Report No. UMTA-CA-11-0028-2

THE COORDINATION OF FUNCTIONAL AREAS WITHIN TRANSIT AGENCIES THROUGH NETWORKS OF MANAGERIAL AND PROFESSIONAL INTERACTION

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and
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Irvine, California 92717

June 1985

FINAL REPORT

PREPARED FOR
U.S. DEPARTMENT OF TRANSPORTATION
URBAN MASS TRANSPORTATION ADMINISTRATION
Office of Technical Assistance
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16. Abstract

This study examines the effects of environmental demands and technological contingencies on the coordination and control of interactions between individuals and units within a transit agency. The relationships between individuals as they accomplish their work is conceptualized as networks of interaction. Based on questionnaire data collected at two transit agencies (Orange County Transit District and San Diego Transit Corporation), it was found that the size and complexity of the agency had significant effects on networks of interaction. The size and complexity of the agency was found to affect the size and strength of an individual's work network; whether an individual was more likely to rely on the vertical chain of command, horizontal interaction with peers, or diagonal interaction with individuals of unequal status with the organization; and what roles units performed in terms of interaction with other units in the agency. Implications for the design and management of transit agencies are discussed.

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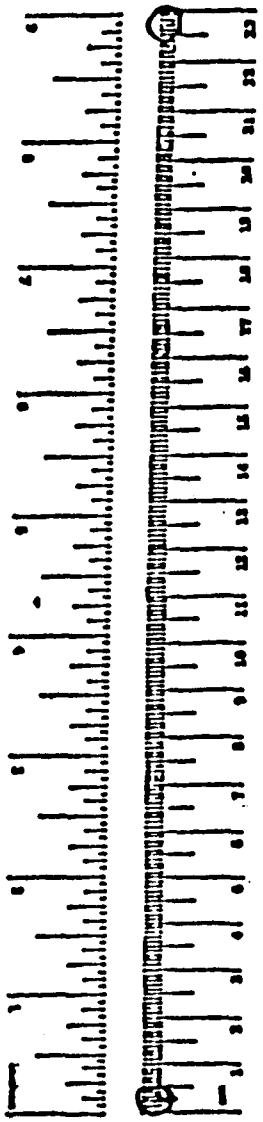
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

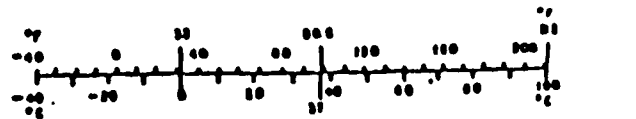
Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
	inches	*2.5	centimeters	
	feet	30	centimeters	
	yards	0.9	meters	
	miles	1.6	kilometers	
	AREA			
	square inches	6.5	square centimeters	
	square feet	0.09	square meters	
	square yards	0.8	square meters	
	square miles	2.6	square kilometers	
	acres	0.4	hectares	
	MASS (weight)			
	ounces	28	grams	
	pounds	0.45	kilograms	
	short tons (2000 lb)	0.9	tonnes	
	VOLUME			
tsp	teaspoons	5	milliliters	
Tbsp	tablespoons	15	milliliters	
fl oz	fluid ounces	30	milliliters	
	cups	0.24	liters	
	pints	0.47	liters	
	quarts	0.95	liters	
	gallons	3.8	liters	
	cubic feet	0.03	cubic meters	
	cubic yards	0.76	cubic meters	
	TEMPERATURE (exact)			
	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
mL	milliliters	0.03	fluid ounces	fl oz
L	liters	2.1	pints	pt
L	liters	1.06	quarts	qt
L	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



EXECUTIVE SUMMARY

STUDY CONTEXT

This report addresses the problem of the managerial coordination of functions within transit agencies. This has become a problem within transit agencies because many agencies have experienced large growth in funding, population served, and personnel in the last ten years. However, transit agencies are now faced with cutbacks in funding and are under greater pressure to economize and become more efficient in the conduct of their operations. This study focuses on the coordination and management of personnel as one strategy to realize increased efficiency.

Recent increases in funding have been accompanied by a large number of changes in the environments of transit agencies that have increased the complexity of transit functions. For example, greater demands from constituencies to hire more minorities and women, provide alternative modes of transit, and provide transit service for the handicapped have led to increases in the complexity of transit agencies. These demands have often been met by adding additional specialized positions and creating specialized units, thereby further increasing the structural complexity of transit organizations. At the same time the labor force has been changing; a larger number of college graduates are being hired in transit agencies to fill these specialized units, and more transit employees are gaining advanced training.

One reaction to this increased complexity is to increase the complexity of the organization through the creation of new organizational units and the addition of rules and procedures. This presents a paradox to transit agencies: administrative complexity is being increased to manage the increase in environmental complexity. Thus, complexity leads to complexity. The obvious danger is that transit agencies will become too complex and the cost of administration will not justify the additional benefits to the public.

In order to understand and manage this new complexity, it is necessary to develop an understanding of how transit agencies are currently being managed and what alternative arrangements are available to them. A large number of studies have been done on transit agencies and other organizations that have emphasized the vertical control of subordinates and the hierarchical arrangement of functions within organizations. In this study, an entirely different perspective is taken. Here the relationships among employees, whether they are vertical interactions between superior and subordinate, horizontal interactions between those at the same level of the organization, or diagonal interactions between people at different levels of the organization are emphasized. Thus the organization, while usually considered to be made up of people occupying formal positions in the hierarchy, in this approach is constructed through the daily networks of interaction among employees. The factors determining the size and strength of individual networks and how departmental interactions, made up of the aggregated individual linkages, affect the performance of the organization are the basic questions to be answered. This analysis of the organization in terms of networks of interaction can suggest what managerial policies, under which conditions, have effects on individual networks. Furthermore, an analysis of the network of interactions among departments can

suggest what the effects of current structural arrangements are on organizational performance, and what alternative structural arangements are possible.

THE STUDY DESIGN

The theoretical model that guided this research posits that transit agencies are faced with environmental demands and technological contingencies that place coordination demands on transit agencies. Transit agencies respond by creating formal organizational positions, units, and procedures. These positions are occupied by personnel who have unique individual characteristics that affect their likelihood of interacting with others. The structures and procedures created to accomplish and coordinate activities, in combination with the characteristics of individuals, lead to networks of interaction within the organization. These networks eventually influence organizational performance, and performance results feed back to the constituencies in the environment.

The variables in this model were measured in a questionnaire distributed to all the managerial and professional employees at two sites, Orange County Transit District (OCTD) and San Diego Transit Corporation (SDTC). This study was intentionally limited and exploratory due to the lack of previous research using this perspective and the limited time and resources available. These sites were selected on the basis of their medium size which was assumed to be large enough to present problems of coordination and control. At the same time there were key differences between the two sites. OCTD is a much larger and more complex agency serving a large suburban area of large population, while SDTC is a smaller, less complex agency serving a smaller metropolitan area.

THE SIZE AND STRENGTH OF AN INDIVIDUAL'S NETWORK

Previous research taking a network perspective on interaction has shown that the number of people involved in an individual's network and the strength of ties to others are important to the individual. Employees with more ties to others are likely to be leaders, be more informed, have greater work satisfaction, and have more resources. Those who have strong ties to others (here measured in terms of the frequency of interaction) can depend on more support and are more cohesively bound to others.

In this study, an analysis of the relative effects of formal organizational position, the job context, formal control mechanisms and individual career history indicated differences between the two organizations. Formal position, measured as whether the individual was in Administration or Operations, was a manager or not, and was located at the top, middle, or bottom levels of the hierarchy had effects on the size and strength of individual networks at both sites. However, in addition to the formal position in the organization, individual career experience, measured by years on the job and number of positions in the agency, led to larger networks at OCTD. At SDTC, by contrast, formal coordination mechanisms such as the supervisor's influence on the work had a significant positive effect on the size of an individual's network, and the routinization of the job had a significant negative effect on the size of an individual's network. Furthermore, task variability and dependence on others, as measures of the job context, had a positive effect on the strength of an individual's network.

These results suggest fundamental differences between the two agencies. Employees at SDTC increase the strength of their ties in response to the uncertainties generated by the job context, and formal coordination mechanisms implemented by managers exert some control over the number of others contacted by an employee. This is more like the expected bureaucratic model of organization. At OCTD, however, the biggest factor in the extensiveness of an individual's network is the number of years the employee has been on the job, and the job context or formal coordination mechanisms do not seem to affect the frequency with which others are contacted in the conduct of the job. This suggests that OCTD employees rely less on formal coordination mechanisms and more on personal networks developed over time.

THE DIRECTION OF INTERACTION

Interaction within an organization can occur in two dimensions. First, interaction between two individuals can have direction. Vertical interaction is contact between a supervisor and subordinate in the direct chain of command. Horizontal interaction is contact between two people at the same level of hierarchy. Diagonal interaction is non-horizontal interaction outside of the chain of command. In addition to direction, interaction can have range. Contacts can be made within a department, across departmental boundaries but within a cluster of departments grouped under a director, or across the organization.

Three hypotheses concerning the direction and range of interaction were developed and tested. The first hypothesis was that actors within departments or within departments grouped under a director would be more likely to regard individuals at the same level to be their peers and interact horizontally. However, actors crossing organizational boundaries were expected to interact with those of higher or lower status (diagonally). This was assumed to be a strategy engaged in to take advantage of status inequalities across the organization. Finally, actors at higher levels of the organization were expected to define their status equals as peers across the organization and be more likely than those at lower levels to interact horizontally.

The hypotheses were confirmed. In addition, a great deal of diagonal interaction was found to occur within both agencies, particularly at the bottom level of the hierarchy at OCTD. The choice between vertical, horizontal, and diagonal interaction at OCTD was conditioned by how much relative influence was exerted by the supervisor and the subordinate. This was not found to be true at SDTC. OCTD can be characterized in terms of interaction between employees as an agency where a great deal of interaction outside of the formal reporting relationships occurs, and an agency where individual initiative and supervisory influence combine to control interactions.

INTERACTIONS BETWEEN DEPARTMENTS

Individual interactions were summed to the departmental level, and the resulting network of interactions between departments was analyzed. Departments were considered to occupy positions in the network of interactions in terms of how centrally located they were in the daily workflow of the organization, and how similar they were to other departments in terms of their interactions with other departments.

Centrality in the workflow was related to ratings of organizational performance made by all the managers within the agency. It was found that being central to the workflow was highly correlated with ratings of influence on policy at SDTC, but departmental centrality was negatively related to influence at OCTD. This was attributed to the fact that OCTD is a larger, more complex bureaucracy in which policy making functions have become separate from the management of daily activity.

The position of a department in the network of interactions can also be measured in terms of how similar a department is to other departments in terms of interactions. Two departments that share a similar pattern of interactions with all other departments are considered to be structurally equivalent. That is, they share the same role-set of other departments on which they are reciprocally dependent and thus occupy a similar role in the organization. A matrix of dissimilarities of departments was created and plotted in a two dimensional space using a statistical technique called multidimensional scaling. Departments that occupy a similar role cluster together in such a diagram, and dissimilar departments may be spread out within the two dimensions.

Such a graphical display of departmental interaction revealed several features of the organization of transit agencies. Transit Services (or the Operations departments) were spread across the diagrams at the two sites, indicating that the departments grouped under Operations performed a variety of roles in the organization. By contrast, the financially related departments grouped under the finance director were more tightly clustered, suggesting a more uniform set of interactions with the rest of the organization. When considering departments in terms of the similar role they play in the organization rather than their formal grouping under directors, several conclusions become apparent. The smaller and simpler SDTC organization displayed a structurally equivalent core of administrative departments, while the larger and more complex OCTD agency showed two core groupings of administrative departments. One grouping was more oriented towards advisory functions, and the other grouping was oriented more towards the financial function. Finally, certain departments not always considered similar were found to group together. For example, Marketing and Public Information appeared very similar to Operations in interactions across the organization.

IMPLICATIONS FOR THE DESIGN AND MANAGEMENT OF TRANSIT AGENCIES

Effects of Managerial Policies on Controlling Interactions

Caution must be exercised in extrapolating results from this exploratory study of two transit agencies. Nevertheless, certain results are suggestive of relationships among variables that may generalize to larger groups of agencies. The strongest result of this analysis was that there were definite differences between the two agencies in patterns of interaction and the effectiveness of mechanisms to control this interaction. The larger size and complexity of OCTD had several effects on interactions that may generalize to other agencies that have grown rapidly in size in the last decade. For example, at the smaller and organizationally simpler SDTC, formal mechanisms of control had effects on the size of an individual's network, and job demands had an effect on the strength of an individual's network. By contrast,

the larger more complex OCTD networks were affected by how many years an individual had been on the job, and relatively unaffected by formal control mechanisms and job demands. This implies that larger, more complex agencies may rely more on personal contacts than on formal control in expediting the work.

Effects of Organizational Boundaries on Interaction

Grouping employees together into departments creates organizational boundaries between departments and grouping departments under directors also creates a boundary between this group and other departments. These boundaries have effects on the interactions between individuals. It was found that personnel are more likely to communicate horizontally within a department as compared to across departments or across the organization. Position in the hierarchy also had effects on interactions. Top level employees were more likely to communicate horizontally compared to other employees. This implies that placing boundaries around groups of employees or departments encourages horizontal interaction. Managerial control policies such as the amount of supervisory influence will, under some conditions, also encourage horizontal interaction and discourage diagonal interaction.

Alternative Organizational Designs for Transit

The role occupied by transit departments does not always reflect the formal grouping of departments under directors. Transit Operations has become a complex function in the organization that includes departments whose roles may differ in terms of the interactions with other departments. In the larger, more complex OCTD organization, the administrative function has become differentiated into a cluster of departments performing the financial function and a second cluster of departments, such as Employee Relations and Risk Management, that perform a general advisory function. This implies that as a transit agency becomes larger, it may be less efficient to group all the staff functions under a Director of Finance and Administration compared to separating finance from other advisory functions. Furthermore, the distinction between line and staff shown in many transit agencies, where most advisory functions are placed in an administrative hierarchy and operations and maintenance are placed under a Director of Operations, needs to be reconsidered. For example, in the two agencies studied, Marketing and Public Information were performing a role very similar to Operations. This implies that certain benefits may accrue if the two departments were placed under the same director.

DIRECTIONS FOR FUTURE RESEARCH

It is important to reemphasize the exploratory nature of this research. A study with a larger sample of organizations is needed to substantiate or refute these preliminary results. However, viewing transit management from the point of view of coordinating functions among interacting individuals and departments has great potential for revealing which policies are effective in coordinating activities and which alternative arrangements of functions may lead to efficiencies in the face of budget cutbacks.

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William B. Stevenson

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CHAPTER ONE
THE PROBLEM OF COORDINATING FUNCTIONS AND DESCRIPTION OF THE STUDY DESIGN

INTRODUCTION

This report addresses the problem of coordinating functions within a transit agency. This is a problem that confronts all organizations but presents a particular challenge for transit management. This is true because transit, like many public bureaucracies, has undergone cycles of growth during this century. The latest cycle of increased financial support, beginning with increased federal support for transit during the 1960s and 1970s, has come to an end in the 1980s. Public transit is now faced with cutbacks in federal support which until recently has provided the bulk of the transit budget. Faced with declining or stable resources, transit agencies are experiencing greater pressures to economize and become more efficient. This economy can be realized in a variety of ways; this report focuses on the coordination and management of personnel within the agency.

Recent increases in funding have had a variety of impacts on transit agencies. Growth in the costs of providing transit has been accompanied by an increase in the number of employees. As an agency has grown in size, additional specialized positions and administrative units have been created, leading to increased organizational complexity. The new employees hired to staff these positions, particularly those hired as administrative staff, represent an increasingly well educated and trained workforce that presents new challenges to transit management.

The main source of the structural complexity that has begun to characterize larger transit operations are the demands placed upon the agency by multiple constituencies. Contingency theories of organization (Thompson, 1967) maintain that the organization's environment and the technology used to produce the product or service are the main sources of contingencies that must be dealt with by the organization. The technology of providing transit service has remained relatively constant for many years but transit agencies, like most public bureaucracies, now find themselves open to multiple demands from the public. For example, in recent years various constituencies have demanded transit services for the handicapped, and increased hiring and promotional opportunities for women and minorities.

Faced with an increasingly sophisticated workforce and increased

organizational complexity, transit management has been somewhat indifferent towards the organization of transit functions (Crossman, Wirth, and Carlson, 1975). The traditional line-staff distinction between Administration and Operations has been maintained, although the advisory functions of Administration have increased through the addition of units such as Marketing and Planning that must interact with the more operationally oriented Bus Operations, thus blurring the distinction between Administration and Operations. Further, the arrangement of functions has been somewhat haphazard or politically motivated. Some General Managers have preferred to have certain staff functions report directly to them in order to maintain direct control over crucial functions. However, with increased organizational complexity, and given that the span of control of any manager is limited, some functions have been grouped together and the overall responsibility for control has been delegated to directors. Thus, for example, the old Controller department that was concerned with accounting and purchasing has become a group of departments under a Director of Finance or Director of Finance and Administration. This director may now supervise such diverse functions as data processing, grants, and financial planning, in addition to the traditional accounting and purchasing.

This study is an exploratory attempt to determine: (1) the pattern of interactions within and between departments in a transit agency; and (2) factors which affect the pattern of interactions between individuals and departments. The study is exploratory in that the scope was limited to two transit agencies, one small and one of medium size and complexity. Contrasts between these two agencies are suggestive of the differences in agencies of different scale facing diverse environments, but no firm conclusions can be drawn based on this limited sample.

Several methods for analyzing the interactions between agency personnel were used in this research. The overall theoretical model of factors influencing coordination within a transit agency are described in this chapter. Then, the study design and a comparison of the two sites is presented. Chapter Two focuses on the amount of interaction between individuals in a transit agency and provides details of the effects of organizational policies and individual careers on the differences in the size and strength of a transit employee's communication network. In Chapter Three the strategies of interactions that individuals use in communicating within and across organizational boundaries is determined. In Chapter Four, interactions are aggregated to the departmental level, and the interaction between departments is

viewed in terms of the position that departments occupy within the entire internal network of interactions. Chapter Five provides a discussion of the results for the management and design of transit agencies.

THE ORGANIZATIONAL DESIGN OF TRANSIT AGENCIES

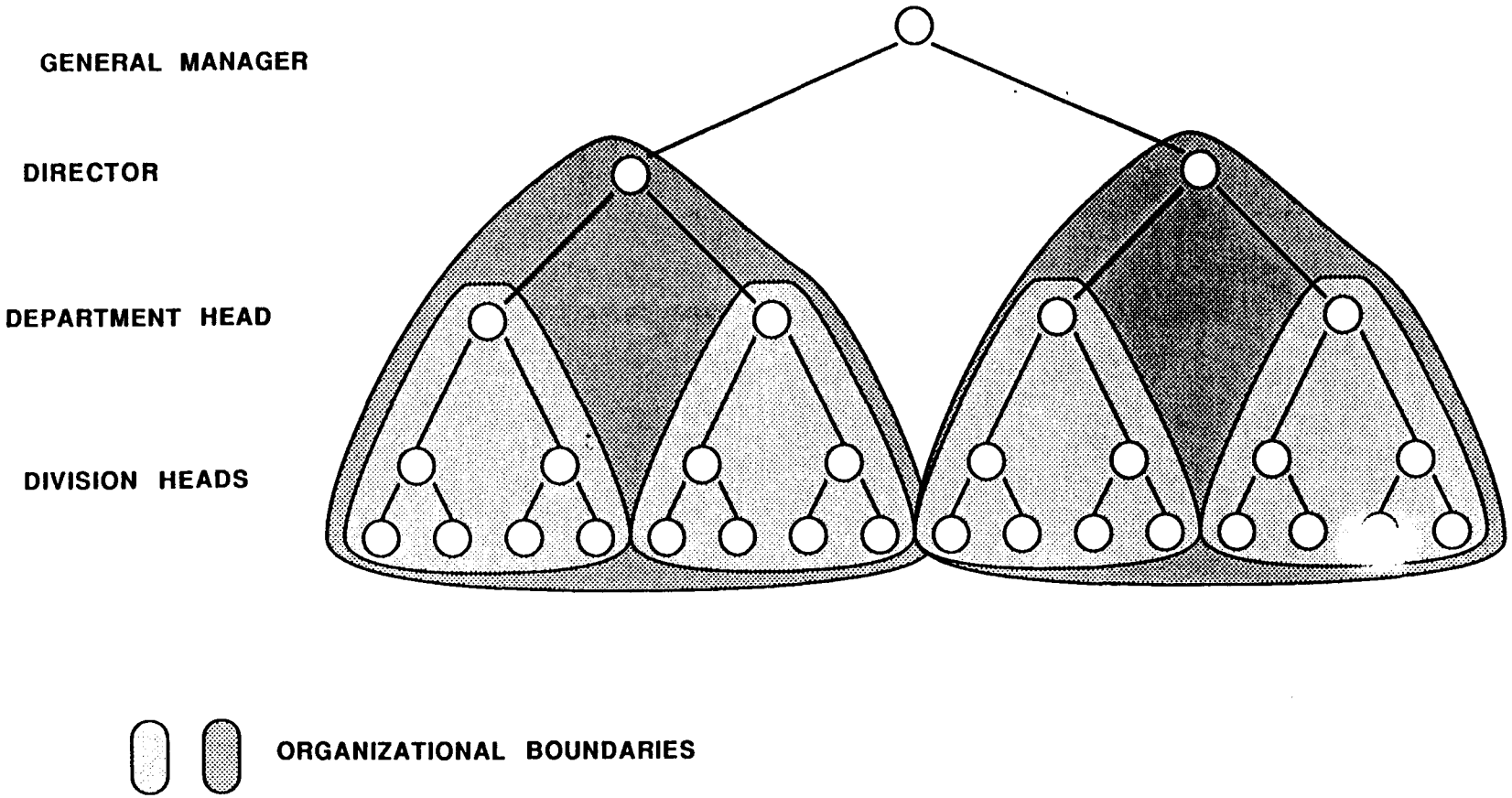
The increased growth in transit agencies, changes in the workforce, and increased complexity of the organization are presenting transit management with the challenge of responding to these demands while continuing to provide basic transit services. One solution to the problems of management is to increase the formal structure of the organization. (Formal structure is defined as the organizational design within which positions are created, grouped together, and placed within a hierarchy of authority as well as the formal procedures that guide day-to-day activity.)

The formal structural solution to increased demands on the organization is to assign people to positions to deal with the problem. If the problem is complex, the task will have to be divided into component parts and allocated to a number of people grouped into divisions. Related divisions are grouped into departments, departments into directorates, etc. This is the classic definition of the functionally organized hierarchical bureaucracy, as shown in Figure 1. This solution emphasizes the vertical control of the employee through supervisors located at higher levels. This has been the emphasis of much practical advice on organizations dating back to the classical management theorists at the turn of the century (Gulick and Urwick, 1937). Transit managers are well versed in the classical principles, e.g., that a manager's span of control should not be too large, and every subordinate should have only one supervisor. Academic analysts of bureaucracy such as Weber (1946) have also emphasized the importance of vertical authority in the hierarchy, and the resulting concentration of power at the higher levels of the organization.

As a result, many transit agencies have a similar form of hierarchical organization. In smaller agencies, many, if not all, functional heads report directly to the General Manager. However this becomes impractical once the agency grows to a larger size. In larger agencies, some functions are grouped together under a director, and this director reports to the General Manager. As an example, finance related functions such as accounting, finance, purchasing, and occasionally data processing are often grouped together under a Director of Finance. Thus, as Figure 1 indicates, common functions are grouped together in such a way that there

FIGURE 1

The Typical Hierarchical Organization of Larger Transit Agencies



is more inclusive responsibility at higher levels of the organization. Other functions which the General Manager is unwilling to delegate too far down the hierarchy are placed in separate departments reporting directly to the General Manager.

As well as establishing vertical control in the organizatic he formal structure must provide for horizontal differentiation of functions. Recently, organizational theorists (Thompson, 1967; Williamson, 1975) have maintained that, in order to control relevant uncertainties, boundaries have to be placed around problems, and specialized units have to be created to deal with important contingencies. Thus, if obtaining government grants is considered to be a high priority in a transit agency, a separate unit will be created to generate grant proposals.

