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Formal Structure as a Constraint on Interaction within Organizations

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ABSTRACT

In contrast to existing theories of organizations that stress the vertical control of intraorganizational interaction, a structural perspective is discussed that emphasizes the networks of social interaction that develop horizontally and diagonally, as well as vertically, across the organization. As an example of this perspective, the effects of the hierarchical arrangement of positions, both in terms of the unequal number of individuals in vertical levels and in terms of the differential allocation of resources across vertical levels, is hypothesized to lead to differential rates of interaction across the organization. These effects of structural differentiation on networks of interaction are tested in a public bureaucracy, and the implications of differentiation for the formation of networks of interaction and resulting collective actions such as coalition formation are discussed.

Social interaction is a core process in the creation and maintenance of organizations. Interaction, and the resulting social ties between individuals, provides a vehicle for perceiving common interests and taking collective action around joint problems. For some time, social researchers have appreciated the importance of considering the networks of interaction within social groupings such as the small group (Bavelas, 1950; Guetzkow and Simon, 1955; Leavitt, 1951), the neighborhood (Fischer, 1981; Granovetter, 1973; Wellman, 1979), the community (Laumann, 1973; Laumann et. al., 1978) or aggregates of interlocked organizations (Aldrich and Whetten, 1981; Galaskiewicz, 1985). However, most organizational theorists and researchers studying intraorganizational processes have tended to view the allocation of hierarchical authority as specifying interactions among individuals; consequently they have emphasized the constraining effects of the vertical authority relationships embodied in the formal structure (e.g., Thompson, 1967; Weber, 1947; Williamson, 1975). There has been a resulting gap in theory that would explain the likelihood of the formation of networks of interaction that occur horizontally and diagonally, as well as vertically, within and across departmental boundaries within the organization.

These intraorganizational networks may have dramatic impacts on the organization. Such networks can lead to collective action and organizational change. Although theorists have discussed collective action in the organization, usually characterizing this action in terms of the actions of coalitions (Cyert and March, 1963) or a dominant coalition (Thompson, 1967), there has been little theoretical or empirical work predicting when, how, or why interaction that could lead to collective action, such as coalition formation, would take place across the organization (Stevenson et al., 1985).

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In this paper an explanation of the formation of networks of interaction and the likelihood of collective action within organizations is proposed based on a structural perspective. This perspective is structural in two senses. First, the primacy of formal structure for conditioning interaction across as well as within the functional boundaries of the organization is emphasized. (Formal structure is defined as the organizationally prescribed positions usually identified on an organization chart.) Thus, it is assumed that patterns of intraorganizational coordination are conditioned by the formal positions of participants, and structural differentiation of the organization into the vertical status hierarchy and functional groupings influence who is likely to interact with whom within the organization. Second, the perspective is structural in the sense of Blau's (1977) theory of structural differentiation. Blau (1977) emphasizes how differences in the relative number of individuals within social categories can result in differences in the likelihood of interaction between them. For example, as developed in some detail later in the paper, individuals at the upper levels of a hierarchical organizational structure will be likely to interact and take group action, under certain circumstances, for two reasons. First, occupying the upper rungs of the hierarchy bestows more resources on these individuals as compared to lower levels. This implies that the upper level employees would be desirable interaction partners among themselves as well desirable for those at other levels. At the same time, the hierarchical configuration of the organization results in there being fewer individuals occupying the top status and, by mathematical truism, the relative density of interactions within this smaller group must be higher than those of the lower positioned and larger groups. This greater relative density is more likely to lead to the formation of a reference group among those at the top compared to the

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lower levels (Rytina and Morgan, 1982) with associated emergent constraints on behavior and the ability to act as a group.

Here, structural constraints on networks of interaction are illustrated with data on interaction among individuals within a government bureaucracy. The impact on interactions of occupying vertically differentiated hierarchical positions and the effects of cross-cutting functional horizontal boundaries on the interactions within and among vertical status levels is considered. The implications of this perspective for analyzing collective action within organizations is then discussed.

ORGANIZATIONAL DESIGN AND INTERACTION ACROSS THE ORGANIZATION

It has long been acknowledged that interaction within organizations is not restricted to vertical formal reporting relationships. Theories and research on interaction outside of the vertical chain of command range across a wide gamut of perspectives. Two broad theoretical traditions, the classical management perspective and the rational model of organizations form the basis for much of the theorizing about intraorganizational interactions and provide a contrast to the structural perspective taken here.

