesion involving members' inclinations to remain in the group and members' capacities for social control and collective action may be predicated on weak ties of acquaintanceship and collegiality (Granovetter 1973, 1982). Moreover, cohesion does not require a *complete* network in which all members are directly tied to each other. Instead, the cohesion of the group is based on the configuration of the group's network. Formal properties of communication networks like connectivity category, diameter, and density (Harary, Norman, and Cartwright 1965) indicate network structures that foster social cohesion. For dyads, the structural cohesion of actors P and O is a function of their joint membership in a structurally cohesive group, *not on*

their feelings about one another. For example, if a structurally cohesive group is defined as a strong component (i.e., a group in which all pairs of members are mutually reachable via communication paths), then P and O are structurally cohesive if, and only if, they are joint members of such a component.

Because information tends to diffuse rapidly in cohesive groups, members of a cohesive group are more likely to be aware of each other's views on an emergent issue than are actors who are not members of the group (Friedkin 1982, 1983). Moreover, visible opinions are likely to be salient in cohesive groups because members are embedded in a field of interpersonal cross-pressures that encourages reciprocity and compromise. Hence, the greater the structural cohesion of P and O, the more likely they are to influence each other.

Face-to-face communication probably mediates the effects of structural cohesion on issue-related interpersonal influence. The greater the structural cohesion of P and O, the more likely they will be in frequent communication on a particular issue; in turn, and independent of the actors' power bases, such issue-related communication may establish the salience of O's opinion for P. Here the foundations of salience are elementary balancing mechanisms that are often elicited by a discussion of discrepant opinions (Heider 1958; Newcomb 1953). Because these balancing mechanisms are a response to interpersonal tensions and conflicts, they are more likely to emerge as a result of a face-to-face discussion of discrepant opinions than from a simple awareness of an opinion difference. Because of the reciprocity and compromise that cohesive groups encourage, the salience that is established by face-to-face communication is likely to be more pronounced if P and O are members of a cohesive group than if they are not.

Moreover, frequent issue-related communication is likely to secure salience during the resolution of an issue. Frequent communication tends to embed opinions in a supporting fabric of arguments and information and also allows adjusting these supports as circumstances change. Hence, the pressure toward uniformity of opinions that arises from a comparison of opinions (Festinger 1954), although predicated on interpersonal awareness, is likely to be more pronounced and more sustained

¹ Visibility of role performance has been of interest to sociologists since preliminary statements on the subject by Simmel (1950). Simmel used the term *surveyable* to refer to the extent to which the role performances of actors can be scrutinized. Simmel was concerned with aristocrats' abilities to observe the behavior of other members of the aristocracy. Merton (1968), in his analysis of reference group behavior, has generalized this concern to any social system. The classical interest in visibility derives from its relationship to social control.

when issue-related communication is frequent.²

Structural Similarity

Consider an actor P who is aware of O's opinions on an issue but who is not cohesively joined to O in a communication network. For example, if the shortest communication path that connects these actors is a long path (i.e., goes through several other group members), then the structural cohesion of P and O is defined as negligible. Nevertheless, the salience of O's opinions for P may be founded on P's recognition that they occupy similar social positions (i.e., that their normative, material, or interpersonal circumstances in the social structure are similar). These positions may correspond to ubiquitous roles (father, physician, assembly-line worker), or to locally defined statuses (the leader of a gang, the resident of a particular neighborhood), or to positions in particular social networks (the central versus peripheral positions in a friendship network, the middle-manager positions in an organization).

Structural similarity may induce a competitive orientation in which P is attentive to O's opinions or behaviors that bear on P's status and interests (Burt 1987). Structural similarity may also be a basis of interpersonal solidarity (Dahrendorf 1959; Durkheim 1933; Hechter 1987) and identification:

P's identification with O can be established or maintained if P behaves, believes, and perceives as O does. Accordingly O has the ability to influence P, even though P may be unaware of this referent power. A verbalization of such power by P might be, "I am like O, and therefore I shall behave or believe as O does," or "I want to be like O, and I will be more like O if I behave or believe as O does." (French and Raven 1959, p. 162)

Because actors' initial orientations on issues are influenced by their definitions of the situation, the more similar are two actors' structural positions, the more similar their initial positions on issues are likely to be. By the same token, actors' initial orientations on is-

sues are more likely to be discrepant the more dissimilar are their structural positions. Furthermore, Festinger's (1950, 1954) theory of social comparison processes suggests that the *salience* of O's opinions for P is inversely related to the discrepancy between their opinions.

Differences of opinion on an issue take on additional social distance when they correspond to differences in actors' material and normative circumstances. The more dissimilar the structural positions of two actors are, the less the perceived salience of discrepant opinions. Hence, actors may not only attach more weight to similar opinions, but will attach even greater weight to opinions of actors who are in similar circumstances. Festinger (1954) argued that "if persons who are very divergent from one's own opinion . . . are perceived as different from oneself on attributes consistent with the divergence, the tendency to narrow the range of comparability becomes stronger" (p. 133).