One result of this differentiation of functions in larger transit agencies is the creation of a dual core hierarchy. A dual core hierarchy (Daft, 1978) exists when an organization is divided into two components: an administrative hierarchy that provides staff support, and an operations hierarchy that conducts the day-to-day business of the organization. Daft (1978), among others, has suggested that because the nature of the work in the two cores is different, the employees in the two organizational components are different in many respects. For example, according to Daft (1978) administrative core employees are conditioned to implement orders from above, and thus attempts to introduce innovations in this part of the organization should proceed from the top down. Operations personnel, on the other hand, are less reliant on the formal hierarchy, and attempts to introduce innovations will be more successful if a bottom-up strategy of introduction is used.

In the case of transit agencies, it is common to divide the organization into Administration and Operations. Each hierarchical core has its own job characteristics. Administrative jobs in transit agencies, as in other organizations, can be characterized as complex, with fewer rules to guide the employee, and often with ambiguous outcomes. Administrative employees tend to follow a different career ladder than those in Operations. Administrative employees often possess some specialized skill such as knowledge of accounting or data processing, and newly hired administrative employees are likely to be college graduates (Mundy and Spychalski, 1973). Administrative employees may identify with their profession rather than their organization, and may consider that there are many opportunities for employment elsewhere. Thus, there is the possibility of high turnover among administrative employees in a transit agency.

By contrast, Operations personnel deal with the fairly routine technology of bus

operations. Guidelines for work are often specified by rules, and the difficult challenges are often those having to do with dealing with people --- either the bus-riding public or the drivers and mechanics in the agency. For many in Operations, the career pattern is to begin as a driver or me ic and work up the hierarchy (Vellenga, 1976). As a result, Operations personnel tend to be less well educated, and have fewer alternative career paths. Thus, turnover among managerial personnel in Operations is likely to be lower than in Administration.

The problem facing transit management in larger transit agencies is to achieve effective coordination of functions within and across the dual core hierarchy. Ideally, even though they represent different functions in the organization, may have undergone different educational and career experiences, and face a different set of job challenges, individuals should be able to interact across the organization with a minimum of conflict and misunderstanding. However, given the potential for conflict among people from different backgrounds pursuing slightly different goals, a variety of formal solutions have been suggested to facilitate interaction between these individuals. One solution is to use principles of organizational design to group common functions under a common supervisor. Further, some individuals may be appointed official boundary spanners to interact with other units. Coordination problems that cannot be resolved by grouping positions or creating formal coordination roles can be solved by creating rules to guide interactions. Thus, Purchasing is formally assigned the responsibility of overseeing the purchase of equipment regardless of which unit needs the equipment. Formal coordination may be further facilitated by procedures such as management by objectives programs that emphasize setting joint goals across units, or by gathering individuals in staff meetings, committees, and ad hoc task forces.

The problem faced by transit agencies, and organizations in general, is that people have to coordinate their activities on a daily basis. It is widely known that organizational design tends to evolve over time based on individual personalities and external politics as much as a by concern for coordinating technological demands. Further, formal programs and rules are often ignored in the organization, and the creation of task forces and committees can sometimes be used to avoid responsibility for decisions rather than to coordinate activities. What is not known is how formal policies, environmental demands, characteristics of individuals, and organizational design interact to affect the daily coordination of transit functions. This report details some of the results of a study examining these interactions.

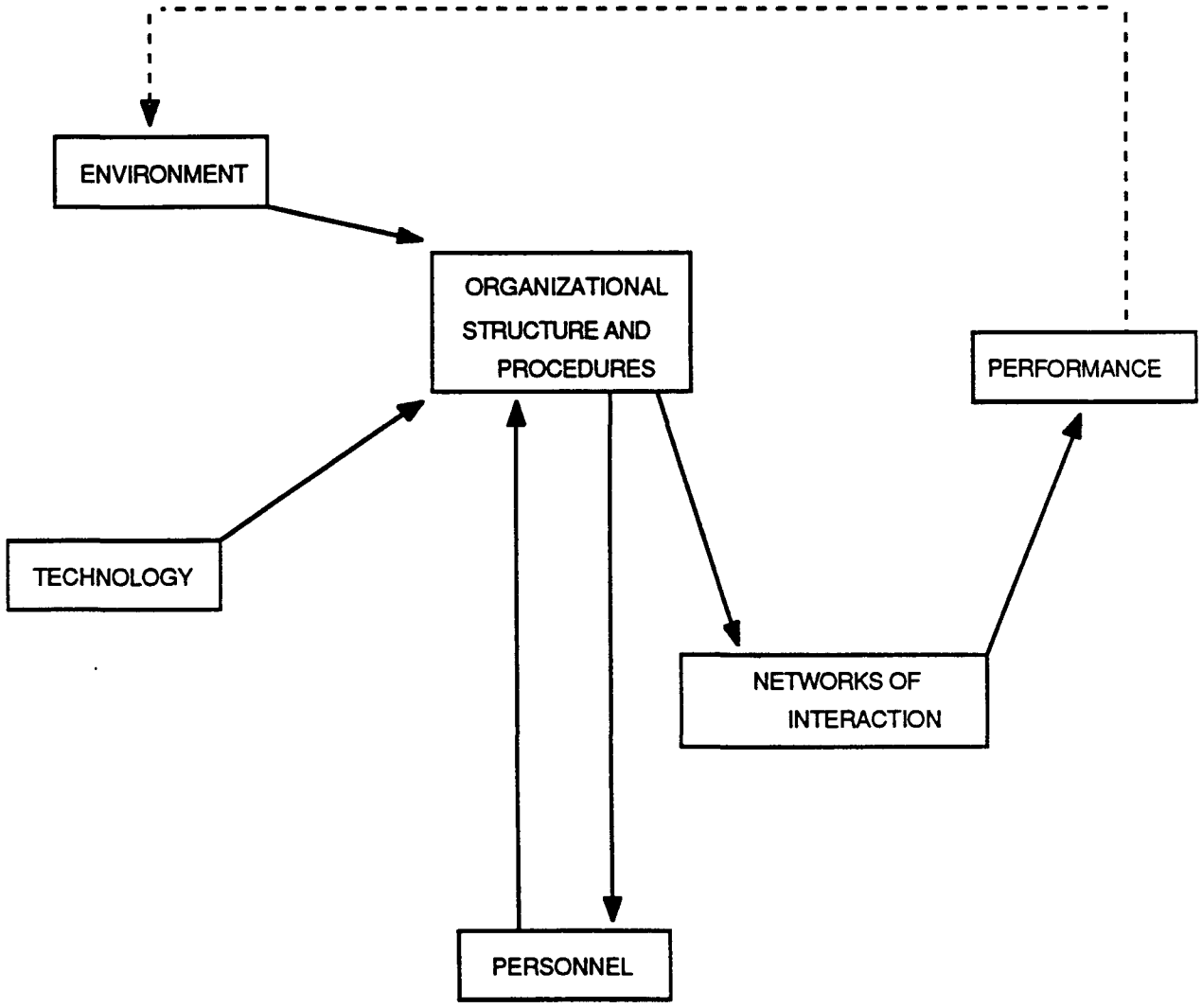
THE THEORETICAL MODEL USED IN THIS RESEARCH

Figure 2 illustrates the relationships among the major theoretical concepts that guided this research. It is assumed that transit agencies are embedded in an environment that places demands on transit agencies. The hnology involved in delivering transit services is also assumed to place coordination demands on the organization. Holding other factors constant, agencies respond by creating positions with associated job characteristics, grouping or clustering positions into organizational units within a formal hierarchical structure, and developing rules and procedures to coordinate activities. These changes to the formal structure create staffing needs which are satisfied by flows of personnel within the organization or from outside to within the organization. Simultaneously, of course, some personnel may be leaving the organization through retirements, terminations, or resignations. It is assumed that the relationship between structure and personnel flows is reciprocal. That is, changes in structures redirect flows of personnel within the organization, and the clustering of units within overarching hierarchical authority structures causes the clustering of job mobility opportunities. At the same time, the availability of personnel may have some effects on the structuring of the organization. In other words, the ability of a transit agency to adapt to a changing environment by creating a unit may be hampered by a lack of qualified personnel. It is further assumed that the structure and procedures created to accomplish and coordinate activities will lead to networks of interaction across the organization that will ultimately affect organizational performance. Organizational performance does not exist in a vacuum; eventually performance results will filter back to constituencies in the environment.

These variables were measured in a variety of ways in this research project. For purposes of clarity, a limited number of variables are included in this report. The effects of the environment and technology employed by the organization on individuals is often through the characteristics of their jobs. Two key variables that were expected to influence interactions across the organization were the task variability of the job and the individual's dependence on others. Task variability was defined as the number of exceptions encountered in the work. The scales were based on items used in studies conducted by Van de Ven and Ferry (1980) and Tushman (1979) among others. It was assumed that task variability would generate uncertainties in the accomplishment of tasks that would require interaction with others (Tushman, 1979). A further inherent technological difference in transit

FIGURE 2

A Theoretical Model of Factors Affecting Coordination Across the Organization



agencies is the distinction between Administration and Operations. Accordingly, the data are analyzed separately for Administration and Operations personnel.

Formal structures and procedures provide guidelines for interaction. Employees at higher levels of the organization can be assumed engage in broader management tasks that require interaction across the organization. Accordingly, formal position in the hierarchical structure is divided into three levels in this analysis. Referring again to Figure 1, the General Manager, directors, department heads, and staff people reporting directly to directors or the General Manager were considered to be top level employees. The middle level consisted of division heads. The bottom level were all employees below the division heads. Since some staff people without managerial responsibility are included in these levels, a distinction is also made between managerial and professional personnel.

As well as occupying formal positions that have differing degrees of responsibility individuals also must adhere to formal rules that guide their interactions. Formal rules for interaction were measured by the centralization and routinization of the job. The vertical authority relationship or the centralization of the organization is measured by the individual's rating of his perceived influence and his or her manager's influence in accomplishing the work. Routinization was measured by an additive scale tapping individual perceptions of the routineness and extent of rules guiding the work. Both of these additive scales were based on scales developed by Van de Ven and Ferry (1980).

In addition to the formal position occupied and characteristics of the job, individuals have a history or career with the organization. Two personal career characteristics, the number of years in the agency and the number of positions that an individual has occupied, were hypothesized to influence networks of interaction.

A variety of networks were measured in this study. This report focuses on the work network, measured as responses to the request to list "the people at work that you interact with to get the job done" with fourteen spaces available in the questionnaire for answers. Finally, organizational performance is measured by ratings of departmental performance made by the department managers.

STUDY DESIGN

This study of interactions across transit organizations is limited and exploratory. Due to a lack of previous research, and given limited time and resources, the strategy taken was to engage in an intensive study of two sites,

Orange County Transit District (OCTD) and San Diego Transit Corporation (SDTC). These sites were selected on the basis of their medium size. Larger sites presented overwhelming complexity and smaller agencies were expected to experience fewer problems of coordination and control.

A variety of data were gathered. Archival data describing the history of the agencies and data detailing the careers of the employees were collected. Site visits were conducted and interviews were made with the staff. A questionnaire was distributed to all managerial and professional employees at the two sites. Responses to the questionnaire were 79 percent or 61 employees at SDTC and 81 percent or 112 employees at OCTD. The analysis that follows is based primarily on the questionnaire data.

Differences Between the Two Sites

Two primary differences characterize the two sites: control of the agency and size of operations. San Diego Transit Corporation is a wholly owned corporation of the City of San Diego. It was privately owned until 1967 when it was purchased by the City. The City Council appoints a Board of Directors. Orange County Transit District, by contrast, began operation in 1972 as a special district serving Orange County. The agency is governed by a five-member Board of Directors composed of two members appointed by the Mayor's Selection Committee, League of Cities; two members appointed by the Board of Supervisors; and a public member selected by the other four.

Orange County Transit District began operations with four employees by acquiring the six buses of the Santa Ana Bus Company. As Table 1 indicates, OCTD has undergone phenomenal growth in the last thirteen years. This growth in operations reflects the explosive growth in Orange County. San Diego has also grown over this period, although not as dramatically. A comparison of the two sites indicates that OCTD is almost twice as large in terms of number of employees, bus fleet, and total budget.

The differences in size and complexity of operations are reflected in the two organizational charts displayed in Figures 3 and 4. OCTD is sufficiently large and complex to require the creation of more organizational units, and more units are grouped into directorates as compared to SDTC. In terms of organizational theory, OCTD is more open to the environment than SDTC. This is because the transit district structure governed closely by a diverse board leads OCTD to be responsive

to diverse constituencies in the county. This openness, combined with a relatively large scale of operations, leads OCTD to be a complex bureaucracy.

Description of the Respondents to the Questionnaire

There are a variety of differences in the managerial and professional employees between the two sites, as displayed in Table 2. The most striking differences are between the number of years employed in the agency and the level of education of the respondents. Employees at OCTD tend to have higher educational degrees and to have been with the agency for a considerably shorter period of time compared to SDTC. The differences in time on the job are at least partially explained by the differences in age between the two agencies. Nevertheless, turnover appears to be much higher at OCTD. The educational level of employees at OCTD is much higher than at SDTC, and in fact is much higher than has been found in other studies of transit agencies (Vellenga, 1976; Mundy and Spychalski, 1973).

Table 3 indicates differences in perceptions of job characteristics and formal control mechanisms between the two sites. The component questions of the task variability scale fluctuate between OCTD and SDTC. Employees in OCTD are more likely to think they encounter difficult problems compared to those at SDTC and are slightly more likely to think they spend a lot of time solving work problems without

TABLE 1

A COMPARISON OF THE SCOPE OF OPERATIONS BETWEEN OTCD AND SDTC

	Orange County	San Diego
Population (1980 Census)	9,479,436	1,704,352
Total Budget (1985)	$73,175,764	$35,737,248
Total Employees	1272.3	746.3
Drivers	759.1	477.9
Mechanics	147.6	107.1
Operations (Administration)	66.1	16.8
Administrative	58.3	25.5
Bus Fleet		
Large Buses	526	340
Dial-A-Ride Vehicles	123	11

Figure 3

The Organization of Orange County Transit District

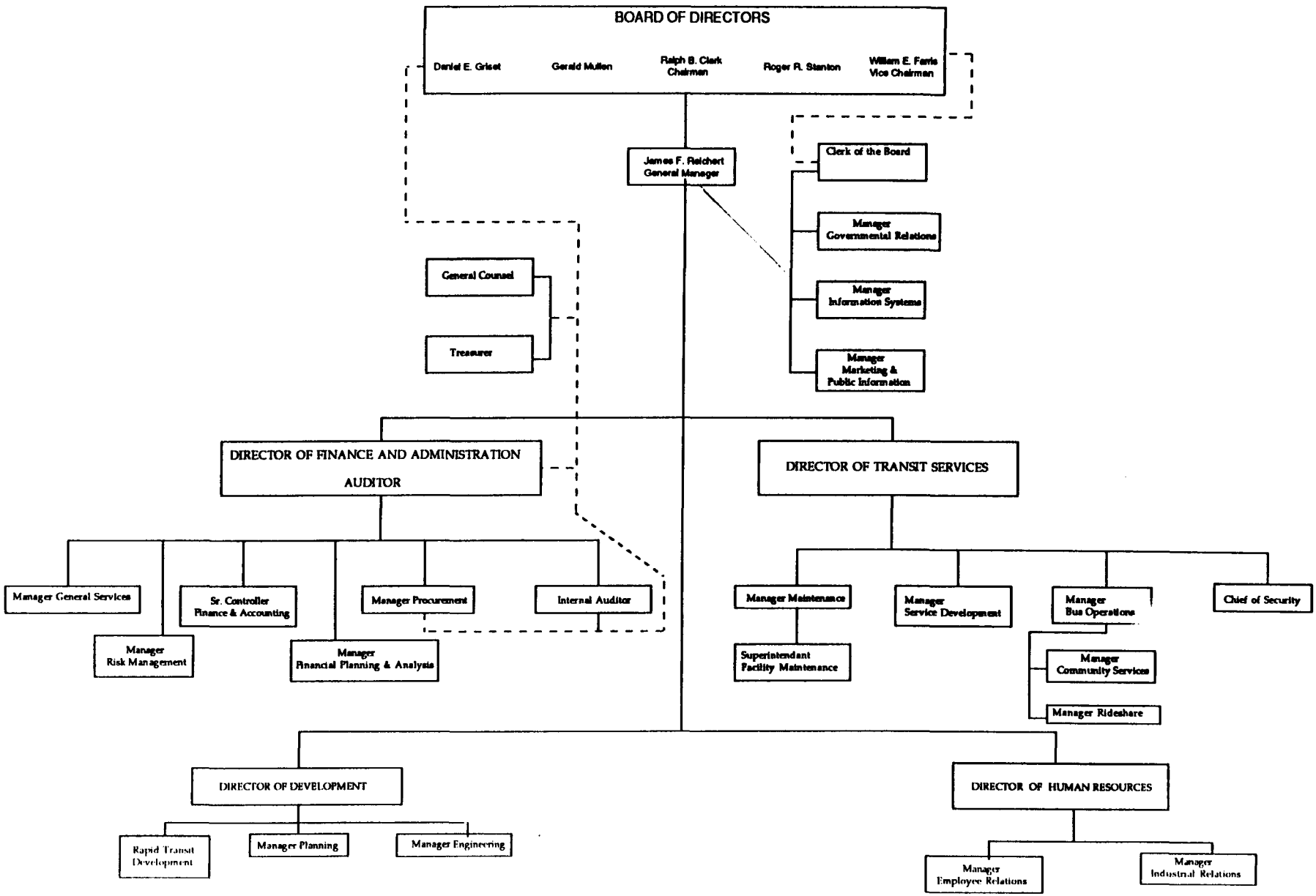


Figure 4

The Organization of San Diego Transit Corporation

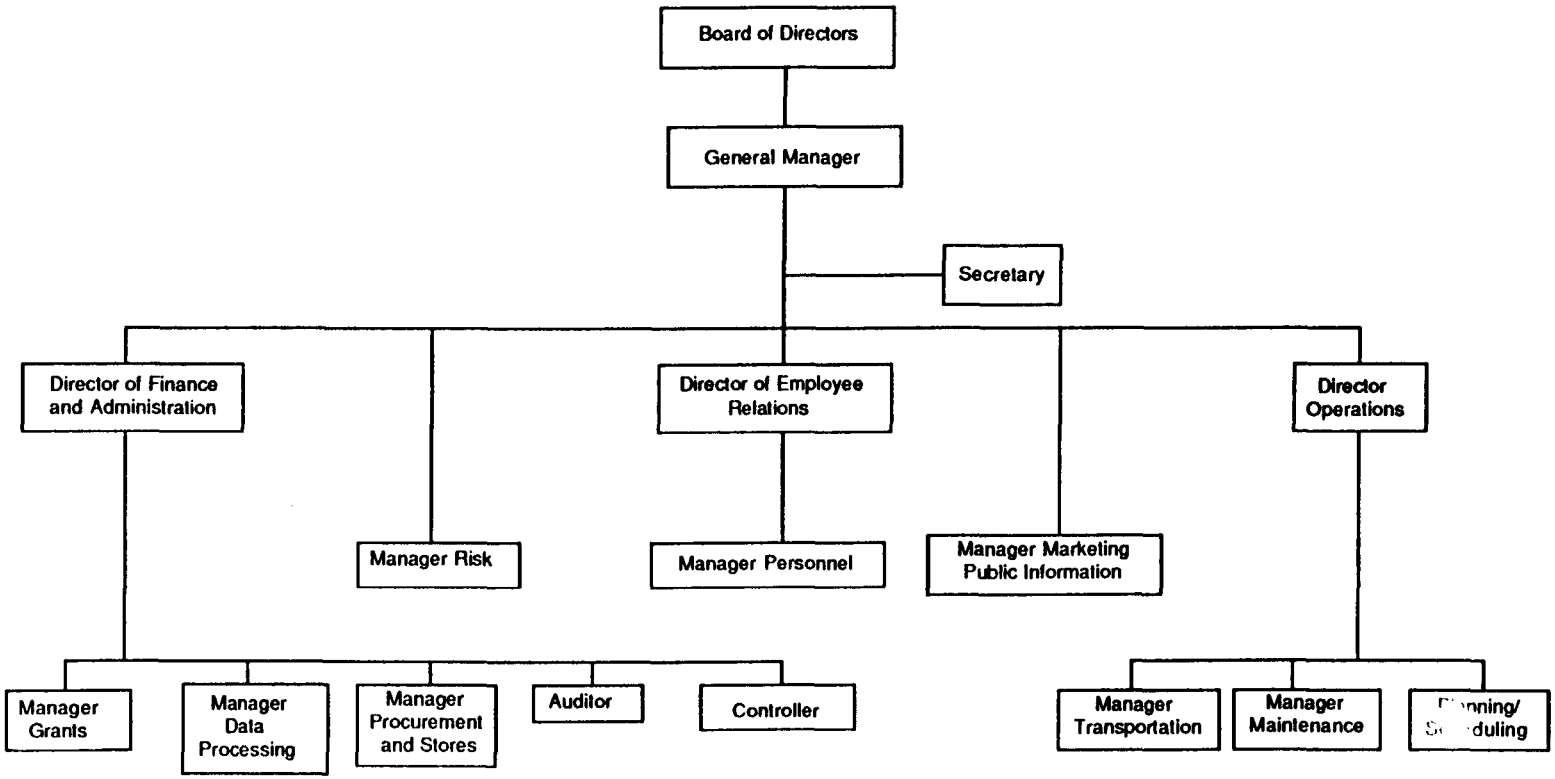


TABLE 2

CHARACTERISTICS OF INDIVIDUALS IN THE SAMPLE

	OCTD			SDTC		
	OVERALL	ADMIN	OPS	OVERALL	ADMIN	OPS
MEAN YEARS EMPLOYED	5.5	5.2	6.1	10.2	10.2	10.2
MEAN AGE	38.0	38.0	38.0	41.0	41.0	41.0
MEAN NUMBER OF POSITIONS	2.5	2.2	3.0	3.1	2.5	3.6
EDUCATION						
High School or Less	1	1	-	16	14	18
Some College AA or Technical Training	31	23	45	54	43	64
College Graduate	48	53	39	20	25	15
Graduate Degree	19	21	16	10	18	3
RACE						
Asian	10	14	3	5	7	3
Black	1	-	3	2	-	3
Caucasian	78	76	82	82	86	79
Hispanic	6	5	8	8	7	9
Other	5	4	5	3	-	6
SEX						
Male	59	53	71	79	64	91
Female	41	47	29	21	36	9

immediate solutions. However, more Administrative than Operations personnel in OCTD believe they spend time solving work problems without immediate solutions, while the reverse is true at SDTC. Although an equal number of employees at both sites believe they "frequently encounter exceptions to th work that require different procedures," the relationships are reversed at the two sites. More Operations personnel agree with the statement at OCTD, while more Administrative personnel agree with the statement at SDTC. Finally, SDTC employees are more likely to believe the techniques, skills, and information needed to do their work are constantly changing compared to OCTD. In general, employees at both sites perceive a great deal of variability in their work, although there are differences in perceptions of individual dimensions of variability.

Dependence on others to accomplish the work is also assumed to affect interactions within the organization. Overall, Orange County employees are more dependent on others in order to get the job done compared to those at SDTC. The only exception to this relationship is the virtually equal likelihood of individuals in both sites consulting people outside the unit. Significantly, Orange County personnel are twice as likely to have to deal with people outside the organization as part of their job. This probably reflects the greater openness to the environment at OCTD.

In addition to characteristics of the job, formal control mechanisms such as routinization and centralization are hypothesized to affect interactions within the organization. In general, SDTC is more routinized than OCTD, with Operations at SDTC tending to be more guided by rules than Administrative employees. The only exception is that OCTD employees are more likely to know what level of work performance is required of them.

Centralization is measured here as the amount of influence the employee perceives that the supervisor exerts over his or her work, and the amount of influence the employee has over the work. Supervisory influence is low and about equal at both sites. The employee's influence is high at both sites and particularly high for the administrative employees at SDTC.