Classical Management. The first systematic attempts to theorize about the control of interaction within the organization were taken by classical management theorists and Max Weber, writing contemporaneously in the early 1900s. Classical management (Gulick and Urwick, 1937) and the bureaucratic organization perspective (Weber, 1947) are similar in their emphasis on the vertical control of work through formal rules and hierarchical structure. Classical management theorists, many of whom were organizational managers, responded to the growth of large and complex organizations at the turn of the century by developing principles of management such as limited spans of control for managers

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and clearly defined non-overlapping domains for functionally oriented departments. Weber, concerned with delineating rational modern bureaucracy from more traditional forms of organizations, focused on the authority inherent in the hierarchical arrangement of positions in which the exercise of authority was ultimately legitimated in the laws of the larger society rather than by the traditional rule of the monarch.

Either of these theories of organizations is very managerially oriented, i.e., focused on vertical control, and together form the basis from which other theories have developed. Often, these newer theories have emphasized the conflicts that inevitably develop because the classical principles or hierarchical rules can not govern all interaction. Thus, Dalton (1950) pointed out that in contrast to the classical managerial assumption of non-overlapping jurisdictions, onflict between staff and line managers was inevitable and endemic to organizations since both line and staff managers could claim some legitimate jurisdiction over the same work flow. Others (e.g., Downs, 1967; Walton and Dutton, 1969; White, 1961) focused on the conflicts that develop as organizational units pursue their own sometimes conflicting, sometimes overlapping sub-goals.

The Rational Model. An alternative model of organizations, acknowledging the limitations of the incomplete and sometimes contradictory classical principles (Simon, 1946), grounded in the cognitive limitations of human decision makers --- but still emphasizing the vertical control of interaction --- was developed, beginning with Herbert Simon (1957; March and Simon, 1958) in the late 1940s. In this rational model, individuals have limited abilities to make decisions, and formal structures enable them to extend their cognitive abilities by dividing organizational problems into smaller and more manageable subproblems through the creation of organizational hierarchy. Thus, problems are made manageable for the limited

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cognitive abilities of decision makers by sealing them off in organizational units and relying on the vertical coordination of management to aggregate the solution of smaller problems into the solutions of larger problems of the organization. Disruption of the organization is limited by grouping units together which handle a specific problem and decoupling them from other organizational units (Simon, 1962). This "vertical slicing" of the organization is designed to minimize the potential destabilizing effects of rapid changes in one specialized part of the organization in response to organizational problems. Other parts of the organization, being relatively autonomous, would be insulated from the rapid change absorbed in the affected group of units.

The contingency theory variation on this model (Lawrence and Lorsch, 1967; Thompson, 1967; Woodward, 1965) emphasized the reduction of uncertainties through the creation of formal structures, with uncertainty being generated by the external environment and the technology of the organization. According to Thompson (1967), interaction and coordination across the organization can be solved by placing units together as contiguously as possible, whether physically next to each other or at least within some higher level grouping of units. Galbraith (1973,1977) proposed a variation of this model in which interaction across the organization is encouraged through formal coordination mechanisms that increase the flow of information and thus reduce uncertainty. Williamson (1975), expanded the rational model by conceiving of organizational structure as a vehicle for reducing the costs of transactions brought about due to individual limits on rationality and human opportunism, combined with organizational complexity, and a limited number of interaction partners (Williamson, 1975). According to Williamson (1975), occupants of more encompassing, higher level units control lateral interactions and make strategic decisions such as the allocation of resources.

As the foregoing indicates, theorists within Simon's rational model tradition, although more theoretical in outlook than those using the prescriptive classical management paradigm, still emphasize the vertical control of interaction across the organization. For example, Galbraith, when discussing lateral interaction, admits informal processes can arise spontaneously and "these processes are necessary but their use can be substantially improved by designing them into the formal organization" (1977:112). However, the few early descriptive studies of interaction that considered interaction outside of formal reporting relationships found a great deal of informal lateral interaction across the organization (Landsberger, 1961; Simpson, 1959; Wickesberg, 1968).

More recent research within the rational model tradition has emphasized the effects of task and environmental uncertainty on interactions across the organization, and has found that environmental and task uncertainty leads to decentralized subunits (Tushman, 1979) and a reliance on more informal coordination between subunits (Van de Ven and Delbecq, 1976). Units with the ability to reduce organizational uncertainty by control of strategic contingencies (Hinings et. al., 1974) or resources (Salancik and Pfeffer, 1974) are found to be more powerful within the organization and, by implication, more centrally located within networks of interaction. Thus, uncertainties are not completely controlled by the creation of formal units, and networks of interaction not entirely under formal control can often guide organizational action.