The effects of structural similarity on interpersonal influence are contingent on interpersonal visibility. Structural similarity can establish salience, which encourages P to respond to O's opinion on an issue. However, not only must P be aware of O's opinion on the issue, P must *also* be aware of their structural similarity. Without information about O's social position, P may not attach particular salience to O's displayed opinions.

Interpersonal communication can mediate the effects of structural similarity on interpersonal influence in two ways. In the absence of other media that convey information to P about O's structural position and opinions, P is more likely to possess such information the more frequently P and O communicate about an issue. Hence, the effects of structural similarity may be contingent on communication when communication determines the relevant interpersonal visibilities. Moreover, the effects of structural similarity may also be transmitted by communication when actors' structural similarity determines their probability of interpersonal communication on an issue.

Early work on structural similarity emphasized the density of interpersonal ties among the occupants of a shared position (Breiger 1976; White, Boorman, and Breiger 1976). Recent work has de-emphasized the importance of the structural cohesion between occupants

² Opinion adjustments may occur in the absence of definite information on other actors' opinions (i.e., actors in cohesive groups may use estimates of each other's positions on an issue when forming their initial opinions).

of a shared position (Borgatti and Everett 1992; Burt 1987). With respect to effects of structural similarity on interpersonal influence, this recent de-emphasis on a position's internal cohesion appears justified only if information diffusion is independent of structural cohesion (e.g., information is acquired from mass media).

Structural Centrality

An extensive literature indicates that an actor's structural centrality in a communication network contributes to the actor's social power. The typical social organization of a network is the center-periphery pattern. This pattern consists of (1) a subset of relatively central prestigious actors who are connected by direct or short indirect communication channels, and (2) a subset of peripheral actors who are more directly connected to the central actors than to other peripheral actors. Such a social organization suggests that an actor P is more influenced by a centrally located O than by a peripheral O, regardless of P's degree of centrality.

Structural centrality provides a basis of interpersonal salience and visibility. Central actors more readily acquire information resources (Raven 1965) that allow their opinions to become influential than do peripheral actors. In comparison to peripheral actors, central actors are not only likely to have more numerous or shorter communication channels for conveying their opinions, but also, on any given issue are likely to be more active in utilizing these channels (French and Snyder 1959). Thus, network centrality is a *hybrid* condition that combines a point attribute of O (O's information resources) with features of the network relationship between O and P. Assuming a center-periphery pattern, central actors tend to be resourceful and cohesively joined to other actors.

The effects of centrality may or may not reinforce the effects of structural similarity. In the case of two central actors, because their positions are likely to be similar, the similarity and centrality effects are reinforcing. However, in the case of a central and peripheral actor, the effects are countervailing. The peripheral actor may dismiss the opinions of a central actor because of the difference in their social positions (the similarity effect), yet also be swayed by the information that the central actor marshals in support of his or her opinion.

As with structural cohesion and similarity, effects of structural centrality on interpersonal influence will be contingent on issue-related communication to the extent that such communication determines the visibility of O's opinions on an issue to P. Moreover, frequent issue-related communication fosters salience, which encourages P to respond to O's opinion on an issue. Without an awareness of the information underlying O's opinion, P can respond to O only on the basis of O's displayed opinions.

METHODS

The data come from a longitudinal case study of the resolution of an issue confronting the teaching staff of a small ($N = 23$) public elementary school in California (Pollock 1991). California's Department of Education requires the staff of public schools to establish criteria for evaluating their school's performance. The present study examines the interpersonal influences that developed among the teachers while establishing these criteria.

Teachers' physical isolation when in the classroom and their professional norms of autonomy, privacy, and equality dampen interpersonal influences. Heterogeneous interpersonal influences among teachers are most likely to emerge when they are under pressures to achieve consensus on an important issue. In general, the effects of power bases on interpersonal influences may be weak if actors are not engaged in an issue and are under no pressure to consider the opinions of others. The issue under examination was viewed as important by most of the teachers—75 percent indicated they were "interested" or "very interested" in the issue, and 60 percent indicated they felt a "moderate" or a "considerable" amount of pressure to reach consensus on the issue.³

³ These findings are based on two questions: "How interested are you in the process of developing the School Accountability Report Card here at . . . School? Please place yourself on a scale of 1 to 5" (1 = Not interested at all; 2 = Not very interested; 3 = Somewhat interested; 4 = Interested; 5 = Very Interested). "How strongly do you *feel pressured* to reach consensus on this issue? Please place yourself on a scale of 1 to 5" (1 = Feel no pressure; 2 = Feel a little pressure; 3 = Feel a moderate amount of pressure; 4 = Feel considerable pressure; 5 = Feel a great amount of pressure).

Data were collected in two waves. Teachers were surveyed at the beginning of the school year, prior to any formal discussions about the issue. This initial questionnaire solicited social structural information about the teachers, including their relations of interpersonal communication and power. Three months later, a follow-up questionnaire was administered that included some of the same items as the first questionnaire as well as additional items dealing with teachers' issue-related communications and influences. Four of the teachers declined to participate in the study, but all teachers who participated in the first wave also participated in the second wave.