In summary, the differences in job characteristics and formal control policies reflect the differences in the two sites. Task variability is about the same, with some site specific differences. OCTD employees, being in a large complex organization, are more dependent on others and more likely to have to deal with people outside the organization. SDTC, being smaller and less complex, is managed

TABLE 3

PERCEPTIONS OF JOB CHARACTERISTICS
AND FORMAL CONTROL MECHANISMS

	OCTD			SDTC		
	OVERALL	ADMIN	OPS	OVERALL	ADMIN	OPS
Job Characteristics						
Task Variability[1]						
1) Encounter difficult problems without immediate solutions	44	45	42	38	39	38
2) Easy to know I have done my work correctly	80	81	78	82	82	82
3) Spend a lot of time solving work problems without apparent solutions	45	47	42	43	36	49
4) Generally sure what the outcome of my work efforts will be	79	82	74	79	79	79
5) Frequently encounter exceptions in my work which require different procedures	62	53	79	62	68	58
6) The techniques, skills or information needed to do my work are constantly changing	55	54	58	63	61	66
Depending on Others[2]						
How much does your job require you check with:						
1) Other unit members	30	26	37	20	26	15
2) People outside your unit but within the organization	24	25	24	25	39	12
3) People outside the organization	17	15	21	8	18	-

TABLE 3 (continued)

	OCTD			SDTC		
	OVERALL	ADMIN	OPS	OVERALL	ADMIN	OPS
Formal Control Mechanisms						
Routinization[1]						
1) I follow about the same work methods every day	61	64	55	80	68	91
2) Rules and procedures specify how my tasks are to be done	20	26	16	27	21	31
3) My job description clearly specifies my standards of performance	27	26	30	32	32	37
4) I know what level of work performance is required	84	83	87	73	75	72
Centralization[2]						
How much influence does your supervisor have in:						
1) Determining my tasks	10	11	8	11	11	12
2) Setting quotas on work	17	16	18	16	14	18
3) Establishing rules and procedures	18	14	26	21	14	27
4) Determining how to handle exceptions	21	19	24	25	25	24
How much influence do you have in:						
1) Defining my tasks	91	90	92	90	100	82
2) Setting quotas on work	82	81	84	87	93	82
3) Establishing rules and regulations	77	78	76	79	89	70
4) Determining how to handle exceptions	67	63	74	75	93	61

[1] Percent answering "agree" and "strongly agree"
[2] Percent answering "quite a bit" or "very much"

more by rules. Supervisory influence is low and individual influence is high at both sites, with a great deal of discretion allocated to the Administrative employees at the smaller San Diego agency.

CHAPTER TWO
THE SIZE AND STRENGTH OF AN INDIVIDUAL'S NETWORK

The number of other people involved in an employee's network and the strength of ties to others are important to employees and to the organization as a whole in transit agencies. The number of people consulted in the conduct of work is an indicator of the flow of communication and the control that employees exert in the organization. In general, employees who are connected to many others in the organization are likely to be influential in the day-to-day operation of the organization. In addition, there may be differences in the size and strength of networks between those employees in Administration and Operations, between managerial and professional employees, and between those at different hierarchical levels. These differences in connectedness are likely to influence the integration or cohesiveness of the employees within and between organizational units. This chapter examines what determines the size and strength of an individual's network.

THE IMPORTANCE OF NETWORKS TO TRANSIT EMPLOYEES

A great deal of research has been done on the size and strength of an individual's network, although relatively little of this research has been conducted within organizations. The size of an individual's network, sometimes conceived of as the range or extensiveness of contacts, has often been studied by anthropologists. (See Boissevain, 1974; Boissevain and Mitchell, 1973 for reviews.) Sociologists have also used this technique for studying relationships in the urban setting (e.g., Laumann, 1973; Wellman, 1979). In these contexts, the focus has usually been on how much support an individual's network can provide in dealing with the social environment. In addition, a variety of results have been produced when the position of an individual in the network is considered, with position being measured by how centrally located the individual is within the network. As Burt (1980) detailed in his review of network research, centrality and prestige (usually measured by the number of people who cite an individual as the object of relations) has been associated with being a leader in a system, having greater work satisfaction, adopting and being aware of innovations, and possessing valuable resources.

As well as having a large number of ties or being centrally located in a network, the strength of ties also affects relationships among individuals. For example,

actors who are the object of strong relations are sometimes considered more prestigious; the stronger or more cohesive the ties, the more similar people are in their attitudes (Festinger et al., 1950); and the more frequently people interact, the more likely they are to be friendly towards each other (Homans, 1950). However, Granovetter (1973) has noted that weak ties are also important to people because it is those individuals with whom you interact less frequently who are likely to provide new information. For example, Granovetter (1973) discovered in a study of job seeking that those who found jobs through personal contacts were more likely to find jobs through acquaintances with whom they seldom had interactions. Granovetter hypothesized that these weak ties could provide a more extensive and diverse network of information by their contacts to others outside of the individual's immediate social circle. Granovetter further hypothesized that social systems in which all ties are strong would become fragmented into mutually exclusive cliques, because weak ties that bridged groups were necessary to bind groups together into a larger system.

Implicit in the weak ties argument is the assumption that individuals have time budgets that can be allocated to their interactions with others. On the one hand, if an individual has strong ties to others (strength usually being measured as frequency of interaction), then the individual's network would have to be small. On the other hand, the highly informed individual would have many contacts, but by necessity, the contacts would have to be brief. In the organizational setting, this budgeting of interaction implies that if individuals were encouraged to interact frequently within their work group, coordination across work groups would suffer and the organization would be in danger of disintegrating as work groups became insular cliques. However, organizations are designed to overcome this problem. For instance communication systems allow an increase in the speed and extensiveness of the flow of information. Bureaucratization can also be used to apportion ties among individuals. That is, first, reliance on rules and procedures can substitute for direct interaction between superiors and subordinates and can provide guidelines for interactions across units. Second, by hierarchically arranging positions, and placing boundaries around groups of positions, those at lower levels within the organizational unit are encouraged to interact among themselves, and higher level employees can be encouraged to develop more extensive contacts across the organization necessary to coordinate work groups.

Those writing on the subject of strong and weak ties have also noted that

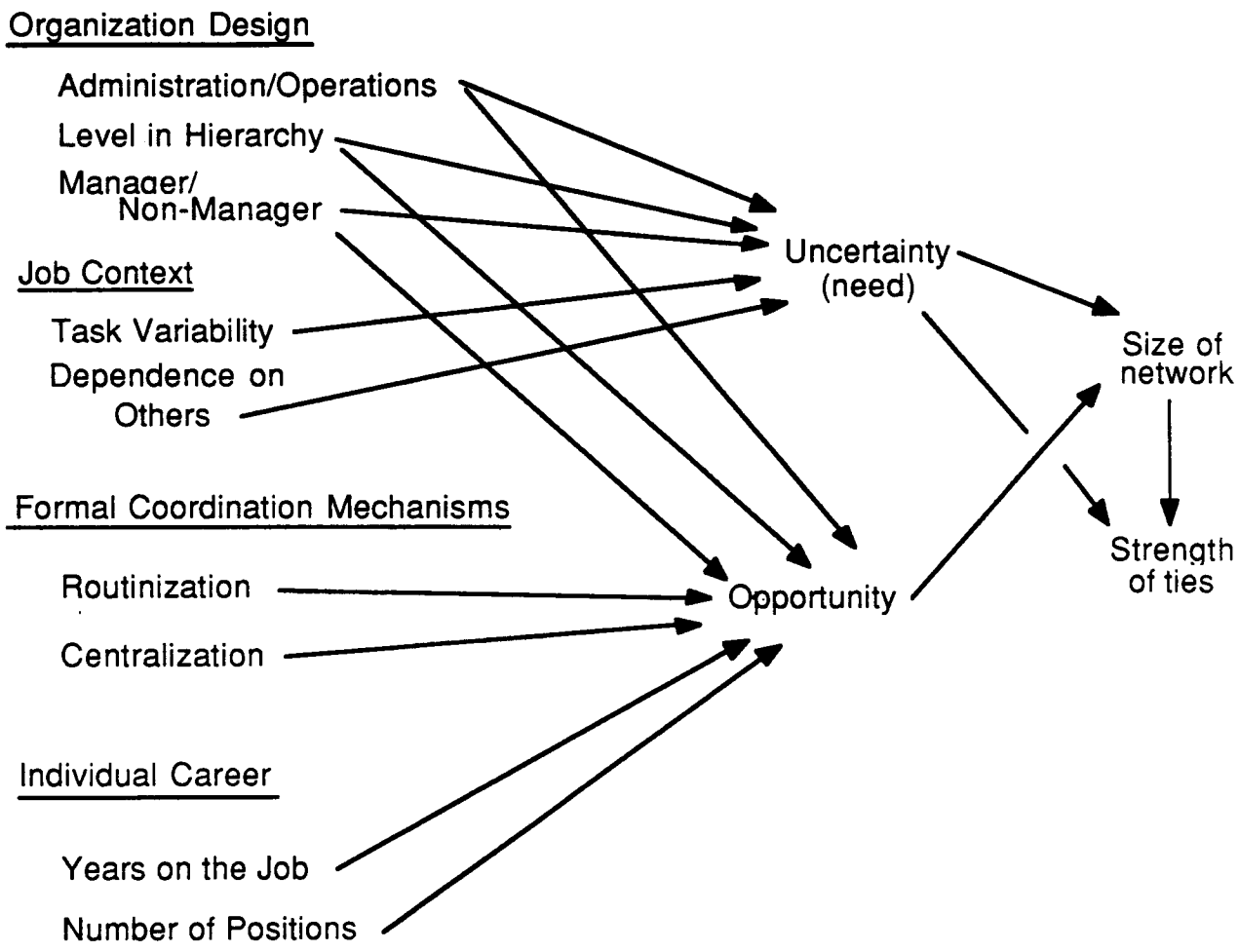
individual circumstances might affect the size and strength of an individual's network. For example, lack of social resources might encourage an individual to develop a few strong ties. Granovetter (1973) found that those who had been unemployed when job seeking were likely to use strong ties to find jobs, and, in a later review of research on strong and weak ties, Granovetter (1982) cited a variety of research indicating that those who were economically disadvantaged were likely to rely on the strong ties of family or neighborhood in coping with poverty. In the organizational context, insecurity can be translated into job uncertainties brought about by environmental demands and ambiguous or rapidly changing technology. Lack of organizational resources to cope with uncertainties may be more characteristic of lower level employees, encouraging them to cultivate a few strong ties.

A MODEL PREDICTING THE SIZE AND STRENGTH OF TIES IN A TRANSIT AGENCY

The implicit assumptions of the size and strength argument, (i.e. that size and strength are inversely related, and that lack of resources or uncertainty encourages the cultivation of a few strong ties) can be tested in the organizational context. Figure 5 presents a model in which variables characterizing an individual in terms of work demands, organizational position, managerial policies and individual career are assumed to lead to the need and opportunity for interaction. The need for interaction is assumed to be synonymous with uncertainty in the organizational context, and uncertainty is assumed to lead to larger networks and to stronger ties within networks. Opportunity is hypothesized to positively affect the size of the network but to have little effect on the strength of the network. The size of the work network is assumed to negatively affect the strength of ties in the network. It is hypothesized that administrative employees, managers, and employees at higher levels of the organization will face more uncertainty in their jobs but have more opportunities for interaction. Furthermore, those facing more variability in their tasks, and those more dependent on others will face more uncertainty in the conduct of their work. Formal coordination mechanisms such as centralizing authority and making jobs more routinized should reduce the opportunities for interaction. Finally, individual career history, measured by the years on the job and number of positions occupied, should lead to more opportunities for interaction.

Figure 5

A Theoretical Model Predicting the Size and Strength of Networks



In summary, Figure 5 represents a model in which the size and strength of networks have been separated so that the direct and indirect effects of variables on the size and strength of networks can be assessed. Further, the variables selected for analysis can account for the effects of the formal organization of work, the job context, managerial policies of control, and the influence of individual discretion on the size and strength of interactions that lead to individual and organizational effectiveness. Deviations from this model between the two sites will indicate how strongly the variables affect individual interaction at the two sites.

DESCRIPTION OF THE SIZE AND STRENGTH OF NETWORKS

Table 4 presents the average size and strength of networks for the organization and different levels of hierarchy at OCTD and SDTC. (A tie is strong if the respondent indicated that he or she communicated once or twice a week or more often with a person concerning his or her work.) As the table indicates, the work networks of transit employees at both sites are quite large, and the size of the network increases at higher levels of the hierarchy. Paradoxically, as the size of the network increases at OCTD, the frequency of interaction in the network also increases. A similar pattern occurs at SDTC, except that middle level employees have stronger networks than top employees.

TABLE 4

SIZE OF NETWORK AND STRENGTH OF TIES AT OCTD AND SDTC

	OCTD		SDTC	
	Size of Network	Strength of Tie	Size of Network	Strength of Tie
Overall	11.3 (112)[1]	.63 (111)	11.1 (61)	.80 (60)
Top	12.7 (18)	.73 (18)	12.8 (14)	.77 (13)
Middle	12.3 (29)	.63 (29)	11.4 (10)	.84 (10)
Bottom	10.5 (63)	.59 (62)	10.5 (35)	.79 (35)

[1] Sample size in parenthesis

These descriptive results challenge the assumption that those with larger networks in transit agencies would have weaker ties to others. Figures 6 and 7 present some simple structural equation models examining the relationship between size and strength within the two sites. Both figures indicate that size and strength are indeed negatively related when other factors such as being a manager or hierarchical location are controlled. These results suggest that the size and strength of individual networks is a multivariate phenomenon, and the direct and indirect effects of other variables on the size and strength of ties must be considered.

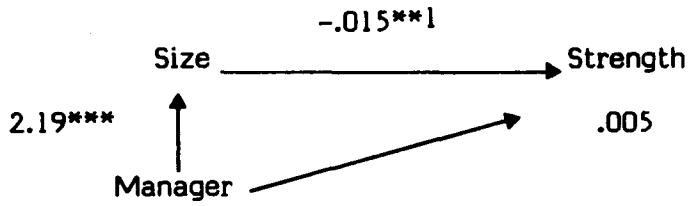
In order to account for the other factors that might affect the size and strength of ties, a series of multiple regressions were run, as reported in Tables 5 through 8. In these tables a baseline model consisting of the organizational design variables identified in Figure 5 was first estimated. Then groups of variables corresponding to the job context, formal coordination mechanisms, and individual career variables were added separately to the baseline equation, and the multiple regression equation was reestimated. Thus, it is assumed that organizational design is of paramount importance in determining the size and strength of interactions. Whether other factors add to the explanation after controlling for position in the organizational design is tested by determining if the addition of a factor increases the explanation of the dependent variable.

Factors affecting the size of the network across the two sites are indicated in Tables 5 and 6. According to the basic equation (the first panel in Table 5), individuals in Administration at OCTD have smaller networks compared to those in Operations. (Administration is a "dummy variable" coded 1 if the respondent was in Administration and 0 otherwise. Thus the coefficient associated with Administration indicates the difference in the mean size of the network controlling for the other variables in the equation. Similarly, "Hier 1" represents top level employees compared to middle level employees, "Hier 2" represents bottom level employees compared to middle level employees, and "Manager" indicates managers as compared to non-managerial employees.) Managers at OCTD, however, have large networks compared to non-managerial employees. Differences in hierarchical level are what would be expected based on the results from Table 4. That is, top level employees have larger networks and bottom level employees have smaller networks compared to the middle level employees, although the differences are not statistically significant. By comparison, as shown in Table 6 first panel,

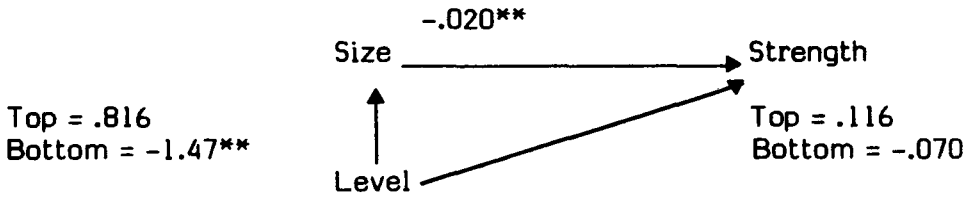
FIGURE 6

SIMPLE CAUSAL MODELS PREDICTING THE SIZE AND STRENGTH OF INDIVIDUAL NETWORKS AT OCTD

A. The Effect of the Managerial Role on the Size and Strength of Individual Networks



B. The Effect of Hierarchical Level on the Size and Strength of Individual Networks



C. The Effect of Size of the Network on its Strength Controlling for Hierarchical Level

Top (N = 18)	Middle (N = 29)	Bottom (N = 62)
-.031	-.013	-.020**
Size → Strength	Size → Strength	Size → Strength

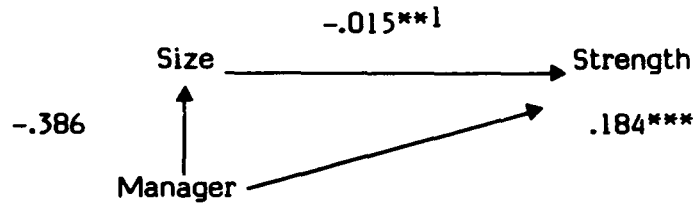
1 Unstandardized Coefficients

***p < .01
**p < .05
*p < .10

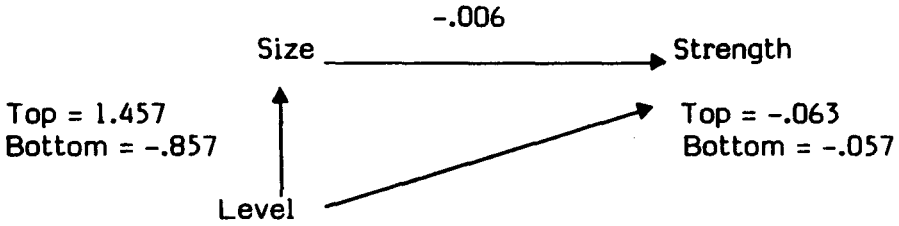
FIGURE 7

SIMPLE CAUSAL MODELS PREDICTING THE SIZE AND STRENGTH OF INDIVIDUAL NETWORKS AT SDTC

A. **The Effect of the Managerial Role on the Size and Strength of Individual Networks**



B. **The Effect of Hierarchical Level on the Size and Strength of Individual Networks**



C. **The Effect of Size of the Network on its Strength Controlling for Hierarchical Level**

Top (N = 13)	Middle (N = 10)	Bottom (N = 35)
-.012	-.007	.009
Size ⟶ Strength	Size ⟶ Strength	Size ⟶
Strength		

1 Unstandardized Coefficients

*** p < .01
** p < .05
* p < .10

TABLE 5

PREDICTING THE SIZE OF AN INDIVIDUAL'S NETWORK AT OCTD
ON THE BASIS OF ORGANIZATIONAL DESIGN, PLUS
JOB CHARACTERISTICS, MANAGERIAL POLICIES
AND INDIVIDUAL CAREER VARIABLES RESPECTIVELY

	B	BETA
ADMIN	-1.1463*	-.1511
HIER 1	.7379	.0757
HIER 2	-.8804	-.1207
MANAGER	1.5960*	.2149
CONSTANT	11.4654***	--
R^2 = .13***	(N = 110)	
ADMIN	-1.1525*	-.1517
HIER 1	.6002	.0601
HIER 2	-.9415	-.1284
MANAGER	1.4924*	.2006
CONSTANT	9.6665***	--
DEPENDENCE ON OTHERS	.0230	.0050
TASK VARIABILITY	.5433	.0805
R^2 = .13**	(N = 109)	

TABLE 5 (continued)

	B	BETA
ADMIN	-1.2006*	-.1580
HIER 1	.7387	.0740
HIER 2	-.9973	-.1360
MANAGER	1.6212*	.2179
CONSTANT	10.3177***	--
SUPERVISOR'S INFLUENCE	-.1096	-.0242
ROUTINIZATION	.5069	.0910
R^2 = .13**	(N = 109)	
ADMIN	-.9586	-.1310
HIER 1	-.0338	-.0036
HIER 2	-1.6334**	-.2314
MANAGER	1.1122	.1553
CONSTANT	11.6361***	--
NUMBER OF POSITIONS	-.3751	-.1577
YEARS IN ORGANIZATION	.2953**	.2870
R^2 = .19***	(N = 109)	

*** $p < .01$
** $p < .05$
* $p < .10$

TABLE 6

PREDICTING THE SIZE OF AN INDIVIDUAL'S NETWORK AT SDTC ON THE BASIS OF ORGANIZATIONAL DESIGN, PLUS JOB CHARACTERISTICS, MANAGERIAL POLICIES, AND INDIVIDUAL CAREER VARIABLES RESPECTIVELY

	B	BETA
ADMIN	.4735	.0663
HIER 1	1.3104	.1571
HIER 2	-.8318	-.1152
MANAGER	-.4322	-.0505
CONSTANT	11.5481***	--
R^2 = .08	(N = 59)	

ADMIN	.4149	.0581
HIER 1	1.0583	.1269
HIER 2	-.6862	.0950
MANAGER	-.7156	-.0836
CONSTANT	5.4739	--
DEPENDENCE ON OTHERS	.6346	.1420
TASK VARIABILITY	1.4082	.1975
R^2 = .142	(N = 59)	

TABLE 6 (continued)

	B	BETA
ADMIN	.6121	.0855
HIER 1	.8238	.0990
HIER 2	-1.5418	-.2133
MANAGER	-.2863	-.0335
CONSTANT	12.5685***	--
SUPERVISOR'S INFLUENCE	1.3031***	.3170
ROUTINIZATION	-1.2966**	-.2543
R^2 = .23**	(N = 58)	
ADMIN	.3923	.0549
HIER 1	1.2102	.1451
HIER 2	-1.0715	-.1484
MANAGER	-.1906	-.0223
CONSTANT	12.0600	--
NUMBER OF POSITIONS	-.0541	-.0288
YEARS IN THE ORGANIZATION	-.0330	-.0615
R^2 = .09	(N = 59)	

*** $p < .01$
** $p < .05$
* $p < .10$

administrative employees at SDTC have larger networks but managers have smaller networks. However, the differences are not statistically significant.

Given these baseline results, groups of variables were added to the equations. At OCTD the only factor that increased the predictive ability of the equation (as measured by an increase in R^2) was the individual's career history. The number of years spent in the organization had the largest influence (as measured by the size of the standardized coefficient) on the size of an employee's network. At SDTC, by contrast, formal coordination mechanisms contributed to the largest increase in R^2. Making the job more routine tended to decrease the size of an individual's network, and an increase in supervisor's influence on work related decisions increased the size of an individual's network. It was not anticipated that the supervisor's influence on work decisions would increase the size of an individual's network. However, it may be that those who perceive that their supervisor is engaged in work decision-making believe their supervisor is assisting them at SDTC, and these are the people who develop more extensive networks.

A different set of variables affected the strength of individual networks at the two sites. As shown in the baseline equation of Table 7, the size of an individual's network at OCTD had a significant negative effect on the strength of his or her network. Being in Administration or being a manager also tended to decrease the strength of the network. As previously noted in the descriptive results, top level employees had stronger networks and bottom level employees had weaker networks than middle level employees. Adding other factors did not appreciably increase the explained variance provided by the baseline equation. Once again, as illustrated in Table 8, SDTC provides a contrast to the OCTD results. The baseline equation (first panel of table), representing the effects of formal design on individuals, does not explain a significant amount of the variance in the strength of ties, as indicated by the non-significant R^2. Adding job contextual variables does produce an increase in R^2, and a significant amount of variance is explained by the equation. In this equation, SDTC is similar to OCTD in that the size of an individual's network does reduce the strength of the network, controlling for other formal design variables in the baseline equation, although the effect is not statistically significant. What is significant is that being a manager and dependence on others leads to stronger networks.