The Structuring of Interaction. Organizational theorists have tended to emphasize the vertical authority constraints on interaction among individuals rather than examining all ties across the organization. By contrast, a structural approach that emphasizes the constraints and resources attached to organizational positions and the effects of the pyramid shaped hierarchical structure on the likelihood of

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interaction among these unequal positions, provides a framework for analyzing the structuring of interactions within and across boundaries within the organization.

This structural approach, with a stress on networks of interaction, is similar to a social network perspective in that interaction is considered to include all ties across the organization, but differs from much of the existing social network literature. Many using the social network perspective tend to emphasize the consequences of network position rather than the social structural antecedents that constrain choice of network partners. Thus many network researchers emphasize how occupying a position in a network bestows advantages and disadvantages on individuals, regardless of social position. From this perspective, power is a function of network centrality (Brass, 1984), network position has little or no relationship to organizational position (Tichy, Tushman, and Fombrun, 1979), and roles such as "middleman" (Breiger and Pattison, 1978) or "sycophant" (Burt, 1976) are inferred from the network of interactions among actors. On the other hand, some network researchers have considered how choice within networks is constrained by social position. For example, Cook and her colleagues (Cook, 1982; Cook and Emerson, 1984; Cook et al., 1983) have conducted experiments showing how the individual outcomes of social exchange vary under alternative constraining patterns of interaction. The preeminence of network properties or social structural properties is not at issue here. Undoubtedly, there is reciprocal influence between network and social position and, under some conditions, network positions may define the social structure. Here, the importance of social structure in the form of formal organizational position on the likelihood of interaction is emphasized.

The effects of the vertical and horizontal boundaries created by formal structure on networks of interaction can be variable. Individual managerial decisions such as establishing a policy of centralized or decentralized decision making may

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affect the amount of vertical interaction within a department. Decentralized units, by definition, are units in which a great deal of lateral interaction across the organization at the lowest levels is encouraged as opposed to vertical formal coordination. Furthermore, at the organizational level, the organizational culture may encourage a great deal of informal interaction and the formation of temporary ad hoc groups to solve problems (Peters and Waterman, 1982) as opposed to creating formal units to focus interaction around problems. In addition, organizations may decouple some elements of formal structure from organizational activities. Thus, offices of occupational safety or affirmative action may be created to satisfy the institutional demands of the larger society, but these units may be isolated from the technical work of the organization (Meyer and Rowan, 1977).

Nonetheless, in most situations, the structuring of activity through formal structure has a strong influence on networks of interaction. For example, as previously discussed, those who study power within organizations often emphasize that, instead of individuals, it is subunits of the organization that deal with contingencies or acquire resources that have more influence in the organization. Thus the "focused organization of ties" (Feld, 1981) around crucial contingencies embodied in formal structure allows some members of the organization to claim more resources and, by implication, those occupying positions at the higher levels of the powerful units are influential representatives of the units in any organizational bargaining.

There are a variety of outcomes that are highlighted by this perspective. Given that those who interact more often are likely to perceive common interests beyond the immediate task situation, an analysis of which actors and units across the organization share common organizational problems and thus interact frequently can suggest who the potential coalition partners are in an organization. For

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instance, the creation of vertical levels of super and subordination may lead those at the uppermost levels to develop common perceptions of problems or "classwide rationality" (Useem, 1982) that might influence organizational actions. Furthermore, adding members to the existing organizational structure may alter the relative number of occupants of vertical and horizontal positions and thus alter the relative density of groupings of positions. For example, a small number of individuals at the top level of the organization would have a high relative density compared to the larger and lower category of members. Enlarging the top category, e.g., adding lots of vice presidents, would, ceteris paribus, reduce the relative density of interaction among those at the top and might reduce any existing constraining norms among the top actors that ultimately rest on high levels of interaction. Thus, occupying a position defined in terms of vertical status and horizontal grouping exerts constraints on the choice of interaction partners. At the same time, the relative number of individuals in structural categories leads to differential rates of interaction. These processes operating together lead to the likelihood of collective action.