Dyads are the unit of analysis. The theoretical rationale for using dyads is straightforward whenever, as in the present situation, dyadic outcomes (i.e., actors' communications or influences with particular other actors) are not reducible to individual-level variables. If the influences of each actor were identical, then a single influence score for each actor would describe the variation in dyadic-level influences among all the actors. However, actors' direct influences on other actors are heterogeneous. Hence, the dyad is the proper unit of analysis for examining the magnitude of one actors' direct influence on another. A similar argument applies for the frequency of communication between two actors. The 19 respondents provided information about their relations with each of the other 22 teachers, yielding 418 dyads for this analysis.

Issue-Related Influence and Communication

A direct measure of interpersonal influence is the magnitude of the acknowledged or felt interpersonal influence of actor O on actor P from P's perspective (i.e., P is the recipient of the influence). The measure of *interpersonal influence* is based on a question in the second wave, three months after the respondents had provided the data on power bases. With respect to the criteria for evaluating school performance that had been under discussion among the faculty, each teacher was asked:

Please rate the faculty members according to how much each faculty member has influenced you to date in the development of your own opinion on this issue? "0" means that person has had no influence; "100" means that person has had a great deal of influence.

March (1957) and Simon (1957) viewed interpersonal influence as a causal effect, and this is my predilection as well. Obtaining an objective measure of the direct (i.e., unmediated) effect of one actor on another is an intractable problem in field settings in which overt changes in actors' opinions are the net result of many variables that may include the influences of significant others. However, it can be argued that interpersonal influence is a predominately subjective relation and, thus, can be measured on this basis. Burt (1977) described the subjective approach: "A manifestation of the distribution of power in a system of actors will be the network of influence and deference relations among actors in the system. Actor B is influenced by, defers to, actor A if B perceives A as being powerful relative to himself. The influence of one actor over another is the perception by the subordinate of the greater relative power of the superior" (p. 254).

At the time the data on issue-related interpersonal influence were collected, data were also collected on the frequency of *issue-related communications* among the faculty:

Please rate the faculty members according to how much discussion you have had about the School Accountability Report Card? "0" indicates no discussion; "100" means that you have often discussed this issue.

Five Elementary Bases of Interpersonal Power

French and Raven (1959) described interpersonal power as typically involving one or more of five elementary bases:

Normally, the relation between O and P will be characterized by several qualitatively different variables which are bases of power. Although there are undoubtedly many possible bases of power which may be distinguished, we shall here define five which seem especially common and important. These five bases of O's power are: (1) reward power, based on P's perception that O has the ability to mediate rewards for him; (2) coercive power, based on P's perception that O has the ability to mediate punishments for him; (3) legitimate power, based on the perception by P that O has a legitimate right to prescribe behavior for him; (4) referent power, based on P's identification with O; (5) expert power, based on the perception that O has some special knowledge or expertise. (pp. 155-56)

To obtain measures of these bases for each dyad, the teachers were given a roster of the teaching staff on which they checked off the names of persons who controlled a particular base of interpersonal power:

Reward power. Please check off faculty members who have the *ability to provide you with rewards*. Rewards include providing positive benefits and removing or decreasing negative circumstances.

Coercive power. Please check off faculty members who have the *ability to punish* you for not conforming to their attempts to influence you.

Legitimate power. Please check off faculty members who have a *legitimate right to influence* you and whose influence you have an obligation to accept.

Referent power. Please check off faculty members with whom you *identify* (or have a feeling of oneness).

Expert Power. Please check off faculty members who have *general expertise* on school related issues.

From the teachers' responses to these items, five matrices were constructed, where

$B_k = [b_{ij(k)}]$ is the matrix of responses for power base k , and $b_{ij(k)} = 1$ if actor i reports that j controls the base (e.g., i identifies with j), and $b_{ij(k)} = 0$ otherwise.

Measures of the Structural Bases of Power

Measures of each actor's structural cohesion, similarity, and centrality in the school's communication network were derived from a matrix of scores indicating the strength of interpersonal ties, $R = [r_{ij}]$. The scores were based on three standard indicators of communication ties: discussion, advice-seeking, and friendship.⁴ As I found in other work (Friedkin 1990b), these relations form a Guttman scale. I then constructed a measure of the strength of an interpersonal tie (r_{ij}) by summing the number of relations claimed by a respondent and dividing by three: r_{ji} was set to r_{ij} when actor i was a

respondent and actor j was a nonrespondent; $r_{ij} = 0$ when both actors were nonrespondents.