TABLE 7

PREDICTING THE SIZE OF AN INDIVIDUAL'S NETWORK AT OCTD ON THE BASIS OF ORGANIZATIONAL DESIGN, PLUS JOB CHARACTERISTICS, MANAGERIAL POLICIES, AND INDIVIDUAL CAREER VARIABLES RESPECTIVELY

	B	BETA
SIZE	-.022***	-.295
ADMIN	-.172***	-.319
HIER 1	.126*	.181
HIER 2	-.127	-.243
MANAGER	-.068	-.127
CONSTANT	1.079	--
R^2 = .22***	(N = 109)	
SIZE	-.024***	-.317
ADMIN	-.175***	.324
HIER 1	.102	.143
HIER 2	-.130**	.248
MANAGER	-.076	-.143
CONSTANT	.835	--
DEPENDENCE ON OTHERS	.015	.045
TASK VARIABILITY	.069	.143
R^2 = .24***	(N = 108)	

TABLE 7 (continued)

	B	BETA
SIZE	-.021***	-.283
ADMIN	-.169***	.313
HIER 1	.115	.162
HIER 2	-.115*	-.220
MANAGER	-.076	-.143
CONSTANT	1.205	--
SUPERVISOR'S INFLUENCE	-.001	-.003
ROUTINIZATION	-.046	-.115
R^2 = .23***	(N = 108)	
SIZE	-.019***	.242
ADMIN	-.170***	-.3193
HIER 1	.143**	.207
HIER 2	-.104	-.201
MANAGER	-.058	-.110
CONSTANT	1.033	--
NUMBER OF POSITIONS	.014	.077
YEARS IN THE ORGANIZATION	-.009	-.122
R^2 = 21***	(N = 108)	

*** p < .01
** p < .05
* p < .10

TABLE 8

PREDICTING THE SIZE OF AN INDIVIDUAL'S NETWORK AT SDTC ON THE BASIS OF ORGANIZATIONAL DESIGN PLUS JOB CHARACTERISTICS, MANAGERIAL POLICIES, AND INDIVIDUAL CAREER VARIABLES RESPECTIVELY

	B	BETA
SIZE	-.005	-.082
ADMIN	.013	.030
HIER 1	-.024	.046
HIER 2	.003	.006
MANAGER	.188***	.371
CONSTANT	.704	--
R^2 = .14	(N = 58)	
SIZE	-.010	-.162
ADMIN	-.001	-.003
HIER 1	-.060	-.119
HIER 2	-.003	-.007
MANAGER	.165**	.325
CONSTANT	.394	--
DEPENDENCE ON OTHERS	.072**	.272
TASK VARIABILITY	.066	.156
R^2 = .23**	(N = 58)	

TABLE 8 (continued)

	B	BETA
SIZE	-.002	-.033
ADMIN	.009	.021
HIER 1	-.015	-.029
HIER 2	.026	.060
MANAGER	.200**	.393
CONSTANT	.717	--
SUPERVISOR'S INFLUENCE	-.033	-.136
ROUTINIZATION	.006	.019
R^2 = .16	(N = 57)	
SIZE	-.004	-.076
ADMIN	.043	.100
HIER 1	.002	.004
HIER 2	.043	.100
MANAGER	.188	.369
CONSTANT	.613	--
NUMBER OF POSITIONS	.023	.196
YEARS IN ORGANIZATION	-.003	-.087
R^2 = .17	(N = 58)	

*** p < .01
** p < .05
* p < .10

SUMMARY

The results of this analysis are summarized in Figures 8 and 9. In these figures, only the paths from the variables in the best predicting equation for size and strength are shown. It was expected that position in the organizational design would significantly affect both the size and strength of an individual's network. This was somewhat true at OCTD, but formal position did not seem to have strong effects at SDTC. The most interesting difference highlighted by these diagrams is that individual career variables had an effect on the size of network at OCTD, whereas formal coordination mechanisms affected the size of networks and the job context affected the strength of networks at SDTC. This suggests fundamental differences between the two agencies. Employees at SDTC increase the strength of their ties in response to the uncertainties generated by the job context, and formal coordination mechanisms implemented by managers exert some control over the number of others contacted by an employee. This is more like the expected rational bureaucratic model of organization. At OCTD, however, the biggest factor in the extensiveness of an individual's network is the number of years the employee has been on the job, and the job context or formal coordination mechanisms do not seem to affect the frequency with which others are contacted in the conduct of the job. This suggests that OCTD employees rely less on formal coordination and more on personal networks developed over time.

Figure 8

The Effects of Organizational and Individual Variables on the Size and Strength of Individual Networks at OCTD

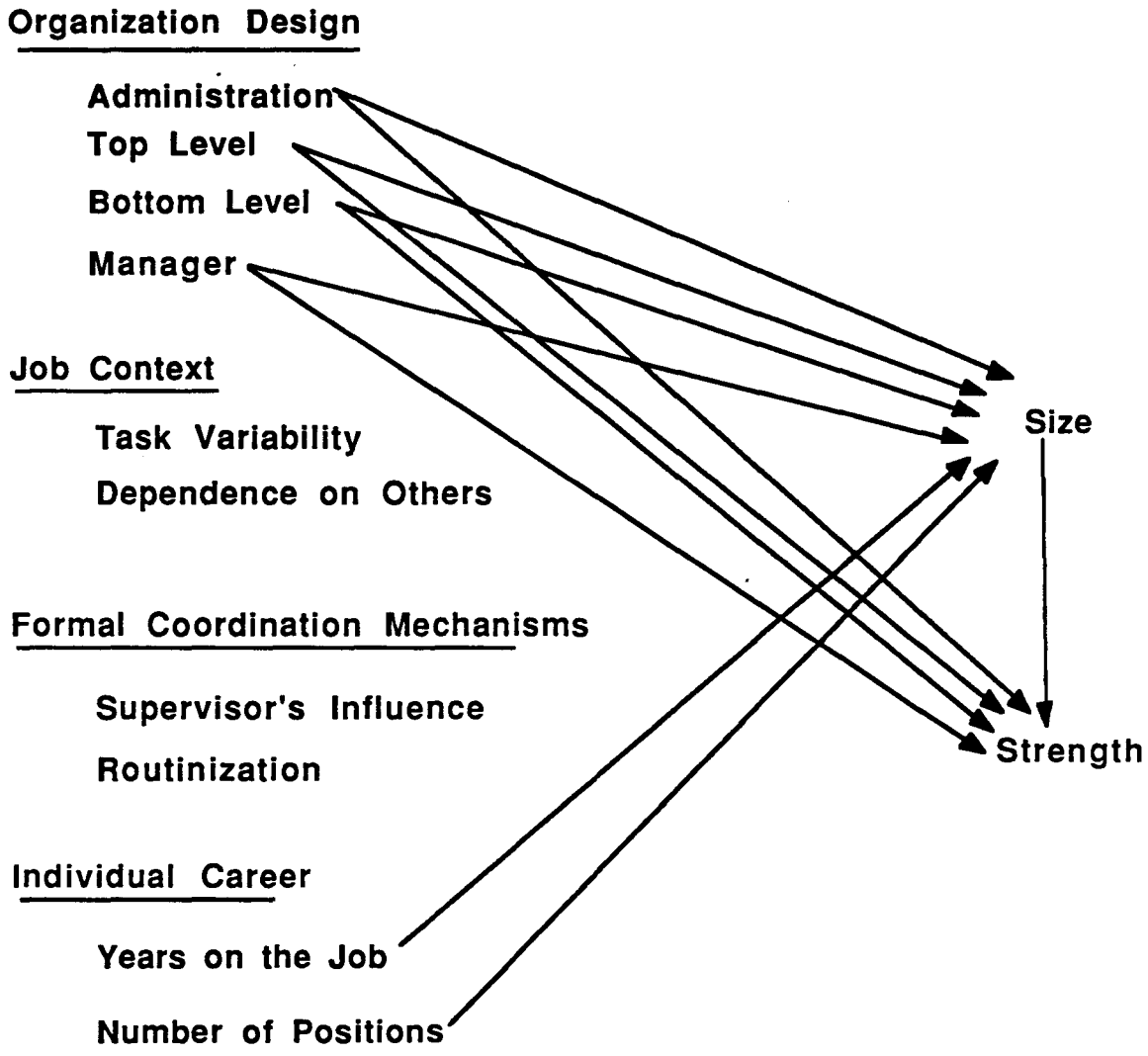
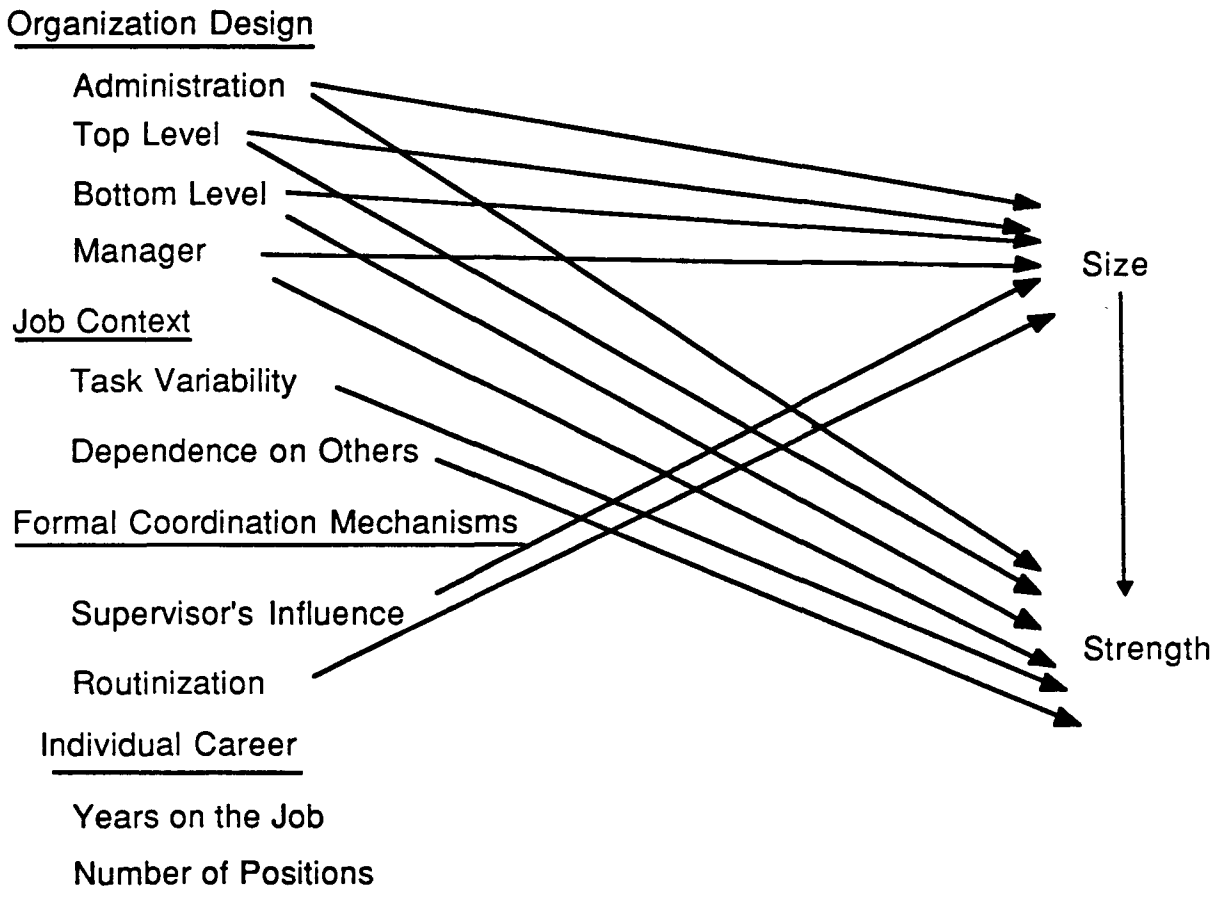


FIGURE 9

The Effects of Organizational and Individual Variables on the Size and Strength of Individual Networks at SDTC



CHAPTER THREE
STRATEGIES FOR INTERACTION

Given that individuals at these two transit agencies have different sizes of networks and different average strengths of ties in their networks, it is useful to consider with whom individuals interact, and what conditions might affect their choice of interaction partners. Interaction within a formal hierarchy can occur in two dimensions. First, interaction can have direction; i.e., interaction can be vertical, horizontal, or diagonal. Vertical interaction is defined here as contact with an immediate supervisor or subordinate. Horizontal interaction is defined as interaction with someone at the same level of hierarchy, and diagonal interaction is contact with someone outside of the individual's direct vertical relationships but not at the same level of hierarchy. Second, interaction can have range. That is, an individual can interact with someone within the same department, or across departments but within the same directorate, or with someone elsewhere in the organization.

DIMENSIONS OF INTERACTION IN A TRANSIT AGENCY

There have been many studies of interaction across the organization, but few that have considered the mulitiple dimensions of interaction. The vertical dimension, usually conceptualized as the supervisor - subordinate relationship from the point of view of the manager, has been studied extensively. In a review of studies of communication in organizations Porter and Roberts (1976) estimate that about two-thirds of a manager's time is spent in communication with superiors and subordinates and about one-third in horizontal communication. They assume, however, that diagonal interactions are subsumed under the vertical dimension. They do note a study by Wicksberg (1968) that indicated that one-third of a manager's time was spent in diagonal interaction, as well as one-third spent in vertical communication. Porter and Roberts speculate that if a study of non-managers were done, the ratio between vertical and horizontal interaction would be reversed.

A few authors have emphasized the importance of non-vertical interactions within organizations. For example, Simpson (1959) found that communication among first line supervisors in a manufacturing plant was largely horizontal. In a study of three companies, Landsberger (1961) discovered that horizontal interactions are

important sources of "reality testing" among peers who face similar problems, as well as sources of conflict. Dalton (1959) noted many years ago that conflict was endemic across the organization between line and staff employees and suggested that cliques among groups of employees may form to help or hinder the efforts of management. Sayles (1964) developed a seven category scheme to describe the functions of horizontal relations across the organization. According to Sayles (1964), trading, work-flow, service, advisory, auditing, stabilizing, and innovating relations occur horizontally across the organization.

It is apparent from this research that horizontal and diagonal relationships can have great relevance for organizational performance. Horizontal relationships are important for coordination between individuals in departments, and across departments and directorates. These relationships can lead to effective coordination among individuals and the formation of cliques and coalitions among frequently interacting individuals that may hinder or assist the organization. What makes these relationships even more interesting is that individuals have some discretion in initiating these interactions since not all interactions across the organization can be formally dictated by rules and procedures. Unfortunately, no one has considered the circumstances that cause individuals to apportion their time to vertical, horizontal, or diagonal interaction, and what organizational mechanisms may affect the direction of ties between personnel. Thus, it is necessary to propose a theoretical model of how transit employees allocate their time. First, a series of assumptions concerning factors which lead to interaction within organizations is stated. A series of hypotheses are derived from the assumptions and then tested.

HYPOTHESES CONCERNING THE LIKELIHOOD OF INTERACTIONS AMONG EMPLOYEES

First, it is assumed that technological interdependence increases the likelihood of ties within the organization. Second, the principle of homophily is assumed to operate in organizations. The principle of homophily, found in numerous studies of interactions within groups, states that people who perceive others to be similar to themselves are more likely to interact with them -- like attracts like. However, not everyone is similar because of the third assumption about organizations: resources are unevenly distributed among organizational members. At higher levels of the organization, for example, individuals are given more discretion in the conduct of their jobs. It has already been shown in this study that individuals at

higher levels have larger, more wide ranging contacts with others. Thus, higher level employees will be more likely to perceive others at their level across the organization as similar to themselves. Thus the principle of homophily may be more likely to be in effect at higher levels of the organization. Finally, it is assumed that individuals are purposive and not completely controlled by the formal organization. This implies that employees strive for discretion in their work and want to avoid excessive dependence on others.

Given these assumptions, a series of hypotheses can be derived. First, given that technological interdependence leads to interaction, interdependent individuals are placed together in departments in organizations, and departments are often grouped together under directors, it follows that placing boundaries around groups of people and encouraging them to interact around common work problems leads them, in general, to share a common vocabulary, to be more cohesive, and to define organizational problems in similar ways. Individuals within more inclusive boundaries are more likely to view those at the same level within the department, or even the directorate as similar to themselves. Thus:

Hypothesis 1: **Actors within more inclusive boundaries are more likely to interact with others at the same level (horizontal interactions).**

Interactions outside of organizational boundaries are likely to possess a different set of characteristics. The exchange process between individuals interacting across boundaries is likely to be less frequent, more short term, quid pro quo, and involve less trust between partners. Under these circumstances, the principle of homophily is less applicable and organizational members will be more concerned with avoiding dependence and accomplishing instrumental actions. Under these conditions it is expected that organizational members will choose to interact with status unequals. This is to be expected for several reasons. Top level employees may find it effective to bypass the formal hierarchy and go directly to a subordinate in another unit. Similarly, lower level employees may find that it is useful to cultivate contacts at higher levels of the organization. Burt (1980) reviews research that indicates that people tend to claim friendship with others of higher rather than lower prestige than themselves. Porter and Roberts (1976) cite research that has demonstrated that low status individuals are more likely to attempt to communicate with high status individuals rather than other low status people. The strategy of interacting with others of high status may be very effective. Lin, Ensel, and Vaughn (1981) found that weak ties to higher status individuals led to finding

higher status jobs. Therefore:

Hypothesis 2: **Actors crossing organizational boundaries are more likely to interact with status unequals (diagonal interactions).**

Finally, perceptions of status equality varies within the organization. Higher level employees have more wide ranging contacts and are more likely to perceive others at their same level across the organization to be status equals. Thus:

Hypothesis 3: **Actors at higher levels of the organization are more likely to interact with status equals (horizontal interactions) across the organization.**

To summarize, it is assumed that individuals who perceive others at their same hierarchical level to be status equals will be likely to interact with them. The creation of organizational boundaries in transit agencies will reduce interaction among personnel and encourage more strategic diagonal interaction. Diagonal interaction is characterized as strategic in that the formal chain of command is bypassed in favor of lower level employees "going over the heads" of those in other units they would like to influence and higher level employees bypassing supervisors in favor of directly contacting lower level employees. Diagonal interaction is assumed to be reduced if units are grouped together in directorates. In this case, individuals sharing the same overall supervisor are likely to interact more and rely on horizontal interaction among equals. It is further assumed, although not formally stated above, that the sheer size of groups within a transit agency and the size of the agency itself will influence interaction. In other words, top level groups in smaller transit agencies are more likely to interact, encouraging perceptions of status equality and horizontal interaction. There is also likely to be less perception of status equality in larger agencies, more boundaries to cross, and a necessity for more diagonal interaction.

DESCRIPTIVE RESULTS CONCERNING VERTICAL, HORIZONTAL, AND DIAGONAL TIES

Tables 9 and 10 indicate the allocations among vertical, horizontal, and diagonal ties made by transit employees in the two agencies under study. Comparing the overall allocation of ties at both sites, it is interesting to note the large number of diagonal ties or ties outside the formal hierarchy. At OCTD, looking across the row of figures for horizontal interaction within the entire organization, the hypothesis that upper level employees are more likely to engage in horizontal interaction is confirmed. However, as shown by the diagonal row for the

TABLE 9

VERTICAL, HORIZONTAL AND DIAGONAL TIES AS A
PERCENTAGE OF OVERALL TIES AT OCTD

					ADMIN				OPS			
	Overall	Top	Mid	Bottom	Overall	Top	Mid	Bottom	Overall	Top	Mid	Bottom
VERTICAL	14	20	18	11	15	20	20	11	11	18	14	9
HORIZONTAL	29	36	36	29	28	37	26	27	30	32	24	33
DIAGONAL	57	44	44	60	57	43	54	62	59	50	62	58

TABLE 10

VERTICAL, HORIZONTAL AND DIAGONAL TIES AS A
PERCENTAGE OF OVERALL TIES AT SDTC

					ADMIN				OPS			
	Overall	Top	Mid	Bottom	Overall	Top	Mid	Bottom	Overall	Top	Mid	Bottom
VERTICAL	21	19	32	18	15	18	11	13	26	21	64	20
HORIZONTAL	31	22	25	37	24	23	27	29	36	18	22	41
DIAGONAL	48	59	43	45	61	59	62	58	38	61	14	39

entire organization, bottom level employees are much more likely to engage in diagonal interaction. This is not the case at SDTC where bottom level employees are more likely to engage in horizontal interactions and top level employees are more likely to engage in diagonal interaction.

The foregoing suggests important differences between the two agencies. At OCTD, there is more horizontal or peer interaction at the top and middle levels of the organization, and more diagonal interaction at the bottom level. This implies that employees at the lower level of the organization find it necessary to bypass the formal chain of command. By contrast, at SDTC, there is large horizontal or peer interaction at the lower levels, particularly in Operations. Diagonal interaction is less likely at the bottom compared to the top. Diagonal interaction from the top may be less destabilizing to the formal chain of command compared to a great deal of diagonal interaction originating from the bottom. However, it is necessary to remember that these two agencies are of very different size and complexity. In smaller, less complex SDTC, it may be much easier to communicate across departments, particularly in Operations and this would encourage more horizontal interaction. Therefore, it may necessary for more diagonal interaction to originate at the bottom level at OCTD.

Tables 11 and 12 provide information testing the hypotheses that higher level employees are more likely to initiate horizontal interactions across boundaries, and that horizontal interactions are more likely within departments compared to directorates, and within directorates compared to across the organization. In other words, these tables provide a test of the effects of creating organizational boundaries on interactions between individuals, and whether higher level employees are less affected by these boundaries. To test the hypotheses, ratios of horizontal ties to horizontal and diagonal ties within a particular category were calculated. To make the ratios in these tables comparable, only data on personnel in departments grouped within directorates is presented. This reduces the sample size considerably, particularly in the case of SDTC. Therefore, only the overall figures will be discussed, although data are broken down in the tables into Administration and Operations.

Both OCTD and SDTC confirm the hypothesis that top level employees are more likely to interact horizontally whether within the department, directorate, or organization, compared to other levels. (This is shown by the rows of the table for values at the organizational level. The dash for the top level Horizontal in

TABLE 11

THE PERCENTAGE OF HORIZONTAL TIES TO NON-VERTICAL TIES IN DEPARTMENTS, DIRECTORATES AND THE ORGANIZATION AT OCTD

					ADMIN				OPS			
	Overall	Top	Mid	Bottom	Overall	Top	Mid	Bottom	Overall	Top	Mid	Bottom
HORIZONTAL IN DEPARTMENT	45	-	49	50	44	-	50	51	46	-	49	49
HORIZONTAL IN DIRECTORATE	18	47	15	6	22	55	7	9	12	25	23	2
HORIZONTAL IN ORGANIZATION	27	49	24	20	35	59	34	29	17	52	15	10

TABLE 12

THE PERCENTAGE OF HORIZONTAL TIES TO NON-VERTICAL TIES IN DEPARTMENTS, DIRECTORATES AND THE ORGANIZATION AT SDTC

					ADMIN				OPS			
	Overall	Top	Mid	Bottom	Overall	Top	Mid	Bottom	Overall	Top	Mid	Bottom
HORIZONTAL IN DEPARTMENT	67	-	79	69	44	-	50	50	74	-	100	73
HORIZONTAL IN DIRECTORATE	23	31	18	21	21	30	31	-	23	33	-	25
HORIZONTAL IN ORGANIZATION	24	33	20	21	33	41	20	39	19	24	20	18

Department cell indicates that only one person occupies the top level in the department.) Furthermore, the hypothesis that strategic rather than horizontal peer interaction will prevail as one interacts outside the department is also supported. However, it does not appear to be true that there is more horizontal interaction within departments grouped into directorates compared to interaction across the organization.

As well as the relative number of interactions, the strength (i.e. frequency) of interactions across the organization is an indicator of the effects of organizational boundaries on different levels of hierarchy. Tables 13 and 14 display the percentage of strong ties to total number of ties for both horizontal and diagonal interactions within the organization. In order to characterize each tie as strong or weak, the unit of analysis in these tables is the tie rather than the person. Looking first at the strength of horizontal ties overall at both sites, the strength of ties drops off at the directorate and organizational level. The decline is relatively less between department and directorate compared to directorate and organization, at least at OCTD. This suggests more cohesiveness within departments, slightly less at the directorate level, and even less at the organizational level. As expected, top level management was more likely to make frequent use of horizontal ties compared to other levels, at least at OCTD. The data for SDTC contradicts this conclusion somewhat, but it must be remembered that there are only two small directorates at SDTC, making the sample size for horizontal ties within the directorate extremely small.

The strength of diagonal interactions, as shown in Tables 13 and 14, indicates that diagonal interactions drop off sharply outside the department at both sites. Thus there is a hesistancy to use diagonal ties outside the department very often, particularly at the lowest levels. This lends support to the theory that diagonal ties may represent somewhat illegitimate interaction, particularly on the part of lower level employees.