VERTICAL AND HORIZONTAL DIFFERENTIATION AS STRUCTURAL CONSTRAINTS ON INTERACTION

Many authors have commented on the constraints of size and category in analyzing social interaction (Kanter, 1977; Meyer, 1971; Mayhew and Levinger, 1976). Recently, Blau (1977) has systematically considered the constraints of social structure in his theory of structural differentiation. Blau describes his theory as "primitive", in that he defines social structure "stripped of its broader cultural and functional connotations to its core properties, its primitive meaning" (Blau, 1977:ix). Blau argues that he is a "structural determinist, who believes that the

structures of objective social positions among which people are distributed exert more fundamental influences on group life than do cultural values and norms, including ultimately the prevailing values and norms" (Blau, 1977:x). He characterizes social structure by social parameters measured in terms of nominal categories (race, sex) and graduated status (wealth, prestige) and by the patterns of relationships that exist between individuals occupying positions defined by social parameters.

Here, several of Blau's limiting assumptions are relaxed. First, Blau's assumption of a bias towards in-category interaction or "positive salience" for those within a social category is modified. Blau (1977) has supported this assumption by maintaining that a positive salience indicates that the category has social importance. If members of the category were indifferent about interacting within the category, then salience would not matter and would be close to zero, according to Blau. However, others (Fararo, 1981; Rytina and Morgan, 1982; Skvoretz, 1982; Skvoretz, 1983) have demonstrated that positive salience is not necessary for deriving many of Blau's propositions and is not a realistic assumption in empirical work. That is, there are circumstances that may lead individuals to desire interaction with those in other categories (have negative salience). Second, the perspective offered here should not be construed as "structurally deterministic". Acknowledging the possibility that the salience of a category can vary implies that crossing some boundaries are considered more desirable, or can be done more easily, than crossing others. Thus, rates of initiating interaction are not completely structurally determined by the relative numbers in each category, but also by the relevance of the boundaries between categories. The vertical and horizontal division of labor that characterizes organizations form the boundaries of relevance in this study, and, as previously discussed, these boundaries can vary in their relevance.

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Vertical Differentiation. In his theory, Blau (1977) develops a series of tautological propositions explaining how rates of interaction are conditioned by the relative sizes of two categories, and how the dominance of a large category by a smaller category is translated into rates of interaction. A small number in one category combined with Blau's assumption of positive in-category preference for interaction partners or salience leads to a series of tautologies concerning interaction. First, the relative density of a category increases as category size decreases. Second, the rate of increase in density is greater when positive salience is greater. Finally, a "leverage" effect (Rytina and Morgan, 1982), or greater effect on relative changes in interaction is exhibited by the larger category. That is, an increase in interaction from the larger category to the smaller category leads to a much larger relative increase in the across-category interaction for the smaller category.

Rytina and Morgan (1982) expand upon Blau's theory by considering that a smaller category with high positive salience, accompanying relatively dense interaction, and, by implication, higher mutual visibility has a likelihood of becoming a Mertonian (1957) reference group. This is possible, according to Rytina and Morgan, because a relatively dense network within a small category of individuals makes shared membership more obvious to the occupants, and makes norms and mutual obligations easier to enforce, thus allowing the category to exhibit the characteristics of a group. Furthermore, Rytina and Morgan argue that the existence of a small social group within a bureaucracy leads this group to be able to strike bargains and form coalitions more easily than other, more diffuse, categories of individuals. Bargaining and the extension of social credit are easier because the small, dense group is able to enforce norms of trust and reciprocity. In addition, the access of the smaller group to other group members makes them

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desirable partners for members of less organized categories. This may lead those in the larger category to have a relatively low density or cohesion and a negative salience, i.e., a desire to interact more often than chance with the smaller category.

This digression into the mathematics of interaction across categories has relevance for the vertical differentiation of organizations. Given the pyramidal shape of organizational hierarchies, and given the tautologies that relative density increases as relative size decreases and the rate of increase in density is greater when positive salience is greater, then a small category of top management is likely to interact densely and form an elite group. This top group will be valuable interaction partners for other categories, and due to the leverage effect, increases in out-of-category interaction for lower level groups trying to gain favor with the top group will be translated into relatively large increases in out-of-category contacts for the top group. Thus, the creation of an elite group at the top may lead to negative salience and low in-category density for lower level categories.