Structural cohesion. Luce and Perry's (1949) definition of a cohesive group as a maximally complete subgraph of a network initiated a line of research on structural cohesion. However, this initial definition did not allow for incomplete cohesive networks. Nearly 40 years of work on structural measures of cohesion has produced a variety of measures characterizing different features of networks. Although many of these measures assign actors to discrete categories, a continuous measure of a dyad's structural cohesion is desirable, especially when subgroup boundaries are amorphous or features of actors' structural connections are finely graded. I employ *access*, a continuous measure of cohesion that (1) incorporates information on the strength, length, and number of communication paths that join two actors and (2) allows cohesively connected actors to have weak ties or no direct ties to each other (Friedkin 1983, 1990a). I replicated the analyses using two other continuous measures of structural cohesion: *tie strength* and *clique co-memberships*—a count of the number of cliques in which the two actors share membership (Seidman and Foster 1978). None of the results change substantially.⁵

The theoretical rationale of the access measure is based on the contributions of network structure to interpersonal flows:

It seems plausible that in interpersonal flows of most any sort the probability that "whatever it is" will flow from person i to person j is (a) directly proportional to the number of all-positive (friendship) paths connecting i and j ; and (b) inversely proportional to the length of such paths (e.g., one is more likely to be influenced by a friend than by the friend-of-a-friend and even less likely by a friend-of-a-friend-of-a-friend). (Davis 1968, p. 549)

Along these lines, structural cohesion for a pair of actors is equated with the probability of a flow of events between them:

⁴ The items were: Check off names of persons with whom you tend to discuss issues that arise here at school; check off the names of persons whom you would go to for advice on issues that arise here at school; and check off the names of persons who you consider your friends.

⁵ The major difference concerned the precise degree to which issue-related communication mediates the effects of structural centrality and similarity on issue-related influence. However, mediation is substantial for all measures—approximately 40 percent or more of the total effect of the structural bases of power is mediated by issue-related communication.

$$\alpha_{ij} = 1 - (1 - \rho_{ij}) \prod_{k=1}^N (1 - \rho_{ik}\rho_{kj}) \quad (1)$$

$i \neq j \neq k,$

where $\rho_{ij} = r_{ij} / \sum_j r_{ij}$ is the relative strength of an interpersonal tie. The mathematical form of the measure is derived as follows. If ρ_{ij} is the probability of a flow from j to i , then $1 - \rho_{ij}$ is the probability that a direct flow will not occur, and $1 - \rho_{ik}\rho_{kj}$ is the probability that a two-step flow will not occur from j to i via k . Hence, $1 - \alpha_{ij}$ is the probability that a flow will not occur either directly or indirectly, and α_{ij} is the probability of at least one such flow.⁶

Structural similarity. Social structural similarity is the similarity of actors' profiles of network relations. The most restrictive definition of similarity defines two actors as *structurally equivalent* if, and only if, they have similar relations with the same actors (Lorrain and White 1971). Generalizations of the early restrictive definition of structural similarity have been vigorously pursued and many alternative measures have been developed (Borgatti and Everett 1992). Unfortunately, there is little consensus on (1) which measure of structural similarity is preferable in particular circumstances, and (2) which interpersonal relations should enter into the construction of a measure.

I rely on a measure of structural equivalence rather than on a measure of general (i.e., regular or automorphic) equivalence. Standard measures of general equivalence were not related to issue-related communication or influence in these data. The measure of structural equivalence that I employ defines two actors as similar to the extent that they have the same profile of tie-strengths to and from other actors in the network. The measure is computed by stacking the tie-strength matrix on its transpose and computing the Pearsonian product-moment correlation for each pair of columns, ignoring cross-product entries on the main diagonals. I replicated the analyses using other measures, including the *Jaccard* and *simple-matching* coefficients described by Sneath and Sokal

(1973), as well as the measure proposed by Burt (1987). The results are sensitive to the choice of measure in that certain effects of similarity do not appear using some of the alternative measures.⁷

Centrality. Many centrality measures have been proposed and assessed since the seminal work of Bavelas (1948). Most of these measures apply only to symmetric networks, ignore variation in tie-strengths, or are constructed on a subset of communication paths (usually the shortest paths) that join actors. Recently, I proposed several more general measures that consider the number, length, and strength of paths in a network (Friedkin 1991). The measures are strongly intercorrelated in these data. I use the *TEC* measure, which is an eigenvector of the standardized tie-strength matrix, $R^* = [r_{ij}^*] = r_{ij} / \sum_j r_{ij}$. The measure is closely related to Bonacich's (1972) eigenvector approach, Coleman's (1973) measure of power, and Burt's (1982) measure of prestige. By this measure, actors are structurally central to the extent that they are strongly tied to other central actors.⁸

Formal Model

With the dyad as the unit of analysis, the task is to predict the amount of interpersonal influence that P accords O. A simple causal model, shown in Figure 1, guides the analysis. The model asserts that issue-related interpersonal influence is affected by the frequency of issue-related communication and power bases involved in the dyad. The model asserts that the frequency of issue-related communication mediates the effects of the elementary (French-Raven) and structural power bases on interpersonal influ-

⁷ The results for the Pearsonian correlation and simple-matching measures are the same, but the results for the Jaccard and Burt measures differ from the Pearsonian-correlation measure in indicating no effects of similarity on issue-related communication and influence.

⁸ I replicated the analyses using Freeman's (1979) measures of degree, closeness, and betweenness centrality. These measures, which assume a symmetrical binary matrix, were computed on the symmetrized matrix of tie-strengths in which all nonzero entries had been set to one. No effects of structural centrality on issue-related communication and influence appeared using these measures.