PREDICTING THE DIRECTION OF INTERACTION

Tables 15 through 18 provide the results of multiple regression equations that predict the direction of ties. It was assumed in these regressions that in addition to the formal position in the hierarchy that has shown effects in the descriptive results, experience in the organization, measured as number of positions occupied and years in the organization would affect interaction strategy. It was also assumed

TABLE 13

THE PERCENTAGE OF HORIZONTAL AND DIAGONAL TIES IN THE DEPARTMENTS, DIRECTORATES AND THE ORGANIZATION AT OCTD

					ADMIN				OPS			
	Overall	Top	Mid	Bottom	Overall	Top	Mid	Bottom	Overall	Top	Mid	Bottom
HORIZONTAL IN DEPARTMENT	78	-	87	77	64	-	78	61	86	-	93	84
HORIZONTAL IN DIRECTORATE	72	83	69	40	74	80	100	25	69	100	56	100
HORIZONTAL IN ORGANIZATION	41	65	16	33	34	54	8	30	64	93	37	45
DIAGONAL IN DEPARTMENT	84	100	97	76	91	100	100	85	80	100	95	75
DIAGONAL IN DIRECTORATE	49	71	55	36	44	57	52	36	55	86	58	36
DIAGONAL IN ORGANIZATION	37	53	32	35	33	47	23	31	45	80	43	40

TABLE 14

THE PERCENTAGE OF HORIZONTAL AND DIAGONAL TIES IN THE DEPARTMENTS, DIRECTORATES AND THE ORGANIZATION AT SDTC

					ADMIN				OPS			
	Overall	Top	Mid	Bottom	Overall	Top	Mid	Bottom	Overall	Top	Mid	Bottom
HORIZONTAL IN DEPARTMENT	100	-	100	100	100	-	100	100	100	-	100	100
HORIZONTAL IN DIRECTORATE	87	78	80	94	75	71	80	-	94	100	-	94
HORIZONTAL IN ORGANIZATION	78	75	100	73	80	70	100	78	75	83	100	69
DIAGONAL IN DEPARTMENT	93	100	100	91	100	100	100	100	89	100	-	89
DIAGONAL IN DIRECTORATE	64	58	67	67	62	61	67	60	67	50	67	70
DIAGONAL IN ORGANIZATION	57	63	79	46	62	56	75	44	54	71	100	46

that the amount of influence the respondent perceived he or she had (MYINF) and the supervisor had (SUPINF) over the respondent's job would affect the strategy undertaken. These variables differ slightly from the variables used to predict the size and strength of networks (job contextual variables and routinization of the job are deleted) because it is assumed that individuals have more discretion in deciding with whom to interact than whether to interact with anyone else at all. Thus the subset of variables used here tap the discretion that individuals may possess as they occupy higher positions, garner more influence, and accrue more experience on the job.

Tables 15 and 16 show the initial results of predicting the direction of ties. In virtually all cases, there is a significant difference between being in Administration versus Operations across the two sites. For this reason, the regressions were rerun for Administration and Operations separately, and these results are presented in Tables 17 and 18. Table 17 indicates that the amount of influence a supervisor exerts on an individual and the amount of influence the individual perceives himself or herself as having has significant effects for different strategies of interaction in Administration and Operations at OCTD. Thus Operations personnel are less likely to interact vertically if they perceive their own influence is high. Administration personnel are likely to interact horizontally if they think their own influence is high, and less likely to interact diagonally if they think their supervisor's influence is high. By contrast, as shown in Table 18, the only statistically significant effects on interaction strategy at SDTC are hierarchical position. However, some caution should be exercised in interpreting the SDTC results because of the extremely small sample sizes.

Once again these results suggest basic differences between OCTD and SDTC. At OCTD, perceptions of relative influence strongly contribute to determining what interaction strategy is undertaken. In other words, the relative control or centralization of the job affects the strategy of interaction at OCTD. Such control mechanisms do not seem to have large effects at SDTC. This may be another indicator of the difference in size and complexity of operations at OCTD. OCTD supervisors may find it necessary to attempt to limit interactions across units, although previous results (Table 9) indicate that diagonal interactions are quite prevalent, particularly at the bottom level of the hierarchy.

TABLE 15

MULTIPLE REGRESSION PREDICTING THE PERCENTAGE OF VERTICAL, HORIZONTAL, AND DIAGONAL TIES AT OCTD

	VERTICAL	HORIZONTAL	DIAGONAL
ADMIN	.0091	.229***	.248***
NUMBER OF POSITIONS	-.070	-.055	.009
YEARS	-.064	.151	.187
HIER 1	.144	.314***	-.125
HIER 2	-.166	-.083	.066
MYINF	.009	.154	.104
SUPINF	.087	.070	-.163
R^2	.25***	.25***	.13**
(N)	106	106	106

[1] Standardized coefficients

*** p < .01
** p < .05
* p < .10

TABLE 16

MULTIPLE REGRESSION PREDICTING THE PERCENTAGE OF VERTICAL, HORIZONTAL, AND DIAGONAL TIES AT SDTC

	VERTICAL	HORIZONTAL	DIAGONAL
ADMIN	-.259*[1]	.383***	.178
NUMBER OF POSITIONS	.323**	.048	-.149
YEARS	.001	-.134	.077
HIER 1	-.150	.149	.097
HIER 2	-.193	-.103	-.135
MYINF	.096	.008	.087
SUPINF	-.175	.040	.072
R^2	.31***	.26**	.15
(N)	59	59	59

[1] Standardized coefficients

*** p < .01
** p < .05
* p < .10

TABLE 17

MULTIPLE REGRESSION PREDICTING THE PERCENTAGE OF VERTICAL, HORIZONTAL, AND DIAGONAL TIES CONTROLLING FOR ADMINISTRATION OR OPERATIONS AT OCTD

	VERTICAL		HORIZONTAL		DIAGONAL	
	ADMIN	OPS	ADMIN	OPS	ADMIN	OPS
NUMBER OF POSITIONS	-.108[1]	.013	.018	-.132	.098	-.157
YEARS	-.066	-.152	.119	.175	.200	.234
HIER 1	.110	.051	.150	.511***	-.101	-.112
HIER 2	-.140	-.286	-.104	-.191	.090	-.061
MYINF	.174	-.377**	.409***	-.153	-.009	.273
SUPINF	.245	-.282	.187	-.041	-.302**	.060
R2	.10	.23	.24***	.45***	.14	.10
(N)	67	39	67	39	67	39

[1] Standardized coefficients

*** p < .01
** p < .05
* p < .10

TABLE 18

MULTIPLE REGRESSION PREDICTING THE PERCENTAGE OF VERTICAL, HORIZONTAL, AND DIAGONAL TIES CONTROLLING FOR ADMINISTRATION OR OPERATIONS AT SDTC

	VERTICAL		HORIZONTAL		DIAGONAL	
	ADMIN	OPS	ADMIN	OPS	ADMIN	OPS
NUMBER OF POSITIONS	-.122[1]	.289	-.052	.130	.241	-.265
YEARS	.363	.069	-.252	.160	.018	-.115
HIER 1	.375	-.430**	-.150	.680***	-.191	.548***
HIER 2	.279	-.465**	-.398	.244	-.164	.090
MYINF	-.054	.013	.176	.055	.125	.114
SUPINF	-.258	-.203	.046	.069	.153	-.004
R^2	.16	.47***	.09	.36**	.12	.33**
(N)	26	33	26	33	26	33

[1] Standardized coefficients

*** $p < .01$
** $p < .05$
* $p < .10$

CONCLUSIONS

Evidence has been presented that supports the hypotheses concerning interaction across the organization. Individuals in transit agencies are likely to interact with others horizontally within departments as compared to outside departments and those at higher levels are more likely to engage in horizontal interaction. OCTD is a larger and more complex transit agency in which more diagonal interaction occurs, particularly at the bottom level compared to SDTC. If it is assumed that diagonal ties represent strategic interactions and horizontal ties are initiated between peers as the evidence presented in support of the hypotheses suggests, then there is less perception of peer groups across the organization at OCTD and more strategic interaction compared to SDTC. The choice between vertical, horizontal and diagonal interaction is conditioned by how much relative influence is exerted by the supervisor and the individual at OCTD, but not at SDTC. OCTD can be characterized in terms of interaction between employees as an agency where a great deal of interaction outside of formal reporting relationships occurs, and an agency where individual initiative and supervisory influence combine to control interactions.

CHAPTER FOUR
INTERACTIONS BETWEEN DEPARTMENTS

Organizational performance is related to the effective accomplishment of the functions of a transit agency, and these functions are divided among the departments of an agency. Ultimately, the sum of individual interactions within and between departments contributes to the performance of organizational functions. However, organizational performance is much more than the simple interaction between employees. Environmental and technological constraints and demands from constituencies also contribute to performance. In this chapter the influence of individual interactions on differences in departmental performance is investigated by aggregating individual interactions up to the departmental level and analyzing the patterns of interactions between departments. Then departmental position in these patterns of interaction is related to peer ratings of departmental performance.

DEPARTMENTS AS EMBEDDED IN NETWORKS OF INTERACTION

Departments are embedded in a network of interactions between departments. Two ways of looking at the relationship between departments are used in this analysis. First, the centrality of a department in terms of interactions is measured in two ways. The first measure of centrality, the degree of a department or the number of people who interact with the department, is a measure of the communication activity of the department. A department of high degree has high contact with other departments and might be seen as a highly visible department and a major channel of information. Only strong ties between individuals are aggregated to the departmental level in this analysis. In addition, all ties are considered symmetric. That is, if one person cited another in a department but the other person did not reciprocally cite the first, it was assumed that an error had been made and the tie was counted as an interaction between departments. This also insures the confidentality of the respondents since the interactions with small departments is a combination of the number of citations by the employee(s) in a small department and all citations made by the other departments to the small department. Another measure of centrality, betweenness, was also calculated for all departments. The betweenness index is based on the idea that a person who is betweeen two others on a communication path can exert some control over the transmission of information. The betweenness index is a measure of the probability

that a point is on a randomly selected path between two other points. (See Freeman, 1979 for a discussion of centrality and formal definitions of these and other measures of centrality.)

A second way of conceptualizing the position of a department in a network is to consider which departments are structurally equivalent. Two structurally equivalent departments have similar relationships to other departments in the agency. In other words, if the marketing department and the transportation department tend to interact with the same other departments, they share a similar set of interaction partners. These two (or more) structurally equivalent departments occupy a similar status in the agency because they have the same role-set or group of other departments on which they place demands and which place demands on them. (See Burt, 1976 for a discussion of structural equivalence.) In this analysis, structurally equivalent departments are determined based on the strong interactions between departments.

The analysis of the position of departments in a network of interactions within a transit agency should provide information on several issues relevant to organizational performance. For example, the performance of units may vary within agencies. In this study, differences in performance ratings are related to network position. A centrally located unit may have a great deal of control over the work flow of the agency and thus may have a large impact on organizational policy. In addition, analysis of the patterns of interaction can determine which departments are similar in their relations to others. This can have important consequences for organizational design. Units with similar missions should have similar relationships to other units and should be grouped together, all other things being equal. Deviations from this principle may suggest alternative groupings of units that could increase organizational performance.

PERFORMANCE AND NETWORK POSITION

Tables 19 and 20 indicate the ratings that department managers gave themselves and other departments on four dimensions of performance based on a 1 to 5 scale. Looking first at influence on policy, the top rated departments on the influence dimension at OCTD are, in order, Bus Operations, Service Development, Finance and Accounting, Information Systems, and Financial Planning. This suggests an organization that is very oriented towards delivering service and controlling costs. By contrast, the most influential departments at SDTC are Employee

TABLE 19

PERFORMANCE RATINGS OF DEPARTMENTS AT OCTD [1]

	Number of New Ideas Introduced	Reputation for Work Excellence	Attainment of Goals	Influence on Policy
Government Relations	2.7 [2]	3.3	3.2	3.3
Information Systems	3.3	2.8	2.9	3.6
Marketing and Public Information	3.5	3.0	3.2	3.2
FINANCE AND ADMINISTRATION				
Finance and Accounting	3.4	3.9	3.6	3.6
General Services	3.1	3.2	3.3	2.2
Contract Administration and Purchasing	3.3	3.2	3.3	3.4
Risk Management	3.5	3.6	3.6	3.0
Financial Planning and Analysis	3.7	3.8	3.5	3.5
TRANSIT SERVICES				
Maintenance	3.6	3.2	3.6	3.4
Service Development	3.5	3.5	3.3	3.7
Bus Operations	3.1	3.3	3.4	4.0
Security	3.5	3.5	3.5	2.9
DEVELOPMENT SERVICES				
Planning	3.7	3.6	3.3	4.0
Engineering	3.5	3.1	3.1	3.0
HUMAN RESOURCES				
Employee Relations	2.4	2.3	2.4	2.9
Industrial Relations	2.5	2.6	2.8	3.2

[1] Performance was rated on a 1 to 5 scale. 1 = far below average, 2 = somewhat below average, 3 = about average, 4 = somewhat above average, 5 = far above average.

2 Differences of .2 or less on performance rating are not significant.

TABLE 20

PERFORMANCE RATINGS OF DEPARTMENTS AT SDTC [1]

	Number of New Ideas Introduced	Reputation for Work Excellence	Attainment of Goals	Influence on Policy
Marketing and Public Information	3.2[2]	3.0	3.1	4.1
Risk Management	3.5	4.2	3.8	3.7
Safety and Training	2.0	2.0	1.9	2.0
Employee Relations	3.5	3.6	3.6	4.4
FINANCE AND ADMINISTRATION				
Grants	1.9	2.2	2.3	2.4
Data Processing	4.5	4.6	4.7	3.7
Procurement and Stores	3.6	3.7	3.8	2.8
Auditor	3.1	3.5	3.5	2.7
Controller	3.5	4.2	3.9	3.7
TRANSIT SERVICES				
Maintenance	3.5	3.2	3.3	3.3
Transportation	3.5	3.5	3.6	3.5
Planning and Scheduling	4.1	4.1	3.7	3.7

[1] Performance was rated on a 1 to 5 scale. 1 = far below average, 2 = somewhat below average, 3 = about average, 4 = somewhat above average, 5 = far above average.

[2] Differences of .4 or less on performance rating are not significant.

Relations, Marketing and Public Information, Controller, Planning and Scheduling, and Data Processing. These rankings are similar, but suggest that SDTC is more employee and marketing oriented.

When comparing across all dimensions of performance at the two sites, there is a fair amount of variability in these peer ratings of performance, and it appears that the ratings are not identical across all dimensions. In particular, the rating for amount of influence on policy does not seem to always coincide with the other dimensions of performance. Tables 21 and 22 display the correlations among measures of performance and centrality. At SDTC, as shown in Table 22, measures of innovativeness, work excellence, and goal attainment are highly interrelated. However, the influence of a unit is less correlated with perceived performance in the organization. The contrast is even stronger at OCTD. The correlations in Table 21 indicate that the first three measures of performance are highly correlated, but perceived influence has a very low correlation with performance on these other measures. Thus the most influential units are not necessarily the highest performers, particularly at OCTD.

The effect of central location in the network of interactions on performance is shown by the correlations between performance measures and centrality measures in Tables 21 and 22. Looking first at Table 22, the degree and betweenness of departments are strongly correlated with performance and influence at SDTC. At SDTC, high performing units are likely to be rated as influential and to be centrally located within the workflow. Once again, OCTD provides a strong contrast. Referring to Table 21, departmental performance is only weakly related to central position in the workflow, and influence in the organization is negatively related to measures of workflow centrality.

This combination of results is not surprising considering the contrast between the two organizations. San Diego Transit Corporation is relatively small, organizationally simple, and considered a branch of the municipal government. That is, a relatively small number of functions are divided up into a small number of departments in an agency that is overseen by a municipally appointed board. Orange County Transit District is much larger in terms of employees or population served, more organizationally complex, and governed by a politically appointed transit board. Thus, in OCTD, a larger bureaucracy has developed to meet the demands of multiple constituencies that exert influence through the board of directors, unions, and various special interest groups. In this larger bureaucracy it appears that a

TABLE 21

CORRELATIONS BETWEEN PREFERENCE MEASURES AND NETWORK CENTRALITY MEASURES AT OCTD

	NEW IDEAS	EXCELL	GOAL	INFLUENCE	DEGREE	BETWEEN
New Ideas	1.00					
Excell	.707	1.00				
Goal	.705	.892	1.00			
Influence	.288	.311	.190	1.00		
Degree	-.093	.076	.292	-.275	1.00	
Between	.049	.137	.360	-.523	.854	1.00

TABLE 22

CORRELATIONS BETWEEN PREFERENCE MEASURES AND NETWORK CENTRALITY MEASURES AT SDTC

	NEW IDEAS	EXCELL	GOAL	INFLUENCE	DEGREE	BETWEEN
New Ideas	1.00					
Excell	.918	1.00				
Goal	.938	.967	1.00			
Influence	.693	.639	.635	1.00		
Degree	.754	.662	.641	.756	1.00	
Between	.608	.504	.450	.536	.919	1.00

division of labor has developed with daily functional interactions becoming separate from policy making. Thus, centrality in the workflow is negatively associated with policy influence. (It is important to note that this general relationship is not always true. Highly influential units with a great deal of daily work responsibilities such as Bus Operations are also central to the work flow.)

THE STRUCTURAL POSITION OF DEPARTMENTS

The position of a department in a network can also be measured in terms of how similar a department is to other departments in terms of interactions. This similarity is measured in terms of social distance which, in turn, is a function of individual distance. The individual distance of one department from another can be measured by the number of interactions between them. This individual distance measures the intensity of interaction between two departments. However, the role that a department plays in a transit agency is also a function of its relationship to all other departments. This simultaneous relationship to all departments is captured by measuring social distance. The social distance between two departments can be measured by the square root of the sum of squared differences between two vectors describing the individual distances of two departments from all other departments (Burt, 1976). Thus if two departments have a social distance score of zero, they have the same individual distances to other departments or, in other words, they have the same pattern of relationships to all other departments. Two departments having a social distance score of zero occupy the same network position.

For each site, a matrix was created to measure the social distance of all departments in an agency from each other. This matrix of dissimilarities was input into a multidimensional scaling program. Multidimensional scaling (MDS) uses a matrix of similarities or dissimilarities to produce a spatial representation of the points. Items that are more similar are grouped more closely. In this analysis Kruskal's (Kruskal and Wish, 1978) MDS program was used to produce a two-dimensional plot of the similarities, in terms of network position, of departments in the agencies.

Figures 10 and 11 display the two dimensional MDS plots of the data. Lines are drawn around the departments that are grouped into directorates. The two dimensions that are used to plot the data are arbitrary, much like the factors extracted in a factor analysis. The two factors are at 90 degree angles to each other but it is up to the analyst to decide what the factors represent and whether

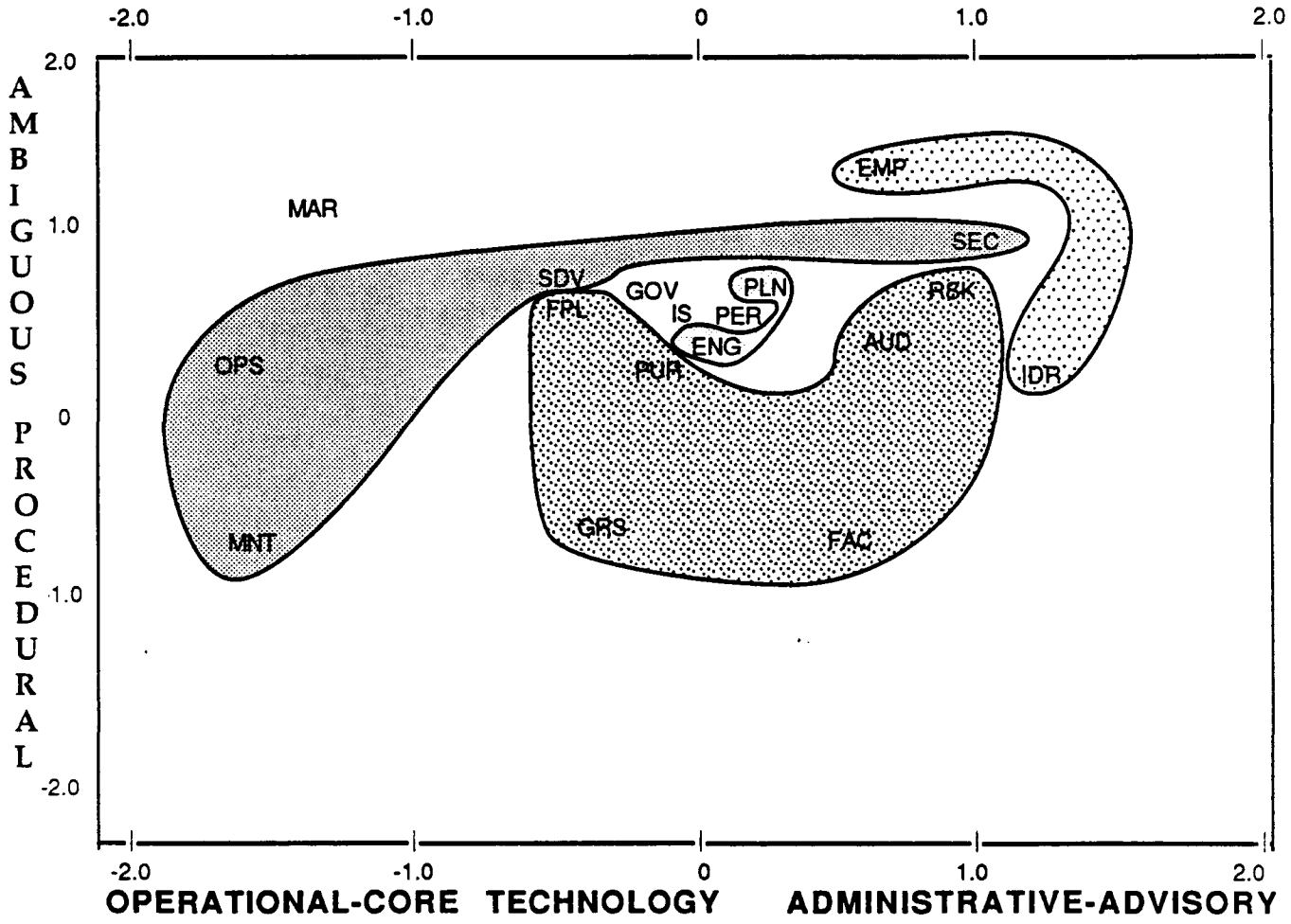
the factor axes should be rotated. In this case the unrotated vertical and horizontal axes appear to represent two dimensions of departmental interaction. The horizontal dimension divides the departments into those which have administrative advising functions and those which have more operational core technology responsibilities. (Note that the axes are reversed in the two figures.) The vertical dimension divides the departments into those with more ambiguous, abstract, people oriented functions and those with more procedural rule driven functions.

The directorate overlays indicate how closely clustered the departments within a directorate are on the two dimensions. Figure 10 shows that the Transit Services directorate at OCTD encompasses a number of functions that vary a great deal in terms of advising versus operational responsibilities. The Finance and Administration directorate appears to be more closely clustered and Service Development is quite closely clustered. A similar pattern is illustrated in Figure 11 for SDTC. Finance and Administration is closely clustered although there is variation of the vertical ambiguous-procedural dimension. Operations shows a great deal of vertical and horizontal variation. It is interesting to note that Marketing is closest to Operations in terms of interactions with other units at both sites.