The foregoing is based solely on the mathematics of rates of interaction between categories of different sizes. Most organizations can be described as pyramid-shaped hierarchies within which more resources and authority are allocated at higher levels. The differential allocation of authority and other organizational resources is likely to accentuate the interaction patterns that are partly determined by category sizes. Assuming that an organization can be categorized by a pyramid of top, middle, and bottom levels of status gradation, the top is likely to form a small elite group, the middle, as coordinators between the top and bottom, may have less positive or even negative salience as they interact with both levels, and the bottom is likely to have negative salience as they are forced to go outside of their category to coordinate with other levels.

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Horizontal Differentiation. Organizations are characterized by more than vertical status differentiation; individuals are also grouped into units around functional problems, resulting in cross-cutting horizontal differentiation of categories. From the organizational theorist's point of view, individuals are grouped around technical problems (Thompson, 1967). Within an organizational department they share a common vocabulary (March and Simon, 1958) resulting in more interaction and a reduction in transaction costs (Williamson, 1975). Thus vertical status barriers should be less important for interaction within an organizational department compared to across departments, and the salience of vertical categories should become closer to zero within departments, at least for day-to-day working interaction.

Organizational designers are seldom able to group all necessary interaction into departments and, from a network perspective, the interactions within organizations begin to look more like the focused organization of ties around problems (Feld, 1981). That is, departmental barriers to interaction become less relevant, and ties are formed around functional problems that span the organization. Without the cross-cutting horizontal category membership that would reduce the impact of vertical differentiation, in-category bias should be higher, but at different rates depending on vertical level. Top level individuals, in a category with fewer in-category members, higher status, and higher relative density of interaction compared to other levels that leads to more elite group properties, are more likely than others to interact with each other when crossing organizational boundaries. The middle level employee, performing more of a buffer function between the top and bottom, and having a higher level of status than the bottom, is likely to interact more often with the bottom when crossing organizational boundaries. The bottom level individual, more constrained in interaction and isolated

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from the top by the middle level buffer, is more likely to interact with others on the bottom level and with the middle level across the organization.

Empirical Implications of the Differentiation of Interaction. The pyramidal design of most organizations guarantees that top level management will have relatively dense interactions compared to lower levels and will be more able to become an elite group. The unequal distribution of status and resources contributes to these differences in interaction and will be likely to lead to negative salience for other vertical categories whose members will prefer to interact with other categories rather than within their own category. Structurally, vertical differentiation should have less impact on interaction within organizational units due to the overlap of vertical and horizontal differentiation. That is, individuals share horizontal group membership within departments, and, all other things being equal, shared group membership should reduce the salience of vertical differences. However, when interacting across the organization, it is likely that the barriers to vertical interaction are stronger. Without overlapping horizontal shared membership, social distances between hierarchical levels should be accentuated. Thus the top level is likely to interact with others at the top across the organization, and the bottom level is likely to interact with the lower levels. In relative terms, occupants of the top level, a level having more group properties, are more likely than the bottom to interact within their category.

METHODOLOGY AND RESULTS

These hypotheses about the effects of formal structure on interactions within organizations were tested with data collected from a West Coast public transit agency. All managerial and professional employees were given a questionnaire asking them, among other things, to list managerial and professional employees

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within the organization with whom they interacted "in order to get the job done". The respondents were also given a list of all other managerial and professional employees. Fourteen spaces were available on the questionnaire to list other employees. A total of 112 members returned the questionnaire for a response rate of 79 percent.

This public agency was considered an ideal location to determine the effects of formal structure on interactions because, like virtually all public organizations of any size, it relied on formal bureaucratic rules, procedures, and assignment of positions to coordinate work. The agency was organized in a hierarchical pattern by grouping individuals together into divisions that were grouped into functional departments such as accounting and purchasing that, in turn, were grouped into larger clusters under a director, e.g., Director of Finance. (These larger clusters will be referred to here as directorates.) For purposes of this analysis, the organization was divided into three vertical levels: the top level encompassed the directors, department heads and any staff people who reported directly to them; the middle level was defined as division heads; and the bottom level included all other professional employees. Table 1 presents the asymmetrical linkages between individuals at the three levels based upon who cited whom in response to the work network question.