⁶ This model assumes that the number of interpersonal connections based on paths of three-steps or longer make no contribution to the probability of a flow. This assumption could be relaxed, although considerably more analytical complexity would be introduced. Friedkin's (1983) evidence supported this assumption with respect to information flows.

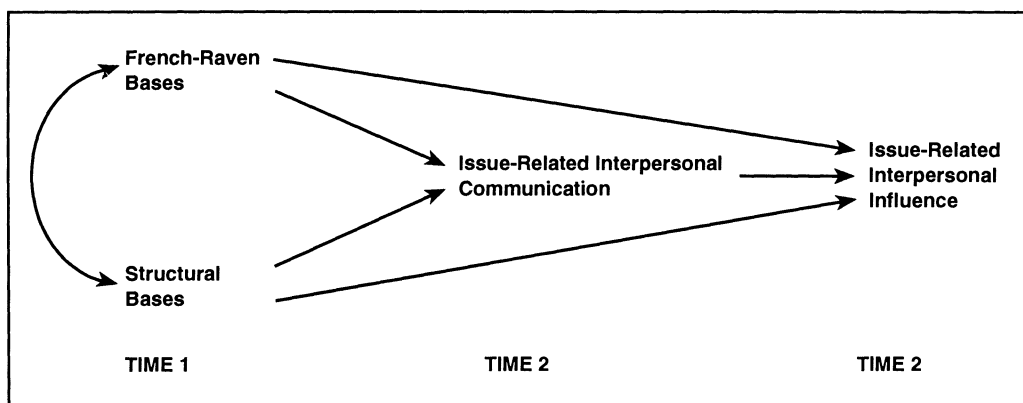


Figure 1. Model of Relationship Between Bases of Interpersonal Power, Communication, and Influence

ence.⁹ The intercorrelations, means, and standard deviations for the variables involved in this model are reported in the Appendix.

Ordinary least squares regression was used to estimate the relevant equations. Regression diagnostics on these equations called for no remedial action. The hard-to-detect and potentially misleading effects of network autocorrelation on standard tests of statistical significance were addressed using the randomization test proposed by Smouse, Long, and Sokal (1986; also see Krackhardt 1988).¹⁰

⁹ Power bases and issue-related communication may interact such that the effects of structural cohesion, similarity, and centrality on issue-related influence increase with the frequency of issue-related communication. Due to collinearity among the measures, I was not able to address the occurrence of such interactions.

¹⁰ This nonparametric approach involves (1) residualizing variables as is done when computing a partial association and (2) conducting a QAP test on pairs of the residualized variables. (The slope of the plot of two such residualized variables equals the magnitude of the regression coefficient for the independent variable.) The QAP test assesses the likelihood that the partial association between the dependent variable and an independent variable arises from a random assignment of scores to individuals. A Monte Carlo method constructs the sampling distribution for the partial association by repetitively permuting the rows and columns of one of the residualized variables. Because it is a permutation test, this test of significance has a valid application in nonprobability samples. The test also is less biased in the presence of violations of independence than is the standard OLS test of significance.

FINDINGS

Model 1 of Table 1 reports the findings for a regression of issue-related interpersonal communication on the structural and French-Raven power bases. The results indicate that each of the three structural bases, along with referent power, have significant positive effects on the frequency of issue-related communication. Separate analyses (not shown) indicate that, while the effects of structural centrality and similarity on issue-related communication are independent of the French-Raven power bases, the "effect" of cohesion on issue-related communication is substantially larger without French-Raven controls than with such controls.¹¹

The primary structural determinant of the frequency of issue-related communication is network cohesion, which accounts for nearly as much of the variance in frequency of communication as is explained by the three structural variables in combination. Among the

For this reason, many network analysts employ the test in analyses of dyads and other interdependent units.

¹¹ Controlling only for structural power bases, the partial associations of the structural bases with issue-related communication are .097, .224, and .102 for centrality, cohesion, and similarity respectively, and are significant at $p < .05$ (one-tailed test). Regressing issue-related communication on the three structural bases, the regression coefficients for centrality, cohesion, and similarity are 1.444, 1.064, and 0.124 respectively. Approximately 16 percent of the variance is explained.

French-Raven power bases, referent power is the primary determinant of the frequency of issue-related communication. The zero-order correlation of .567 between structural cohesion and referent power is among the strongest correlations among the power base variables. Hence, these findings suggest that social cohesion, broadly construed as including actors' structural contexts and their sentimental attachments, is a key factor explaining the frequency of actors' communications on specific issues.