As well as the formal grouping of departments into directorates, departments can also be grouped together in terms of how similar they are in their relationships to other departments or their structural equivalence. The matrix of dissimilarities was input into a hierarchical clustering program using the diameter algorithm (Johnson, 1967) that grouped similar departments into clusters. Departments that cluster together over a range of social distances can be assumed to occupy the same structurally equivalent position in a network. Figures 12 and 13 show the resulting structurally equivalent positions overlaying the MDS diagrams. Figure 12 indicates that two structurally equivalent administrative positions are occupied by departments at OCTD. The position on the right is occupied by departments who have more advisory responsibilities. The position on the left is staff oriented but closer to the core functions of the agency. This diagram illustrates the large number of staff positions in a larger transit agency and how the staff positions tend to differentiate into core groupings. The other departments are a residual category that does not exhibit enough similarity in interactions with others to be grouped into a position. A similar, but simpler pattern is shown in Figure 13 for SDTC. A core of advisory staff functions which share similar relationships to other units is surrounded by a large residual grouping. Transportation and Marketing and Public

FIGURE 10

MDS PLOT FOR OCTD WITH BOUNDARIES DRAWN AROUND DIRECTORATES

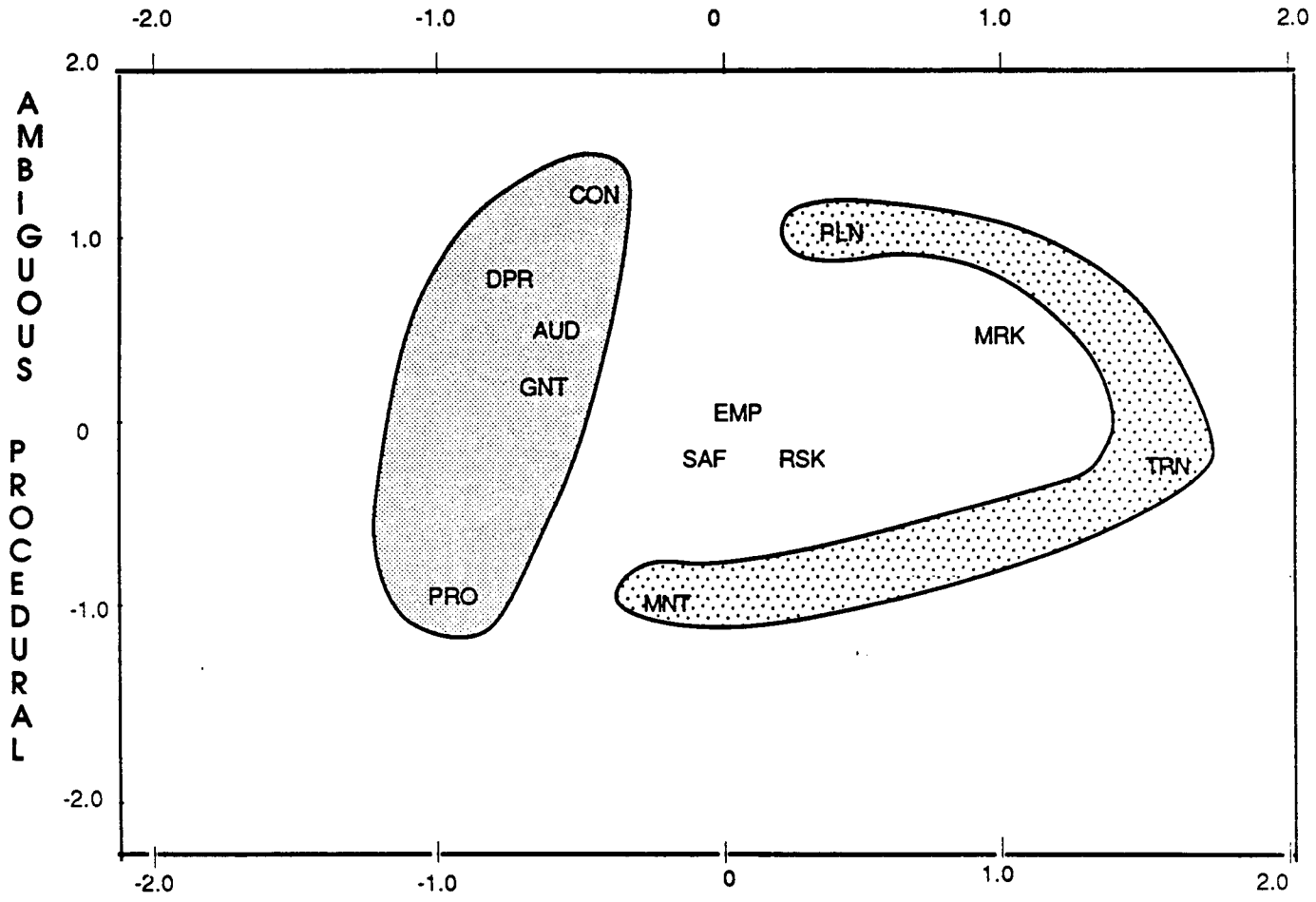


MAR - Marketing and Public Relations
MNT - Maintenance
FPL - Financial Planning
IS - Information Systems
PLN - Planning
RSK - Risk Management
ENG - Engineering
PUR - Purchasing
FAC - Finance and Accounting

OPS - Bus Operations
SDV - Service Development
GOV - Government Relations
EMP - Employee Relations
SEC - Security
PER - Personnel Services
AUD - Auditor
GRS - General Services
IDR - Industrial Relations

FIGURE 11

MDS PLOT FOR SDTC WITH BOUNDARIES DRAWN AROUND DIRECTORATES

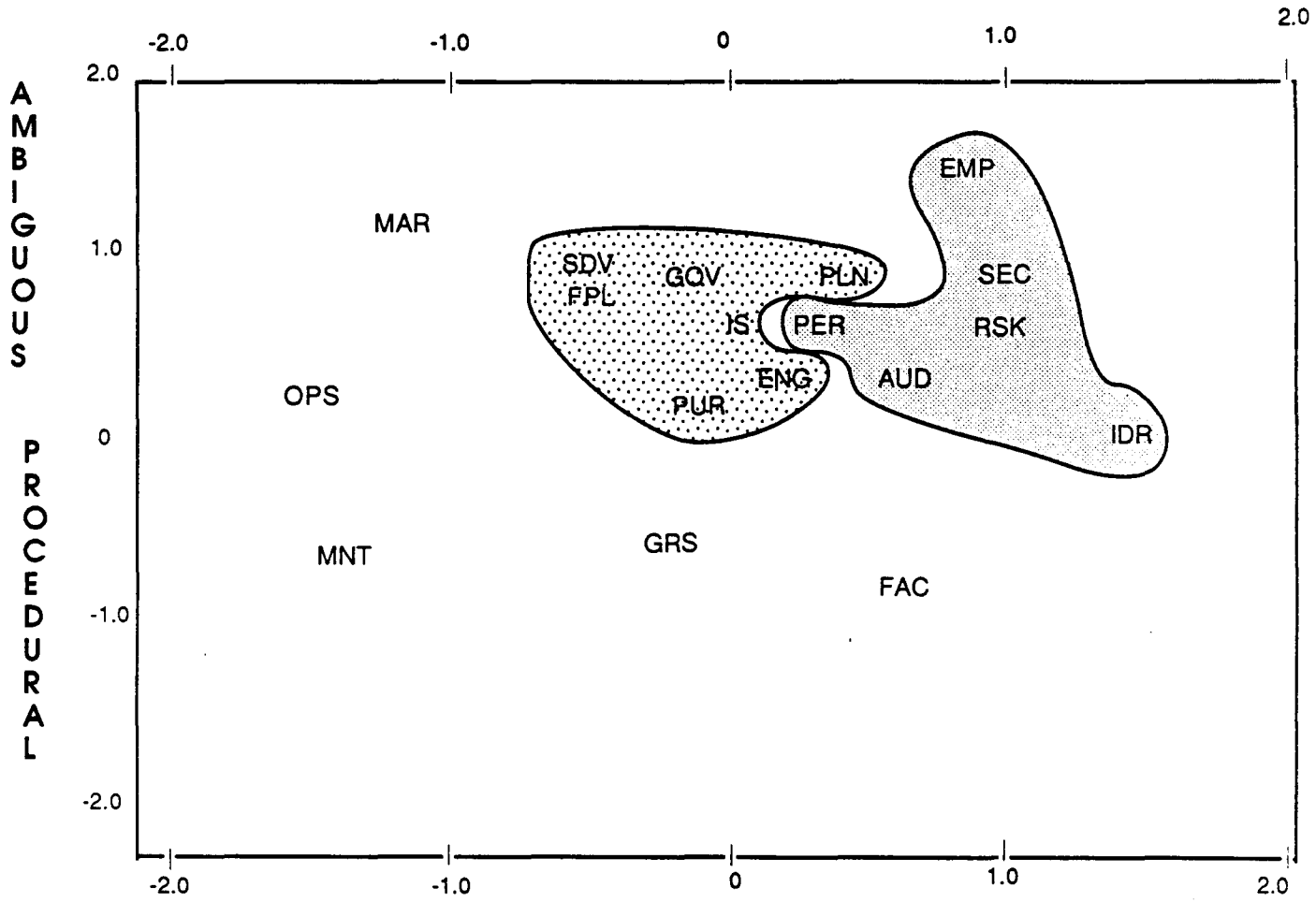


MRK - Marketing and Public Information
RSK - Risk Management
SAF - Safety and Training
EMP - Employee Training
GNT - Grants
DPR - Data Processing

PRO - Procurement and Stores
AUD - Auditor
CON - Controller
MNT - Maintenance
TRN - Transportation
PLN - Planning and Scheduling

FIGURE 12

MDS PLOT FOR OCTD WITH BOUNDARIES DRAWN AROUND DEPARTMENTS WITH SIMILAR ROLES

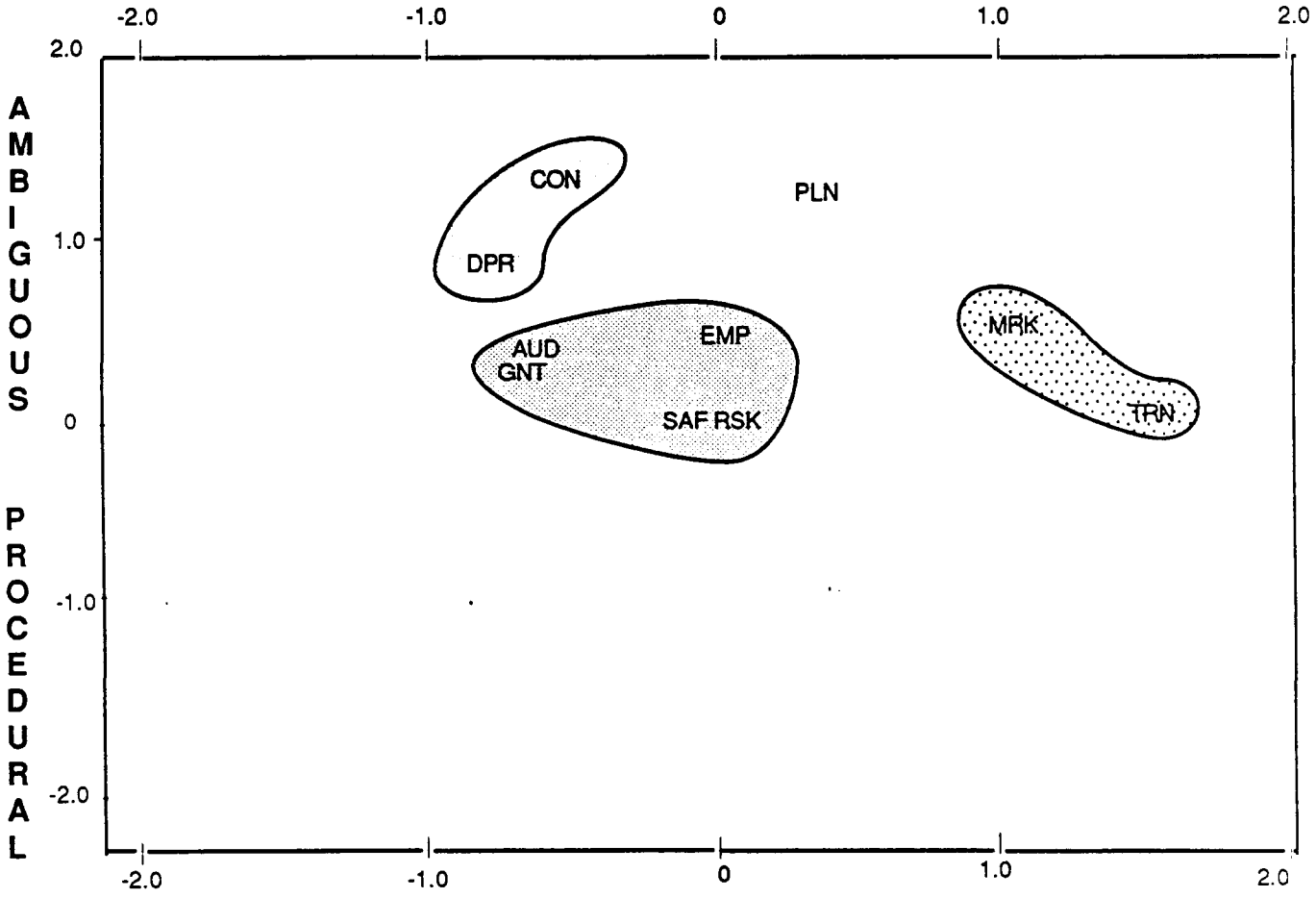


MAR - Marketing and Public Relations
MNT - Maintenance
FPL - Financial Planning
IS - Information Systems
PLN - Planning
RSK - Risk Management
ENG - Engineering
PUR - Purchasing
FAC - Finance and Accounting

OPS - Bus Operations
SDV - Service Development
GOV - Government Relations
EMP - Employee Relations
SEC - Security
PER - Personnel Services
AUD - Auditor
GRS - General Services
IDR - Industrial Relations

FIGURE 13

MDS PLOT FOR SDTC WITH BOUNDARIES DRAWN AROUND DEPARTMENTS WITH SIMILAR ROLES



ADMINISTRATIVE-ADVISORY

MRK - Marketing and Public Information
RSK - Risk Management
SAF - Safety and Training
EMP - Employee Relations
GNT - Grants
DPR - Data Processing

OPERATIONAL-CORE TECHNOLOGY

PRO - Procurement and Stores
AUD - Auditory
CON - Controller
MNT - Maintenance
TRN - Transportation
PLN - Planning and Scheduling

Information form the beginning of a cluster, as well as Data Processing and the Controller.

CONCLUSIONS

The analysis in this section has provided a contrast between a large, complex transit agency and a smaller operation. In the larger agency, there is a separation of policy making from the daily work operations of the agency. In the larger agency with a greater division of labor, more diverse functions are grouped into directorates. The core staff or advisory functions are differentiated into several positions within the workflow. Finally, functions that are not immediately perceived as similar, such as Marketing and Operations, appear similar in terms of their interactions with other units.

CHAPTER FIVE
IMPLICATIONS FOR TRANSIT AGENCY DESIGN AND MANAGEMENT

This study has considered those organizational and individual factors which affect the size and strength of individual networks within transit agencies, and how likely individuals are to communicate vertically, horizontally, and diagonally within and between departments in transit agencies. The position that departments occupy in the resulting networks of interactions and how these positions are related to the formal organizational design and organizational performance was also examined. These results have a variety of implications for theories of organizational design. Some of the theoretical implications have been discussed in previous chapters. In this chapter the practical implications of these results for transit management are emphasized. Because this study was limited to an exploratory analysis of two transit agencies, it is necessary to remember that all results and implications are tentative.

THE EFFECTS OF MANAGERIAL POLICIES ON CONTROLLING INTERACTIONS ACROSS THE ORGANIZATION

It was found in Chapter Two that transit employees have large networks of work-related interactions with others. Organizational complexity had strong effects on the differences between the two agencies in terms of size and strength of ties. In the smaller and simpler SDTC, formal control mechanisms such as supervisory influence and rules had effects on the number of people an individual interacted with as part of the job. The job context, measured as whether a task had more variability and whether a job required more dependence on others, increased the frequency or strength of interaction between employees. By contrast, OCTD as a larger, more complex organization, did not show these relationships. Instead, individual career history, such as number of years on the job and the number of positions occupied, were the strongest predictors of the size of an individual's network. This implies that, under conditions of bureaucratic complexity, it is personal contacts developed over time rather than job demands and formal coordination mechanisms that determine those individuals with whom one will interact. Unfortunately, this result is confounded by the fact that OCTD is also a relatively young organization with high turnover. An alternative explanation is that the relatively few organizational members who have remained with the organization

over time have become connected to more other members. In an older, more stable organization with lower turnover like SDTC, individual career history may have less effects. Further research on a larger sample of organizations is necessary to separate these factors.

THE EFFECTS OF ORGANIZATIONAL BOUNDARIES ON INTERACTION

The hypotheses of Chapter Three concerning organizational boundaries were confirmed: boundaries placed around employees encouraged more horizontal interaction, and employees at higher levels of the organization were engaged in more horizontal interaction across boundaries. It was also found that a great deal of interaction within a transit agency takes place outside of the formal hierarchy but not among those at the same level, i.e., diagonally. This could present problems to an agency if lower level employees spent a great deal of time interacting across the organization with higher level employees in other departments. This could mean that the organization was "out of control" in that the formal hierarchy was not directing communication across the organization. However, larger and more complex agencies, such as OCTD, can be expected to have a great deal of diagonal interaction as employees attempt to coordinate activities across the organization. The question becomes how much influence supervisors have on controlling the interaction across the organization. At OCTD, it was found that formal control mechanisms such as the supervisor's influence on activities did reduce the amount of diagonal interaction among employees and individual influence increased horizontal interaction, at least among the administrative employees. This suggests that managerial policies of centralization can alter the pattern of interactions between units.

The placing of boundaries around employees also has its effects. Those within organizational boundaries engaged in more horizontal interaction at both sites. This implies that grouping departments together under a director would encourage more interaction and cohesion. However, very diverse departments could be grouped together within transit agencies. As illustrated in Chapter Four, departments with little similarity of interactions with other departments were grouped into Transportation or Operations functions.

ALTERNATIVE GROUPING OF DEPARTMENTS INTO DIRECTORATES

Chapter Four considered the role that departments occupied in networks of

interaction and compared the role of departments to the formal grouping of departments. Transportation, or Operations, has become a large grouping of diverse functions, at least at the two study sites. By contrast, financial functions tended to cluster together and perform a similar role. In OCTD, as a er agency, the role of Administration becomes differentiated into advisory staff departments and a core financial function. This differentiation of functions was further reflected in the low correlation between influence on policy and network position at OCTD. This suggests that, in larger transit agencies, policy making becomes separated from the daily operation of the organization.

An interesting result of the analysis in Chapter Four was the clustering of organizational units that are not usually grouped together. For example, Marketing and Public Information were similar to Operations in interactions with other units. This suggests that Marketing could be combined with Operations in a reorganized directorate. This would have a variety of ramifications in a transit agency. Since Marketing and Operations tend to be rated as highly influential on policy, at least at SDTC, the director of Marketing and Operations would be an extremely powerful individual. The general goal shared by Marketing and Operations, service to the customer, would be reinforced by combining departments under a director. Career alternatives would be opened for bus drivers and mechanics who have traditionally moved into operations management. With additional training, these employees, who have intimate knowledge of daily operations, could move into Marketing. Further research examining the interactions among units in a larger sample of agencies will allow the discovery of other alternative transit groupings.

DIRECTIONS FOR FUTURE RESEARCH

This study has been exploratory. It has been an intensive examination of two transit agencies. Unfortunately, limiting the study to two sites, while necessary in terms of time and budget limitations, has confounded many factors that need to be separately controlled for in a larger sample of organizations. For example, a larger sample could control for the size of the agency, the scope of operations, the age of the agency, and the amount of turnover among personnel.

Given the limitations of the sample, this study has shown the wisdom of the general approach of regarding transit employees and departments as embedded in networks of interactions. It may be time to abandon the classical principles of management and rational models of organizations that have emphasized the vertical

control of the organization through a hierarchy of positions, and substitute a consideration of the interactions between individuals that constitutes the daily structuring of activities within a transit agency. By considering the organization of departments in terms of roles developed through inter ɔn, the traditional emphasis on line and staff becomes irrelevant. Even grouping units by assumed similarities in technology is brought into question. Further research with this new approach can suggest alternative designs that may aid transit agencies looking for managerial efficiencies in the face of funding cutbacks.

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APPENDIX A

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Transit Communication Study

Dear Survey Participant:

A study team from the University of California, Irvine has been awarded a research grant from the Urban Mass Transportation Administration to study the effects of the working environment on communication patterns among managerial and professional employees within transit agencies. You have been selected to help us learn about how differences in task demands and managerial policies affect communication patterns.

In order to obtain a wide range of views and experiences, we need your input. If our results are to be representative. it is important that each survey be completed and returned. The overall results of this study will be mailed to you at the conclusion of this study.

Since we need frank and honest answers, we have taken steps to assure you of complete confidentiality. To insure confidentiality, your answers will be combined with others so that no individual responses will be reported or made available to anyone. Only University of California research personnel will have access to your responses. The survey is numbered to allow them to check your name off the mailing list when your survey is received.

Please complete this survey as soon as possible. This is not a test, and there are no right and wrong answers. The survey should take about 30 minutes to fill out. The analysis of the survey would be greatly assisted if you could mail your completed survey within the next 5 days. A prepaid and addressed envelope is provided for you.

If you have any questions about this survey, please write or call us at (714) 856-6229. We will be happy to answer your inquiries.

Sincerely,

William B. Stevenson

William B. Stevenson
Assistant Professor of Management

PART ONE

General Instructions

Most of the questions ask that you circle one of several numbers that appear on a scale to the right of the item. You are to choose the one number that best matches the description of how you feel about the question. For example, if you were asked how much you agree with the statement, "I enjoy the weather in this town," and you feel that you agree, you would circle the number under "agree" like this:

	Strongly disagree	Disagree	Undecided	Agree	Strongly agree	
I enjoy the weather in this town.	1	2	3	(4)	5	(1:10)

Even if you have only recently begun working in this organization, do your best to answer the questions.

Note that the descriptions of how you feel may be different in different parts of the questionnaire. For example, they may ask not whether you agree or disagree, but perhaps whether you are satisfied of dissatisfied, or whether you think something to be likely or not likely to happen. So, be sure to read the special instructions that appear on each page.

You will find some numbers in parentheses along the right edge of some questions as in the example above (1:10). *Pay no attention to these.* They are there to help us record the answers for data processing.

When you have finished, please put the questionnaire in the self-addressed, prepaid envelope provided, seal it, and return it by mail.

THE FOLLOWING INFORMATION IS NEEDED TO HELP US WITH THE STATISTICAL ANALYSIS OF THE DATA. ALL OF YOUR RESPONSES ARE STRICTLY CONFIDENTIAL. ONLY GROUPED DATA WILL BE MADE AVAILABLE. WE APPRECIATE YOUR HELP IN PROVIDING THIS IMPORTANT DATA. PLEASE FILL IN THE BLANK OR CIRCLE THE NUMBER OF THE MOST APPROPRIATE ANSWER FOR EACH ITEM.

1. How many years have you been employed by this organization? _____ Months _____ Years (1:11)

2. How old are you? _____ Years

3. What is your educational level? (Circle the number that indicates the highest level completed.)

   1. Elementary school (grade 1–8)
   2. Some high school or some technical training
   3. Graduated from high school or GED (Graduate Equivalency Degree)
   4. Some college
   5. High school degree plus technical training or apprenticeship
   6. Associate of Arts (A.A.) degree
   7. Graduated from college (B.A., B.S., or other bachelor's degree)
   8. Graduate Degree (Masters, LL.B., Ph.D., M.D., etc.)

4. Are you:

   1. Asian
   2. Black
   3. Caucasian
   4. Hispanic
   5. Other

5. Are you: (1:17)

   1. Male
   2. Female

6. List below the positions or job titles you have held since you began working for this organization. Indicate the months and years during which you held each position.

A. _____ From _____ To _____ (1:18–29)

B. _____ From _____ To _____

C. _____ From _____ To _____

D. _____ From _____ To _____

E. _____ From _____ To _____

F. _____ From _____ To _____ (2:11–22)

G. _____ From _____ To _____

H. _____ From _____ To _____

I. _____ From _____ To _____ (2:47–58)

THE FOLLOWING STATEMENTS ASK YOU TO EVALUATE YOUR JOB. HOW MUCH DO YOU AGREE OR DISAGREE WITH EACH STATEMENT? (CIRCLE ONE NUMBER FOR EACH QUESTION.)