The Salience and Density of Hierarchical Categories. In Table 2, the ties cited by an individual are presented as symmetric dyads. That is, if one individual cited another, they were considered to be reciprocally linked. This assumption is made for two reasons. First, symmetric ties are necessary for the tautological relationships among categories discussed by Blau (1977) and Rytina and Morgan (1982). Second, it can be argued (Freeman, 1978; Davis, 1970) that asymmetrical ties already imply status inequality. Thus, only symmetrical ties allow the

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TABLE 1

Links Among Three Hierarchical Levels of Organization

	Destination		
Origin	Top	Middle	Bottom
Top	159	55	24
Middle	123	94	136
Bottom	141	215	300

possibility of greater or lesser status equality. Therefore, treating ties as symmetric in Table 2 does not lead the analyst to prejudge the status inequalities between categories.

As Table 2 indicates, the average ties of those at the top and bottom are greater within their category than across categories. However, the salience (preference for in-group interaction) is considerably different at the top and bottom of the organization. Using Rytina and Morgan's (1982) mathematical definition of salience, 25 percent of the ties that would have gone to other categories under random mixing are directed inward at the top level of the organization. By contrast, salience is negative at lower levels of the organization. Negative salience reaches a peak at the bottom level, with 23 percent of the tes that would have been randomly directed within the category going to other categories. This confirms the hypothesized in-category preference for those at the top of the hierarchy and out-category preference at the bottom. As expected, given the pyramidal shape of

TABLE 2

Average Symmetric Links, Salience, and Density
Among Three Hierarchical Levels of Organization

	Destination				
Origin	Top	Middle	Bottom	Total Mean	N
Top	8.01[1]	6.1	7.0	21.1	
	(159)[2]	(123)	(141)		20
Middle	4.2	3.3	7.4	14.9	
	(123)	(94)	(215)		29
Bottom	2.2	3.4	4.8	10.4	
	(141)	(215)	(300)		63

[1] Average Links

[2] Cell Frequency

Salience(top)	= .25	Density(top)	= .40
Salience(middle)	= −.05	Density(middle)	= .11
Salience(bottom)	= −.23	Density(bottom)	= .08

Salience = (1 − Segregation Index)

$$\text{Segregation} = \frac{\text{total average out of} / \text{total category ties} \quad / \text{average ties}}{\text{number in out categories} / \text{total sample size}}$$

Density = Average in category ties / number in category

the hierarchy and the relative preferences of different levels, the density of interaction at the top is much larger than at lower levels.

Table 2 demonstrates that in-category preference is positive at the top level of hierarchy and density is (and must be, given the high positive salience) higher at the

top level when interactions are treated as symmetric dyads. However, the levels of hierarchy also represent a status hierarchy in which propositions about dominance controlling for the relative number of interactions at a given level can be tested. An examination of the asymmetrical ties of Table 1 provides information on the relative tendency to initiate interaction within and across categories. Analysis of the asymmetric ties in Table 1 involve propositions about relationships among categories that are no longer tautologies, but instead become probabilistic predictions about the initiation of interaction. Accordingly, analysis of this table should control for differences in marginal totals that may obscure in-category and out-category preference. For example, the larger number of interactions initiated at the bottom level and received by the bottom level is somewhat a function of the larger number in the bottom category, biases any measure of in-category preference in a table of asymmetric ties, and should be adjusted for in the analysis of the table.

Log-linear techniques for tables have been developed to control for the sizes of the marginal distributions of the categories. (For an overview see Knoke and Burke, 1980.) For instance, in social mobility research cross-tabulations of origin status and destination status are often analyzed by removing the main diagonal (Duncan, 1979; Goodman, 1979a; Hout, 1983) from the table. This is done under the assumption that the large numbers on the main diagonal --- the "stayers" who remain in an occupational category or social class --- are obscuring the mobility effects between the "movers" who change categories over time.

In the present case, it is not assumed a priori that all levels will have an in-category preference and therefore, techniques applied to social mobility tables are not used. However, it is clear from Table 1 that a large number of interactions do lie on the main diagonal, particularly those cells representing within category interaction at the top and the bottom levels. This suggests that the ordering of the

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columns of the data for each row, i.e., the tendency for interactions in the top row to go from the top to the top and less often from the top to the middle and the bottom (and so on for the other rows) should be modeled in the log-linear framework. In addition to the standard model of independence that hypothesizes that the logarithms of the cell frequencies are only a function of differences in marginal totals, and, therefore, no association exists between two variables, a variety of ordinal hypotheses can be tested in log-linear analysis (Agresti, 1984; Clogg, 1982; Goodman, 1979b). The row effects model, which treats the rows of a table as nominal categories but takes into account the ordering of the columns is the most useful model in the present case. The row effects model adds an association term to the independence model. This association term produces a row effect coefficient for every row of the table (although only r-1 of the coefficients are linearly independent). For a given row, the row effects coefficient measures the linear deviation of the cells from the independence model with a slope equal to the coefficient. If the coefficient for a row is greater than zero, then observations in that row are likely to fall at the upper end of the scale of the column variable (the far right columns of the table), and if the coefficient for a row is less than zero then observations are expected to fall at the lower end of the scale of the column variable (the far left columns of the table). (These models are presented more formally in Agresti, 1984.)