Table 1. Ordinary Least Squares Coefficients for the Regression of Frequency of Issue-Related Communication on Power Base Variables (Model 1) and the Regression of Issue-Related Influence on Power Base and Frequency of Communication Variables (Models 2 and 3)

Independent Variable	Frequency of Interpersonal Communication	Interpersonal Influence	
	Model 1I	Model 2	Model 3
Constant	-.015 (-.537)	-.039 (-1.232)	-.029 (-1.127)
Frequency of interpersonal communication	—	—	.662*** (14.264)
<i>French-Raven Bases of Power</i>			
Coercive power	.070 (1.592)	.038 (.745)	-.009 (-.211)
Legitimate power	-.054 (-1.719)	.012 (.341)	.048 (1.624)
Referent power	.127*** (4.181)	.083* (2.390)	-.001 (-.026)
Reward power	-.030 (-1.203)	.011 (.383)	.031 (1.315)
Expert power	.017 (.704)	.047 (1.662)	.035 (1.534)
<i>Structural Bases of Power</i>			
Centrality in network	1.782* (2.410)	2.145* (2.529)	.966 (1.383)
Cohesion of network	.577* (2.176)	.634* (2.082)	.252 (1.006)
Similarity of network position	.128* (2.175)	.171* (2.522)	.086 (1.541)
Number of dyads	418	418	418
R ²	.203	.214	.475

* $p < .05$ ** $p < .01$ *** $p < .001$ (one-tailed test)

Note: Statistical significance is assessed using a randomization test (Smouse et al. 1986). The numbers in parentheses are ordinary least squares t -statistics.

Models 2 and 3 of Table 1 have interpersonal influence as the dependent variable. Model 2 in Table 1 regresses issue-related interpersonal influence on the power bases. The pattern of findings is the same as that for issue-related communication: Structural bases of power, along with referent power have significant positive total effects on issue-related interpersonal influence. Separate analyses (not shown) indicate that the effects of structural centrality and similarity on interpersonal influence are independent of the French-Raven power bases, and that the "effect" of cohesion on interpersonal influence is substantially larger without French-Raven controls than with such controls.¹² Hence, the significant total effect of cohesion on influence, net of French-Raven bases, may be underestimated if structural cohesion affects those French-Raven bases that have positive direct effects on interpersonal communication or influence. Referent power is the most likely candidate, given its observed effects on communication and influence and its plausible reciprocal relationship with structural cohesion.

Model 3 in Table 1 adds frequency of issue-related communication to the regression in Model 2. The frequency of issue-related communication has a substantial effect on interpersonal influence and mediates the effects of the structural bases of power.¹³ The total ef-

¹² Controlling only for structural power bases, the partial associations of the structural bases with issue-related influence are .132, .218, and .133 for centrality, cohesion, and similarity respectively, and are significant at $p < .05$ (one-tailed test). Regressing issue-related influence on the three structural bases, the regression coefficients for centrality, cohesion, and similarity are 2.229, 1.172, and 0.185 respectively. Approximately 19 percent of the variance is explained.

¹³ Individuals communicate with persons whom they consider influential; hence, they communicate with persons who have a *pre-existing* basis of interpersonal power (the power bases were measured prior to the occurrence of issue-related communication and influence). If, in addition, individuals seek to communicate with persons who are influential *on the issue*, then the estimated effect of issue-related communication on influence may be inflated. Such misspecification is probably slight given the inclusion of a control for expert power, unless individuals' general expertise is independent of their issue-related expertise.

fects of structural centrality, cohesion, and similarity on interpersonal influence are reduced by 50 percent or more when frequency of issue-related communication is added to the model. Issue-related communication also completely mediates the significant total effect of referent power on interpersonal influence.

DISCUSSION

The longitudinal design of this study permits a relatively straightforward assessment of the extent to which the frequency of issue-related interpersonal communications and influences are shaped by previously existing relational power bases. In recent work, structural theorists have neglected the classical foundations of social power (coercion, authority, expertise, etc.) while advancing claims for the effects of network structure on patterns of influence. The present study provides some support for structuralist claims and elucidates the mechanisms by which structural conditions can affect actors' interpersonal influences. The findings indicate significant effects of structural bases of power on issue-related interpersonal influence independent of French-Raven bases of power. Furthermore, the frequency of issue-related communication is an important factor mediating structural effects.

Broad effects of French-Raven and structural bases of power on interpersonal influence have been documented in a small groups (experimental and natural) and in various organizations. However, the *mechanisms* underlying these structural effects are problematic. In the present data, the effects of structural variables on interpersonal influence are linked with the frequency of issue-related communication, but the structural variables do not *necessarily* always entail this link. This link holds among actors who have developed a network of interpersonal communications on an issue (i.e., a network that conveys information about actors' opinions and comprises various frequencies of interpersonal communication).

Frequent issue-related communication provides the visibility and salience of O's opinion on an issue for P. Hence, if the visibility and salience of opinions are obtained by other means (e.g., actors' locations in a formal hierarchy of authority, mass media), then frequent interpersonal communication on an issue may

not be a significant factor explaining interpersonal influence. Moreover, even if visibility of an opinion arises from interpersonal communication, such communication need not mediate the effects of structural power bases—a network of heterogeneous communications seems crucial. Consider an issue that is settled in a single brief meeting of a group at which each member voices an opinion on the issue. Although the relative influence of displayed opinions may be affected by actors' structural bases of power, these influences cannot be affected by the *frequency* of interpersonal communication, which in this example is invariant.