		Strongly disagree	Disagree	Undecided	Agree	Strongly agree	
7.	I follow about the same work methods or steps in doing my major tasks from day to day.	1	2	3	4	5	(2:59)
8.	Any decision I make has to have my boss' approval.	1	2	3	4	5	
9.	My job description clearly specifies the standards of performance on which my job is evaluated.	1	2	3	4	5	
10.	My immediate supervisor often discusses my work performance with me.	1	2	3	4	5	
11.	Even small matters have to be referred to someone higher up for a final answer.	1	2	3	4	5	
12.	Rules and procedures clearly specify how my major tasks are to be done.	1	2	3	4	5	
13.	I often encounter difficult problems in my work for which there are no immediate or apparent solutions.	1	2	3	4	5	
14.	I have to ask my boss before I do almost anything.	1	2	3	4	5	
15.	I generally have quite a bit of control in setting the pace of my work.	1	2	3	4	5	
16.	I clearly know what level of work performance is expected from me (in terms of amount, quality, and timeliness of output).	1	2	3	4	5	
17.	There can be little action taken here until a supervisor approves a decision.	1	2	3	4	5	
18.	The techniques or skills or information needed to do my job are constantly changing.	1	2	3	4	5	(2:70)

		Strongly disagree	Disagree	Undecided	Agree	Strongly agree	
19.	A person who wants to make his own decisions would be quickly discouraged.	1	2	3	4	5	(2:71)
20.	It is often easy to know whether I have done my work correctly.	1	2	3	4	5	
21.	I spend a lot of time solving work problems for which there are no immediate or apparent solutions.	1	2	3	4	5	
22.	I am generally sure of what the outcomes of my work efforts will be.	1	2	3	4	5	
23.	My work load is generally very heavy.	1	2	3	4	5	
24.	My work alone gives me many clues to figure out how well I am doing my job (without relying on feedback from my supervisor or co-workers).	1	2	3	4	5	
25.	I often receive suggestions or feedback from my co-workers.	1	2	3	4	5	
26.	I frequently encounter exceptions in my work which require substantially different methods or procedures for doing it.	1	2	3	4	5	
27.	I receive enough information concerning:						
	a. Overall organizational policy.	1	2	3	4	5	
	b. Plans formulated in my department that may affect my work.	1	2	3	4	5	
	c. Plans developed in other departments that may affect my work.	1	2	3	4	5	(3:11)
	d. My job performance.	1	2	3	4	5	(3:12)

THE FOLLOWING STATEMENTS REFER TO YOUR ORGANIZATION. HOW MUCH DO YOU AGREE OR DISAGREE WITH EACH STATEMENT? (CIRCLE ONE NUMBER FOR EACH QUESTION.)

		Strongly disagree	Disagree	Undecided	Agree	Strongly agree	
28.	This organization is always moving toward the development of new answers.	1	2	3	4	5	(3:13)
29.	This organization can be described as flexible and continually adapting to change.	1	2	3	4	5	
30.	Around here people are allowed to try to solve the same problem in different ways.	1	2	3	4	5	
31.	People in this organization are always searching for fresh, new ways of looking at problems.	1	2	3	4	5	
32.	A person can't do things that are too different around here without provoking a negative reaction.	1	2	3	4	5	
33.	In this organization we tend to stick to tried and true ways.	1	2	3	4	5	
34.	Assistance in developing new ideas is readily available.	1	2	3	4	5	
35.	Members of this organization feel encouraged by their superiors to express their opinions and ideas.	1	2	3	4	5	
36.	Members of this organization realize that in dealing with new problems and tasks, frustration is inevitable; therefore it is handled constructively.	1	2	3	4	5	
37.	The best way to get along in this organization is to think the way the rest of the group does.	1	2	3	4	5	
38.	Once this organization develops a solution to a particular problem, that solution becomes a permanent one.	1	2	3	4	5	
39.	Around here, a person can get into a lot of trouble by being different.	1	2	3	4	5	(3:24)

THE FOLLOWING STATEMENTS ASK FOR YOUR OPINIONS ABOUT YOUR WORK UNIT. YOUR WORK UNIT INCLUDES YOU (AS THE SUPERVISOR) AND ALL INDIVIDUALS WHO REPORT DIRECTLY TO YOU. IF YOU ARE NOT A SUPERVISOR THEN YOUR UNIT INCLUDES YOUR IMMEDIATE SUPERVISOR AND ALL INDIVIDUALS (YOUR CO-WORKERS) WHO REPORT TO YOUR IMMEDIATE SUPERVISOR. HOW MUCH DO YOU AGREE OR DISAGREE WITH EACH STATEMENT?

		Strongly disagree	Disagree	Undecided	Agree	Strongly agree	
40.	I feel I am really a part of my work unit.	1	2	3	4	5	(3:25)
41.	The members of my work unit are ready to defend each other from criticism by outsiders.	1	2	3	4	5	
42.	The members of my work unit always help each other on the job.	1	2	3	4	5	
43.	The members of my work unit get along well together.	1	2	3	4	5	(3:28)

THE ITEMS BELOW REFER TO VARIOUS ASPECTS OF YOUR JOB. PLEASE CIRCLE THE NUMBER THAT MOST ACCURATELY REFLECTS YOUR ANSWER TO EACH QUESTION.

	A day or less	About a week	About a month	About 6 months	A year or more	
44. How far in advance do you generally know how much work will be required of you?	1	2	3	4	5	(3:29)
45. In your own job, how long do you have to wait before the results of your decisions become known?	1	2	3	4	5	

	Not at all	A little	Some	Quite a bit	Very much	
46. How much do you have to depend on each of the following people to obtain the materials, clients or information needed to do your work:						
a. Your boss?	1	2	3	4	5	
b. Other unit members and co-workers?	1	2	3	4	5	
c. People outside of your unit but within the organization?	1	2	3	4	5	
d. People outside of the organization?	1	2	3	4	5	(3:34)

	Not at all	A little	Some	Quite a bit	Very much	
47. How much does your job require that you check with the following people while doing your major tasks:						
a. Your boss?	1	2	3	4	5	(3:35)
b. Other unit members and co-workers?	1	2	3	4	5	
c. People outside of your unit but within the organization?	1	2	3	4	5	
d. People outside of the organization?	1	2	3	4	5	
48. After you finish your part of the job, how much do you have to rely on each of the following people to perform the next steps in the process before the total task or service is completed:						
a. Your boss?	1	2	3	4	5	
b. Other unit members and co-workers?	1	2	3	4	5	
c. People outside of your unit but within the organization?	1	2	3	4	5	
d. People outside of the organization?	1	2	3	4	5	(3:42)

	None	Little	Some	Quite a bit	Very much	
49. How much influence do you have in making each of the following decisions about your work:						
a. Determining what tasks I will perform from day to day?	1	2	3	4	5	(3:43)
b. Setting quotas on how much work I have to complete?	1	2	3	4	5	
c. Establishing rules and procedures about how my work is to be done?	1	2	3	4	5	
d. Determining how work exceptions are to be handled?	1	2	3	4	5	
50. Listed below are the same work decisions. This time indicate how much influence your immediate supervisor has in making each decision about your work:						
a. Determining what tasks I will perform from day to day?	1	2	3	4	5	
b. Setting quotas on how much work I have to complete?	1	2	3	4	5	
c. Establishing rules and procedures about how my work is to be done?	1	2	3	4	5	
d. Determining how work exceptions are to be handled?	1	2	3	4	5	(3:50)
51. How much influence do you have in making the following decisions:						
a. Deciding work goals for your unit?	1	2	3	4	5	
b. Adopting new policies?	1	2	3	4	5	
c. Hiring new employees?	1	2	3	4	5	
d. Promoting employees?	1	2	3	4	5	
e. Salary increases of other employees?	1	2	3	4	5	(3:55)

		Very rarely		Occasionally	Often	Very often	Constantly	
52.	How often are the following methods used to coordinate your work with other people within your organization:							
	a. Established rules or procedures.	1		2	3	4	5	(3:56)
	b. Work plans and schedules	1		2	3	4	5	
	c. Your supervisor acts as the coordinator of work.	1		2	3	4	5	
	d. Your assistant supervisor acts as the coordinator of work.	1		2	3	4	5	
	e. Someone other than a supervisor is in charge of coordinating work.	1		2	3	4	5	
	f. Through informal communication channels (simply contacting another person who is likely to have the desired information).	1		2	3	4	5	
	g. Through an established committee that meets regularly to plan and coordinate the work within the unit.	1		2	3	4	5	
	h. Through staff meetings that are held to coordinate the work within the unit.	1		2	3	4	5	
	i. Through a temporary group brought together for problem solving on particular issues relating to the work within the unit.	1		2	3	4	5	(3:64)

53. Do you belong to any committees? (Check the appropriate box.) (3:65)

☐ Yes. Please list the name of the committee and any official position that you occupy (for example, chairperson, secretary, etc.) along with the additional information requested below. If you belong to more than six committees, only list the six committees that you consider the most important.

☐ No. Please skip to question 54.

	Number of times per year this committee meets	Average number of hours you spend in meetings	
A. Committee: _____ _____ Position: _____			(3:66–75)
B. Committee: _____ _____ Position: _____			(4:11–20)
C. Committee: _____ _____ Position: _____			
D. Committee: _____ _____ Position: _____			
E. Committee: _____ _____ Position: _____			
F. Committee: _____ _____ Position: _____			(4:51–60)

Instructions for Part 2
Analysis of Communication Flows

In this section we will be gathering information about organizational communication flows between managerial and professional employees by asking you questions concerning the people you interact with at work. This information is critical to our analysis since we can not accurately map the various communication paths without detailed knowledge of who you interact with. The names you list will not be cited in any report and will be computer coded for strict confidentiality.

For ease in the computer coding of these individual names, we have included an insert containing the names and departments of all managerial and professional employees in your organization. Please print the names as they appear on this sheet when you list the people you interact with. If a managerial or professional employee that you interact with is not listed, please print the person's name *and* organizational department on the questionnaire. (If you interact with more people than the spaces available on the right-hand side of a page, just list the people that you interact with the most often.)

After listing the names of the people you interact with at work, a series of questions are asked for each person. For each question there is an answer scale with brief descriptions of what the numbers on the scale represent. Choose one number that best reflects your answer to each question for each person listed and write that number in the appropriate box.

PLEASE LIST ON THE RIGHT-HAND PAGE THE PEOPLE AT WORK THAT YOU INTERACT WITH TO GET THE JOB DONE. (IF YOU INTERACT WITH MORE PEOPLE THAN THE SPACES AVAILABLE, JUST LIST THE PEOPLE YOU INTERACT WITH THE MOST OFTEN.)

Use the scale below each of the following questions to answer the question.

54. How long have you been interacting with this person?

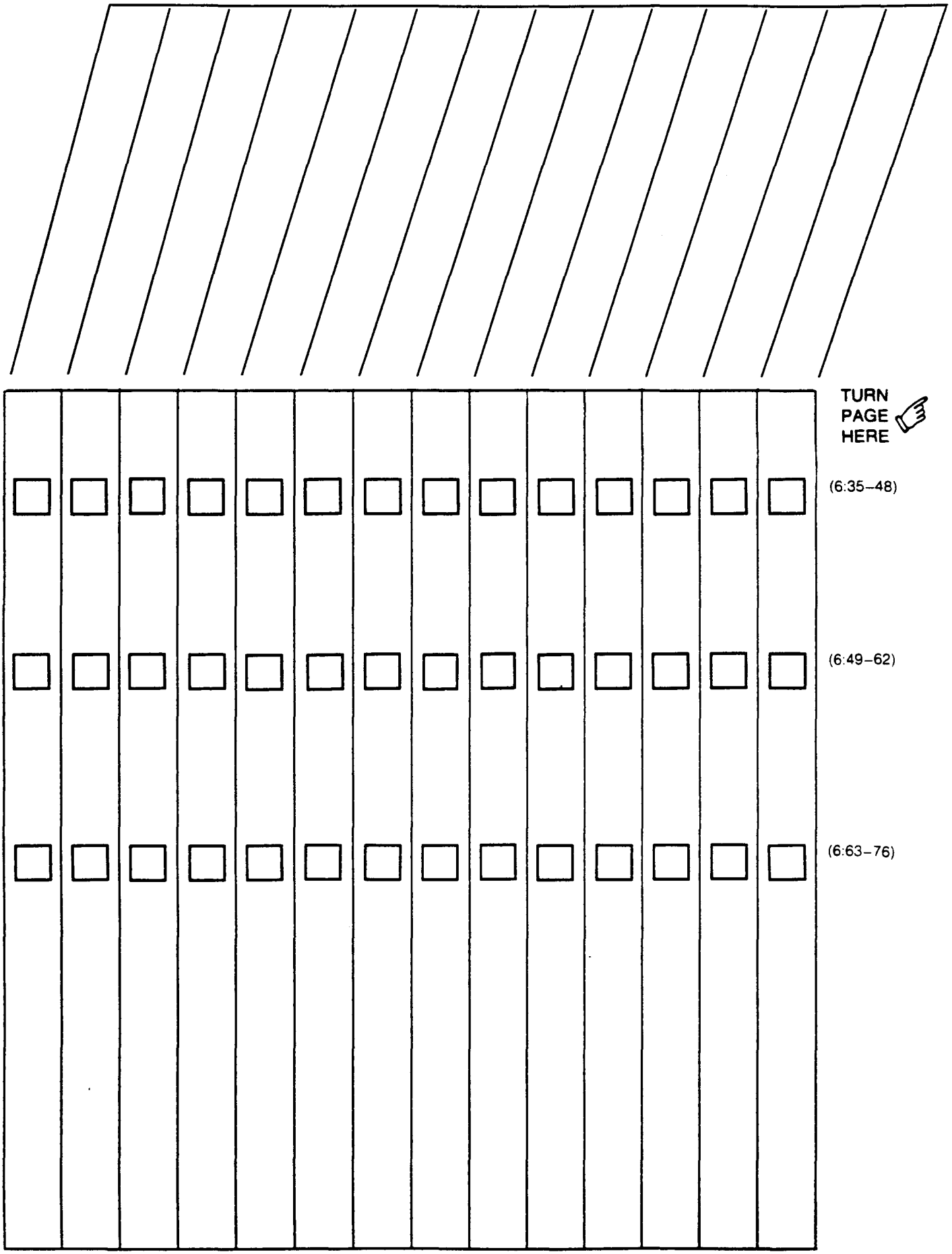
1. Less than one month.
2. One to six months.
3. Seven to eleven months.
4. One to two years.
5. More than two years.

55. How frequently do you interact with this person at work?

1. Many times daily.
2. Once a day.
3. Once or twice a week.
4. About every two weeks.
5. About monthly.
6. Once or twice in the last six months.

56. How important do you judge your work-related interaction with this person?

1. Not important at all.
2. Somewhat important.
3. Important
4. Very important.
5. Extremely important.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(6:63–76)

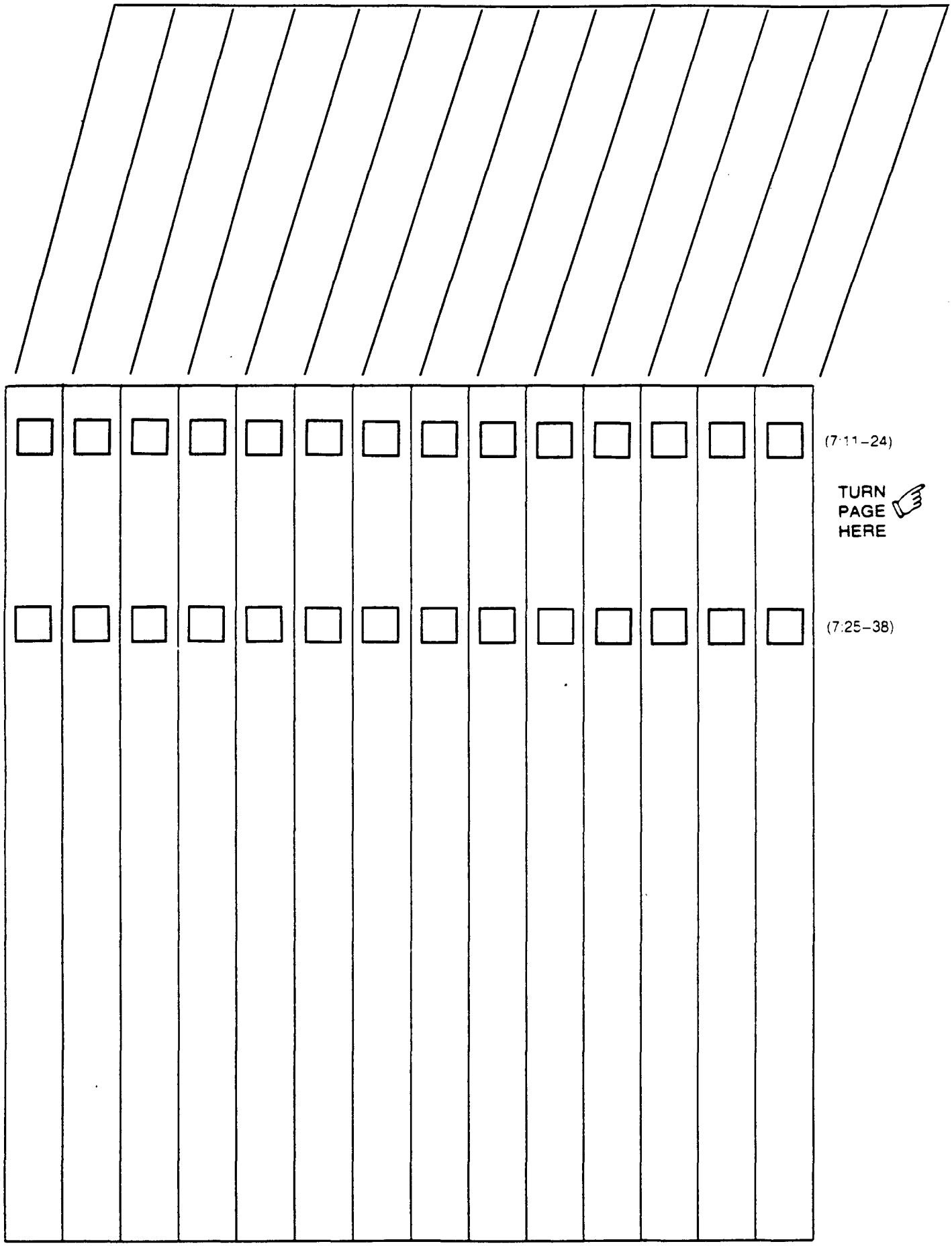
PLEASE LIST ON THE RIGHT-HAND PAGE THE PEOPLE AT WORK THAT YOU INTERACT WITH TO GET THE JOB DONE. (IF YOU INTERACT WITH MORE PEOPLE THAN THE SPACES AVAILABLE, JUST LIST THE PEOPLE YOU INTERACT WITH THE MOST OFTEN.)

57. How much influence does this person have on the performance of your work?

1. None at all.
2. A slight amount of influence
3. Some influence.
4. A considerable amount of influence
5. A great deal of influence

58. What method are you most likely to use to get in touch with this person?

1. Regularly scheduled meetings (for example, a weekly staff meeting).
2. One of us makes a formal appointment with the other.
3. My supervisor arranges a meeting between the other person and myself.
4. A written memo.
5. A phone call is made first to make sure that one of us can arrange to see the other.
6. One of us will just drop by the work area or phone the other without advance notice.
7. We are in the same work area, one of us will just drop by the work area of the other.
8. Our meetings are often by chance. (For example, we run into each other in the hall, at lunch, etc.)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PLEASE LIST ON THE RIGHT-HAND PAGE THE PEOPLE AT WORK THAT YOU INTERACT WITH TO GET THE JOB DONE. (IF YOU INTERACT WITH MORE PEOPLE THAN THE SPACES AVAILABLE, JUST LIST THE PEOPLE YOU INTERACT WITH THE MOST OFTEN.)

59. How close is this person to your work area?

1. We are in the same work area.
2. The other person is on the same floor but not in the same work area.
3. The other person is on a different floor of the same building.
4. The other person is in a different building.

HOW MUCH DO YOU AGREE OR DISAGREE WITH EACH OF THE FOLLOWING STATEMENTS CONCERNING EACH PERSON? PLEASE USE THE SCALE BELOW TO ANSWER THE QUESTIONS ON THIS PAGE. WRITE THE NUMBER WHICH REFLECTS YOUR OPINION OF EACH PERSON IN THE APPROPRIATE COLUMN TO THE RIGHT.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
1	2	3	4	5

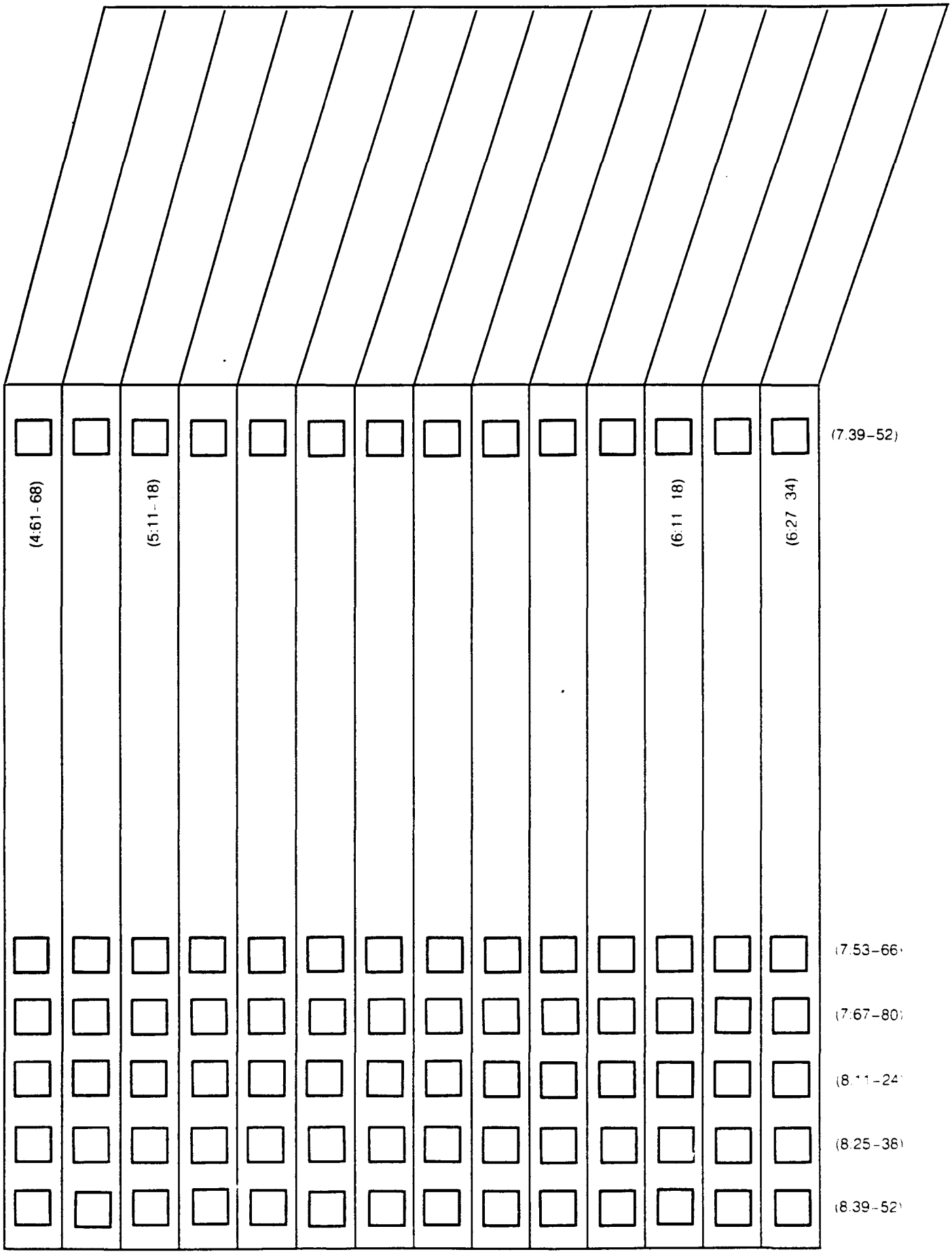
60. If I get into difficulty at my job, this person would help me out.