In the present case, it is hypothesized that those at the top level prefer to interact with others at upper levels, while those at the bottom are constrained to interact more with the bottom levels, and the middle buffers interaction by interacting with both levels. In terms of row effect coefficients, preference for upper level interaction at the top should be translated into a negative effect coefficient and constraint on the bottom level to interact with lower levels should

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result in a positive effect coefficient, while the middle level should more evenly distribute interactions and have an effect coefficient closer to zero (and positive given the dominance of the middle over the bottom). In relative terms, the preference of the top for upper level and in-category interaction is hypothesized to be stronger than at other levels due to the group-like properties of the top level, so the effect coefficient for the top row should be larger than other rows.

Table 3 gives the results of fitting a series of models to the data contained in Table 1. The independence model (reflecting the null hypothesis of a random network of interaction, i.e., structural position has no effect on interaction) is clearly a bad fit to the data, implying some association between the variables. Treating the origin of interactions as nominal and the destination as ordinal produces a significant improvement in fit, and the fit is a borderline adequate fit to the data. The relatively large negative row effects parameter for the top level implies a large in-category preference (more observations predicted for the top destination and progressively less observations predicted for the middle and bottom destinations) that is offset by an in-category preference (although smaller) at the bottom level. The middle level finds itself in the middle with a preference for initiating interactions downward. This is as expected given a status hierarchy in the organization. Examining the residuals indicates that the middle level origin row does not fit as well as the other rows. Removing this row produces a very good fit which is significantly better than the associated independence model.

Crossing Organizational Boundaries. It was predicted that crossing organizational boundaries would cause individuals to perceive the social distance between vertical levels to be greater. This would lead those in the top level category, which has more group properties, to be most likely to interact with each other. Great differences were not found in interactions across the departmental

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TABLE 3

Log-Linear Models Fitted to Data on Links Among Hierarchical Levels

Model	L^2	DF	P
Independence	178.80	4	.000
Row Effects (Destination Variable Ordinal)	6.22	2	.045

$T_1 = -1.09$

$T_2 = .33$

$T_3 = .76$

Delete Middle Level Origin

Independence	177.19	2	.000
Row Effects	.69	1	.406

$T_1 = -.96$

$T_2 = .96$

barrier and the results are not presented. However, because departments are small and most are grouped together into functionally similar directorates, a departmental boundary may not present much of a barrier to interaction. Crossing a boundary and going outside the directorate might present stronger barriers to interaction. Table 4 presents the interactions of the three hierarchical levels within directorates compared to interactions across the directorate boundary. Table 5 presents the results of fitting log-linear models to Table 4. The bottom panel of Table 5 indicates that adding a uniform ordinal interaction term to the standard partial association model for the combined three way table produces a significant

improvement in fit. This implies that the ordinal association between origin and destination is significantly different in the two tables (Agresti, 1984). In the upper panels it can be seen that the row effects model is a significant improvement over the independence model and a good fit to the data for interactions within and outside directorates. A comparison of the row effects parameters for the two tables confirms the hypothesis that top level employees are more likely than other employees to interact at the same level when going outside of the directorate. This change in the top level row effects parameter is offset by small changes in the row effects parameters for the lower levels.

TABLE 4

Links Among Hierarchical Levels Within and Outside Directorates

	Destination		
Origin	Top	Middle	Bottom
Within Directorates			
Top	49	27	16
Middle	55	36	72
Bottom	70	94	177
Outside Directorate			
Top	110	28	8
Middle	68	58	64
Bottom	71	121	123

TABLE 5

Log–Linear Models Fitted to Data on Links
Within and Outside Directorates

Model	L^2	DF	P
Interactions Within Directorates			
Independence	51.02	4	.000
Row Effects (Destination Variable Ordinal)	3.99	2	.136
$T_1 = -.77$			
$T_2 = .33$			
$T_3 = .76$			
Interactions Outside Directorates			
Independence	130.77	4	.000
Row Effects	4.32	2	.116
$T_1 = -1.41$			
$T_2 = .50$			
$T_3 = .91$			
Test of Three Way Effects			
Standard Partial Association	10.95	4	.027
Uniform Interaction	6.08	3	.108
$B = .33$			