The magnitude of the effects of structural bases of power on interpersonal influence probably depends on the issue. Although interpersonal influence is always contingent on visibility, the salience of O's opinion for P may be established more or less easily. In the case of an hysterical contagion (Kerckhoff, Back, and Miller 1965), visibility can produce high salience. Salience also may be readily established for technical innovations among actors who have a competitive or professional interest in improving performance. When detailed information about an issue is pertinent and social exchanges (e.g., bargaining and compromise) are likely, the resource bases of actors and their issue-related communications may be important components of the structural effects on interpersonal influence.

These data do not allow an examination of antecedents and effects of interpersonal visibility. Although strong effects of network structure on interpersonal visibility are likely, it is not clear how visibility is determined by the different structural variables. My work (Friedkin 1983) indicates that interpersonal visibility is predicted by structural cohesion, but I do not address the separate contributions of cohesion, similarity, and centrality. Furthermore, it is not clear whether visibility has a significant effect on issue-related influence independent of actors' power bases and issue-related communications. Visibility alone may not induce a high level of interpersonal influence. However, as a contingency of influence, visibility is probably involved in important interactions with actors' resources and structural conditions. These interactions should be explored.

An understanding of the foundations of structural effects on interpersonal influence in-

volves distinguishing among variables that have close theoretical relationships. A prime example is cohesion, which may be treated as a multidimensional phenomenon entailing structural relations (structural cohesion), affective relations (referent power), and frequent interpersonal communications on important issues. Centrality also may be treated as a multidimensional phenomenon entailing various French-Raven power bases and structural cohesion. Finally, similarity can be broadly construed as two actors' profile similarity across all variables that affect interpersonal influence. Integrating variables into more inclusive scales or employing single variables as indicators of blocks of effects may be useful especially if the theoretical foundation of such scales and indicators is clear. Controversy over the interpretation of different structural indicators can only be resolved by empirical work on the origins of the correlations between structural characteristics and outcomes.

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REFERENCES

- Bavelas, Alex. 1948. "A Mathematical Model for Group Structures." *Human Organization* 7:16-30.
- Bonacich, Phillip. 1972. "Factoring and Weighting Approaches to Status Scores and Clique Identification." *Journal of Mathematical Sociology* 2:113-120.
- Borgatti, Stephen P. and Marton G. Everett. 1992. "Notions of Position in Social Network Analysis." Pp. 1-35 in *Sociological Methodology*, edited by P. V. Marsden. Oxford, England: Basil Blackwell.
- Breiger, Ronald L. 1976. "Career Attributes and Network Structure: A Blockmodel Study of a Biomedical Research Specialty." *American Sociological Review* 41: 117-35.
- Burt, Ronald S. 1977. "Power in a Social Topology." Pp. 251-334 in *Power, Paradigms, and Community Research*, edited by R. J. Liebert and A. W. Immershein. Beverly Hills, CA: Sage.
- . 1982. *Toward a Structural Theory of Action*. New York: Academic Press.
- . 1987. "Social Contagion and Innovation: Cohesion Versus Structural Equivalence." *American Journal of Sociology* 92:1287-1335.
- Cartwright, Dorwin. 1965. "Influence, Leadership, Control." Pp. 1-47 in *Handbook of Organizations*, edited by J. G. March. Chicago, IL: Rand McNally.
- Coleman, James S. 1973. *The Mathematics of Collective Action*. Chicago, IL: Aldine.
- Dahrendorf, Ralf. 1959. *Class and Class Conflict in Industrial Society*. Stanford, CA: Stanford University Press.

Appendix. Intercorrelations, Means, and Standard Deviations for Variables Used in the Analysis

Variable	Intercorrelations										
	Mean	S.D.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Issue-related influence	.190	.278	—	—	—	—	—	—	—	—	—
(2) Issue-related communication	.160	.241	.653	—	—	—	—	—	—	—	—
(3) Coercive power	.067	.250	.093	.105	—	—	—	—	—	—	—
(4) Legitimate power	.177	.382	.195	.094	.152	—	—	—	—	—	—
(5) Referent power	.278	.448	.321	.345	.048	.342	—	—	—	—	—
(6) Reward power	.361	.481	.212	.133	.137	.317	.390	—	—	—	—
(7) Expert power	.459	.499	.278	.212	.099	.277	.276	.236	—	—	—
(8) Structural centrality	.043	.019	.329	.295	.040	.200	.273	.256	.404	—	—
(9) Structural cohesion	.084	.063	.405	.385	.174	.318	.567	.386	.418	.593	—
(10) Structural similarity	.171	.197	.258	.227	.068	.197	.231	.150	.219	.168	.382

Note: N = 418.