61. This person can be relied upon to do as they say they will do.

62. I have full confidence in the skill of this person.

63. This person will always treat me fairly.

64. I can rely on this person not to make my job more difficult by careless work.



USE THIS PAGE TO ANSWER QUESTIONS 59 TO 64

PLEASE LIST ON THE RIGHT-HAND PAGE THE PEOPLE AT WORK THAT YOU GO TO FOR HELP OR TECHNICAL ADVICE CONCERNING WORK-RELATED PROBLEMS. (SOME OF THE PEOPLE MAY BE THE SAME AS THOSE YOU INTERACT WITH TO GET THE JOB DONE.)

65. How frequently do you go to this person for technical advice?

1. Many times daily.
2. Once a day.
3. Once or twice a week.
4. About every two weeks.
5. About monthly.
6. Once or twice in the last six months.

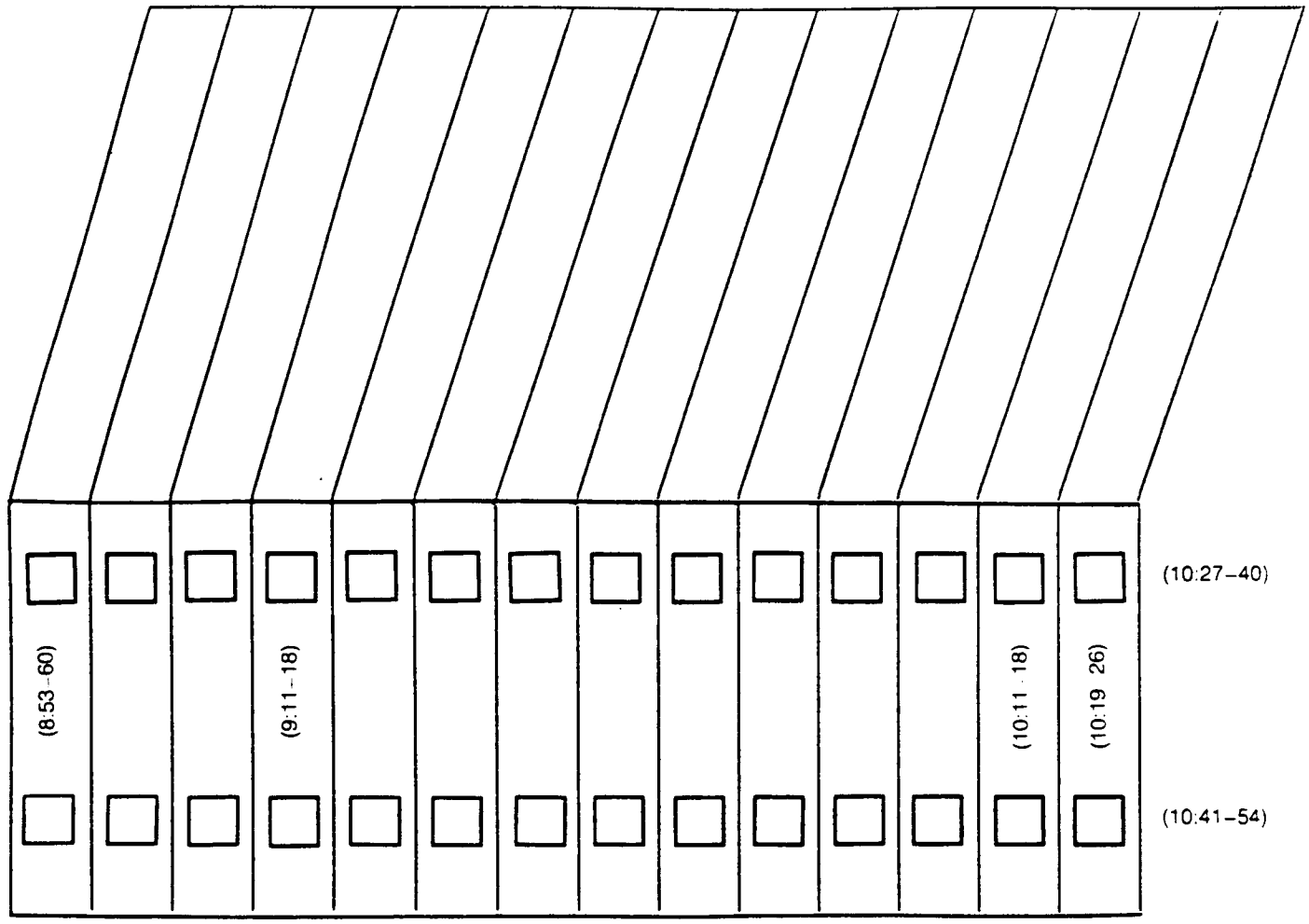
66. How much influence does this person have on the performance of your work?

1. None at all.
2. A slight amount of influence.
3. Some influence.
4. A considerable amount of influence.
5. A great deal of influence.

PLEASE LIST ON THE RIGHT-HAND PAGE THE PEOPLE AT WORK THAT YOU ARE LIKELY TO HAVE SOCIAL (NOT WORK-RELATED) CONVERSATIONS WITH. (SOME OF THESE PEOPLE MAY BE THE SAME AS THOSE PREVIOUSLY LISTED.)

67. How frequently do you have social conversations with this person at work?

1. Many times daily.
2. Once a day.
3. Once or twice a week.
4. About every two weeks.
5. About monthly.
6. Once or twice in the last six months.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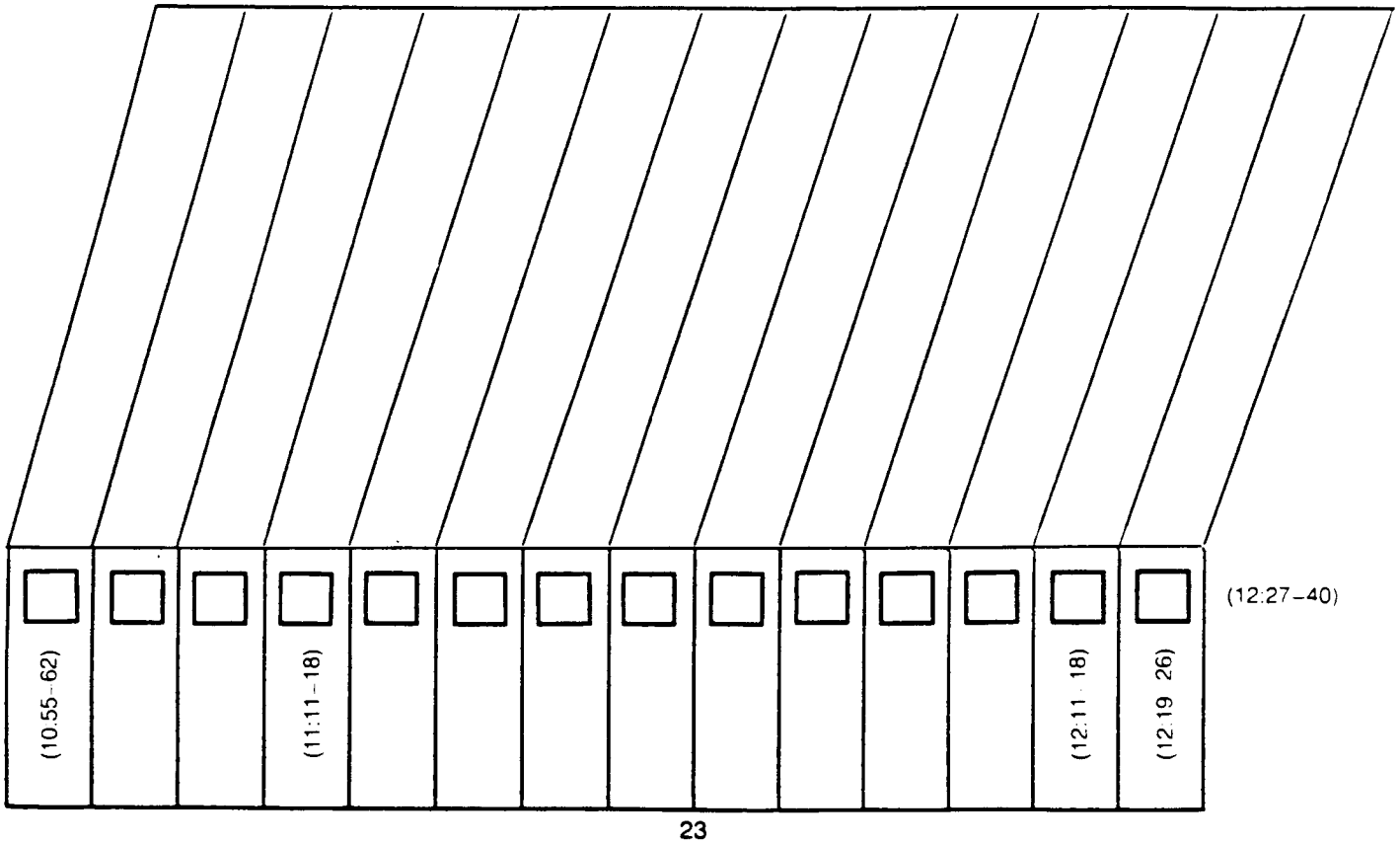
(10:27-40)
(10:41-54)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(12:11-18)
(12:19-26)
(12:27-40)

68. Do you interact with people in other organizations (such as vendors, contractors, government agencies, other transit agencies, etc.) to get your job done? (Check one box.) (12:41)

☐ Yes. Please print the names and organizations of these people on the page to the right and answer the questions below. (If you interact with more people than the spaces available, just list the people you interact with the most often.)

☐ No. Please skip to question 79.

69. How long have you been interacting with this person? ⟶

1. Less than one month.
2. One to six months.
3. Seven to eleven months.
4. One to two years.
5. More than two years.

70. How frequently do you interact with this person? ⟶

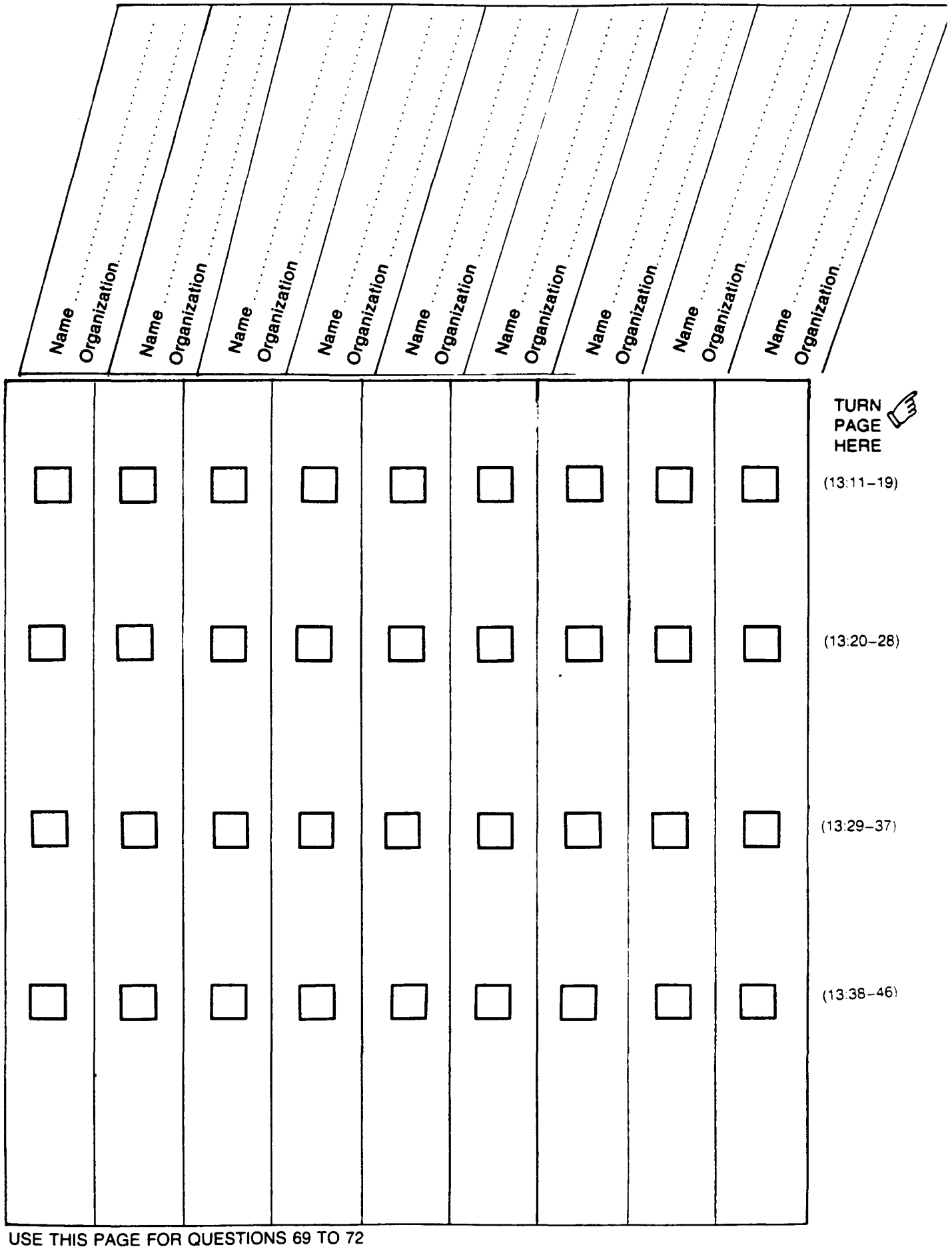
1. Many times daily.
2. Once a day.
3. Once or twice a week.
4. About every two weeks.
5. About monthly.
6. Once or twice in the last six months.

71. How important do you judge your interaction with this person? ⟶

1. Not important at all.
2. Somewhat important.
3. Important.
4. Very important.
5. Extremely important.

72. How much influence does this person have on the performance of your work? ⟶

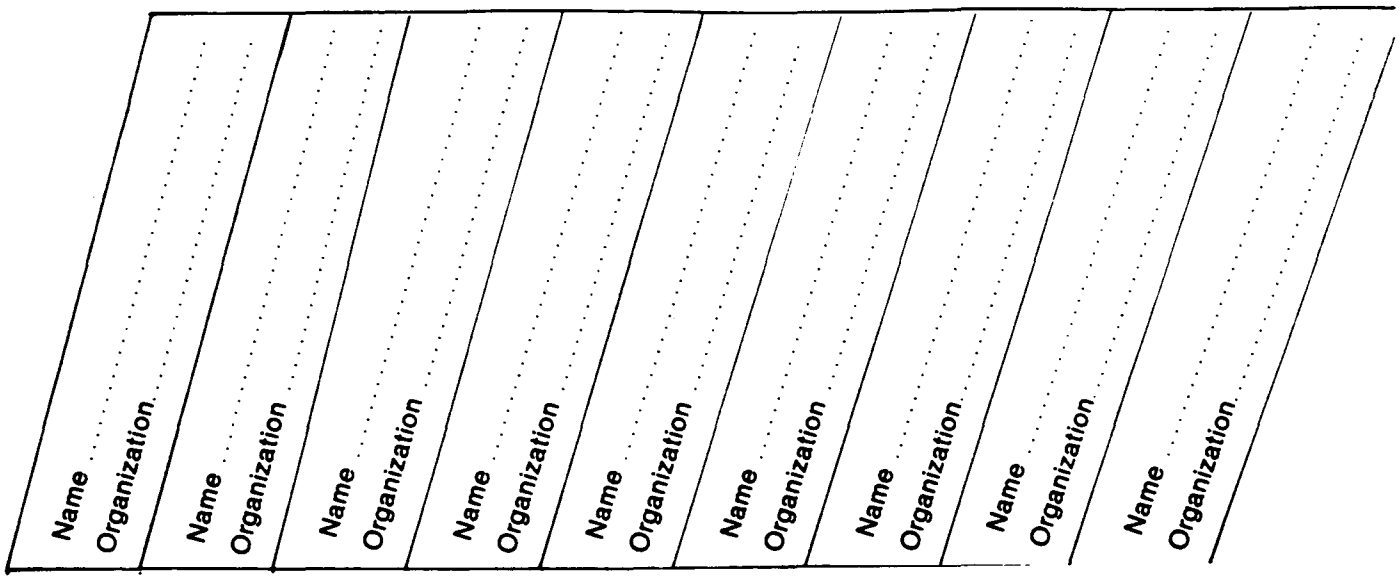
1. None at all.
2. A slight amount of influence.
3. Some influence.
4. A considerable amount of influence.
5. A great deal of influence.



USE THIS PAGE FOR QUESTIONS 69 TO 72

73. What method are you most likely to use to get in touch with this person? ——————————▶

1. Regularly scheduled meetings.
2. One of us makes a formal appointment with the other.
3. My supervisor arranges a meeting between the other person and myself.
4. A written memo or letter.
5. A phone call is made first to make sure that one of us can arrange to see the other.
6. One of us will just drop by the office or phone the other without advance notice.



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(13:47–55)

USE THIS PAGE FOR QUESTION 73

HOW MUCH DO YOU AGREE OR DISAGREE WITH EACH OF THE FOLLOWING STATEMENTS CONCERNING EACH PERSON? PLEASE USE THE SCALE BELOW TO ANSWER THE QUESTIONS ON THIS PAGE. WRITE THE NUMBER WHICH REFLECTS YOUR OPINION OF EACH PERSON IN THE APPROPRIATE COLUMN TO THE RIGHT.

Strongly disagree	Disagree	Undecided	Agree	Strongly agree
1	2	3	4	5

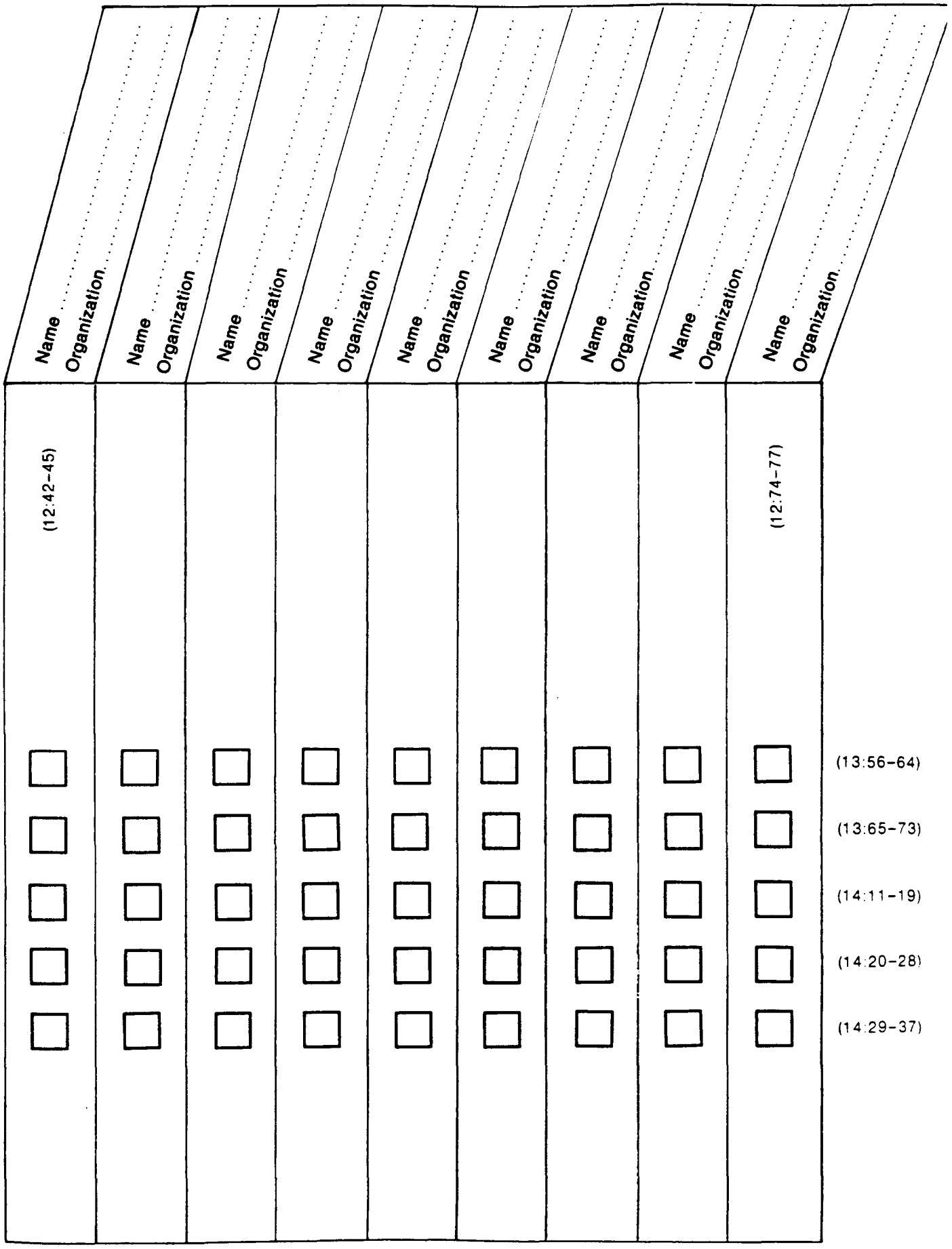
74. If I get into difficulty at my job, this person would help me out. ——▶

75. This person can be relied upon to do as they say they will do. ——▶

76. I have full confidence in the skill of this person. ——▶

77. This person will always treat me fairly. ——▶

78. I can rely on this person not to make my job more difficult by careless work. ——▶



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THE FOLLOWING SECTION ASKS FOR YOUR OPINIONS AS A STAFF DIRECTOR OR DEPARTMENTAL MANAGER.

79. How much influence do each of the following have in deciding what kinds of work or tasks are to be performed in your unit?

	None	Little	Some	Quite a bit	Very much	
A. The Board of Directors.	1	2	3	4	5	(14:38)
B. The General Manager.	1	2	3	4	5	
C. The Staff Director (if under the authority of a director).	1	2	3	4	5	
D. You as a manager.	1	2	3	4	5	
E. Managers or staff *outside* of your department.	1	2	3	4	5	
F. Your subordinates individually.	1	2	3	4	5	
G. You and your subordinates *as a group* in unit meetings.	1	2	3	4	5	

80. Consider the criteria or measures used to determine how effectively your unit performs its work. How much influence does each of the following have in deciding on these criteria?

	None	Little	Some	Quite a bit	Very much	
A. The Board of Directors.	1	2	3	4	5	
B. The General Manager.	1	2	3	4	5	
C. The Staff Director (if under the authority of a director).	1	2	3	4	5	
D. You as a manager.	1	2	3	4	5	
E. Managers or staff *outside* of your department.	1	2	3	4	5	
F. Your subordinates individually.	1	2	3	4	5	
G. You and your subordinates *as a group* in unit meetings.	1	2	3	4	5	(14:51)

81. Think about the various operating rules, policies and procedures that all personnel in your unit are expected to follow to coordinate and control all the work activities performed in your unit. How much influence does each of the following have in deciding upon these operating rules, policies, and procedures?

		None	Little	Some	Quite a bit	Very much	
A.	The Board of Directors.	1	2	3	4	5	(14:52)
B.	The General Manager.	1	2	3	4	5	
C.	The Staff Director (if under the authority of a director).	1	2	3	4	5	
D.	You as a manager.	1	2	3	4	5	
E.	Managers or staff *outside* of your department.	1	2	3	4	5	
F.	Your subordinates individually.	1	2	3	4	5	
G.	You and your subordinates *as a group* in unit meetings.	1	2	3	4	5	(14:58)

Please rate each of the organizational units listed below using this 0 to 5 scale.

Don't know	Far below average	Somewhat below average	About average	Somewhat above average	Far above average
0	1	2	3	4	5

	(14.59-62)	Number of innovations or new ideas introduced by the unit	Reputation for for work excellence	Attainment or production service goals	Influence on organizational policy
82.	Marketing and Public Information	_____	_____	_____	_____
83.	Risk Management	_____	_____	_____	_____
84.	Safety and Training	_____	_____	_____	_____
85.	Employee Relations	_____	_____	_____	_____
	Finance and Administration				
86.	Grants	_____	_____	_____	_____
87.	Data Processing (15:11-14)	_____	_____	_____	_____
88.	Procurement and Stores	_____	_____	_____	_____
89.	Auditor	_____	_____	_____	_____
90.	Controller	_____	_____	_____	_____
	Operations				
91.	Maintenance	_____	_____	_____	_____
92.	Transportation	_____	_____	_____	_____
93.	Planning and Scheduling (15:35-38)	_____	_____	_____	_____