DISCUSSION

This analysis suggests that those in the top level of a bureaucracy are more likely to coordinate activities as a group, at least in this transit agency. (The

analysis was confirmed in another similar transit agency.) In this agency, top level employees freely crossed organizational boundaries to maintain connections with other top level employees. By contrast, middle level employees formed a buffer between the top and bottom by interacting between the two levels; the bottom, in relative terms, devoted a great deal of interaction to other levels, and, in absolute terms, interacted a great deal among themselves.

The potential for the formation of a group among top employees should not imply that an elite as opposed to a pluralist perspective on intraorganizational power is necessarily true within organizations. Others, as previously discussed, have noted that units with more control over strategic contingencies may be more centrally located and powerful in organizations compared to other units. However, this analysis suggests that position is important. Thus, the top level employees of more powerful units will be the most effective agents for the unit and an upper level classwide rationality may exist within which some units are more dominant than others.

In terms of the mobilization of coalitions that may create multiple power bases within organizations, top level employees may be desirable as coalitional members because of their extensive connections with others at the top. Further, the more extensive interaction at the top implies that top level employees are more likely to realize common interests and form coalitions. This is usually assumed in organizational research by referring to ultimate power in the organization as being located in a "dominant coalition" composed mainly of top level members. However, the higher density of interactions, and resulting visibility at the top, may make the formation of multiple opposing coalitions more difficult among top level employees. This may be so because the norms against exerting influence outside of the formal boundaries of authority delineated by job responsibilities may be easier to enforce at the top level.

The potential for multiple coalition formation at the middle level of the organization may be higher than at the top level. Middle level employees have less visibility in terms of interactions among themselves because of their organizational position that requires a great deal of interaction with other levels. Therefore, norms against forming coalitions may be more difficult to enforce within the middle level. Furthermore, middle level employees may be likely to engage in "power balancing" (Cook, 1982) coalition formation in order to offset the interaction advantages of the top level employees. In addition, differential status between middle level employees and employees at other levels combined with interaction across levels may make coalition formation more easy and desirable for middle level individuals. Middle level employees may prefer to form coalitions with upper level individuals in order to gain the increased power of higher level allies. Similarly, middle level employees may find it advantageous to increase their organizational influence by dominating coalitions formed by including lower level employees who they frequently interact with inside their coalitions.

Horizontal differentiation also has effects on differential interaction. Research in the growth of public bureaucracy has found a tendency to proliferate lower level units contained within more stable overarching departments in response to environmental demands during this century (Meyer et al., 1985, Stevenson, 1985). As Meyer et al. (1985) have suggested, this structural response of creating organizational units to respond to not easily articulated or managed problems of the public domain may lead to a paradoxical consequence: by following the rational model tenet of reducing complex and uncertain problems to manageable size by devoting specialists to problems and grouping specialists into organizational units, the organization increases its own complexity with accompanying problems of coordination and uncertainty of outcomes. However, goals do get accomplished in

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large bureaucracies, sometimes in spite of the rules and organizational boundaries. If the pattern of interaction found in the present study were found to be generally true in public bureaucracies, then the growth of bureaucratic departments, accompanied by the addition of large numbers of middle level managers should have several effects. First, since the top level bureaucratic component would increase at a declining rate (Blau and Schoenherr, 1971; Meyer, 1971), the top level would maintain its relative advantage of higher rates of in-category interaction. Second, larger departments would lead to maintaining a larger amount of in-group interaction within the department. However, interaction across the organization would become more problematic. The larger middle management component would exhibit even less relative in-group density of interaction, while the top level employees would be likely to interact among themselves across the organization. This could lead to isolation of the top from the bottom, with a large amount of coalition formation and internal politics initiated from the middle level employees.

Much of the existing organizational theory and research has been conducted with a bias towards assuming the existence of vertical authority constraints and has ignored the full spectrum of interaction across the organization. These networks of interaction, conditioned by the formal structure of the organization, can lead to emergent organizational properties that have often been discussed but have yet to be fully subjected to research. Enlarging theoretical perspectives to include all dimensions of interaction is an important first step in gaining an understanding of these emergent properties.

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