- Davis, James A. 1968. "Social Structures and Cognitive Structures." Pp. 544-50 in *Theories of Cognitive Consistency: A Sourcebook*, edited by R. Abelson, E. Aronson, W. McGuire, T. M. Newcomb, M. Rosenberg and P. Tannenbaum. Chicago, IL: Rand McNally.
- Durkheim, Emile. 1933. *The Division of Labor in Society*. New York: The Free Press.
- Emerson, Richard M. 1962. "Power-Dependence Relations." *American Sociological Review* 27: 31-40.
- Festinger, Leon. 1950. "Informal Social Communication." *Psychological Review* 57: 271-82.
- . 1954. "A Theory of Social Comparison Processes." *Human Relations* 7: 117-40.
- Freeman, Linton C. 1979. "Centrality in Social Networks: Conceptual Clarification." *Social Networks* 1:215-39.
- French, John R. P., Jr. and Bertram Raven. 1959. "The Bases of Social Power." Pp. 150-67 in *Studies of Social Power*, edited by D. Cartwright. Ann Arbor, MI: Institute for Social Research.
- French, John R. P., Jr. and Richard Synder. 1959. "Leadership and Interpersonal Power." Pp. 118-49 in *Studies of Social Power*, edited by D. Cartwright. Ann Arbor, MI: Institute for Social Research.
- Friedkin, Noah E. 1982. "Information Flow Through Strong and Weak Ties in Intraorganizational Social Networks." *Social Networks* 3: 273-85.
- . 1983. "Horizons of Observability and Limits of Informal Control in Organizations." *Social Forces* 62: 54-77.
- . 1984. "Structural Cohesion and Equivalence Explanations of Social Homogeneity." *Sociological Methods and Research* 12: 235-61.
- . 1990a. "Social Networks in Structural Equation Models." *Social Psychology Quarterly* 53: 316-28.
- . 1990b. "A Guttman Scale for the Strength of an Interpersonal Tie." *Social Networks* 12: 239-52.
- . 1991. "Theoretical Foundations for Centrality Measures." *American Journal of Sociology* 96: 1478-1504.
- Granovetter, Mark S. 1973. "The Strength of Weak Ties." *American Journal of Sociology* 78: 1360-80.
- . 1982. "The Strength of Weak Ties: A Network Theory Revisited." Pp. 105-30 in *Social Structure and Network Analysis*, edited by P. V. Marsden and N. Lin. Beverly Hills, CA: Sage.
- Harary, Frank, Robert Z. Norman, and Dorwin Cartwright. 1965. *Structural Models: An Introduction to the Theory of Directed Graphs*. New York: Wiley.
- Hechter, Michael 1987. *Principles of Group Solidarity*. Berkeley, CA: University of California Press.
- Heider, Fritz. 1958. *The Psychology of Interpersonal Relations*. New York: Wiley.
- Kerckhoff, Alan C., Kurt W. Back, and Norman Miller. 1965. "Sociometric Patterns in Hysterical Contagion." *Sociometry* 28: 2-15.
- Krackhardt, David. 1988. "Predicting with Networks: Nonparametric Multiple Regression Analysis of Dyadic Data" *Social Networks* 10: 359-81.
- Lorrain, Francis P. and Harrison C. White. 1971. "Structural Equivalence of Individuals in Social Networks." *Journal of Mathematical Sociology* 1: 49-80.
- Luce, R. Duncan and Albert Perry. 1949. "A Method of Matrix Analysis of Group Structure." *Psychometrika* 14: 95-116.
- March, James G. 1957. "Measurement Concepts in the Theory of Influence." *Journal of Politics* 19: 202-26.
- Marsden, Peter V. and Noah E. Friedkin. 1993. "Network Studies of Social Influence." *Sociological Methods and Research* 22: 125-49.
- Merton, Robert K. 1968. *Social Theory and Social Structure*. New York: Free Press.
- Mizruchi, Mark S. 1990. "Cohesion, Structural Equivalence, and Similarity: An Approach to the Study of Corporate Political Power." *Sociological Theory* 8: 16-32.
- Newcomb, Theodore. M. 1953. "An Approach to the Study of Communicative Acts." *Psychological Review* 60: 393-404.
- Pollock, Dolores E. 1991. "Coming to Consensus in Schools." Ph.D. dissertation, Graduate School of Education, University of California, Santa Barbara, CA.
- Raven, Bertram. H. 1965. "Social Influence and Power." Pp. 371-82 in *Current Studies in Social Psychology*, edited by I. D. Steiner and M. Fishbein. New York: Holt, Rinehart, and Winston.
- Rosenberg, Morris. 1968. *The Logic of Survey Analysis*. New York: Basic Books.
- Seidman, Stephen B. and Brian L. Foster. 1978. "A Graph-Theoretic Generalization of the Clique Concept." *Journal of Mathematical Sociology* 6: 139-54.
- Simmel, Georg. 1950. *The Sociology of Georg Simmel*. New York: Free Press.
- Simon, Herbert A. 1957. *Models of Man*. New York: Wiley.
- Smouse, Peter E., Jeffrey C. Long, and Robert R. Sokal. 1986. "Multiple Regression and Correlation Extensions of the Mantel Test of Matrix Correspondence." *Systematic Zoology* 35: 627-32.
- Sneath, Peter H. A. and Robert R. Sokal. 1973. *Numerical Taxonomy*. San Francisco, CA: W. H. Freeman.
- White, Harrison C., Scott A. Boorman, and Ronald L. Breiger. 1976. "Social Structure from Multiple Networks. I: Blockmodels of Roles and Positions," *American Journal of Sociology* 81: 730-81.