THE ARCHITECTURE OF LEADERSHIP COGNITION: A MULTI-METHOD STUDY OF MENTAL MAPS IN A MANUFACTURING COMPANY

IE Working Paper CO8-104-I 15 / 07 / 2002

Juan Carlos Pastor(*)

Instituto de Empresa
Dept. Org. Behavior & Human Resource Management
C/ María de Molina 12-5º, 28006 Madrid – Spain
juan.pastor@ie.edu

Abstract
Grounded on a social constructionist perspective, this study focuses on followers' intersubjective sense making about leaders. A socio-cognitive model of leadership is advanced in which followers' views of their leaders are conceptualized as cognitive architectures composed of leadership and other organizational concepts. The cognitive aspect of the model suggests that leadership information does not exist in a vacuum, but rather it is integrated with other organizational concepts into a whole knowledge structure or mental map. The social side of the model states that followers actively construct their leaders in a social process as they interact with their close friends. Members of six production departments (N=280) in a large manufacturing company provided information on their views of the company leaders, their views of relevant organizational issues, and the frequency of communication with other members of the organization. Neural network methods were used to analyze cognitive data and social network methods were used to analyze social data. The results provide a first positive test to the notion that leadership information is organized into semantic structures including leadership and other organizational concepts as well as their relationships. Furthermore, the results confirmed the general idea that individuals' mental maps can be predicted from their relative position in the social network. In particular, central individuals in the friendship network tend to have highly interconnected mental maps that represent the average mental map of the group, and tend to ascribe the concept of leadership a central stature in their minds relative to other organizational concepts. When comparing dyads, the results show that close friends share similar mental maps of the organization and its leadership. Theoretical and practical implications of these results are discussed.

Keywords
Leadership, leadership attributes, mental maps, semantic networks.

*I would like to thank James R. Meindl, Brian Becker and Joseph Woelfel for their helpful comments and support during this research. The paper was also greatly improved with comments from Ajay Mehra, Craig Pierce and Ronald Rice.

Introduction

The last few years have seen a revival of the concept of leadership. This renewed emphasis in an age-old topic has been re-energized with a new set of concepts such as charisma, vision, empowerment and transformation that have come to replace the more traditional themes of task and people oriented leadership. For some authors, this "New Leadership" perspective represents a "paradigm shift" in the Kuhnian sense, a totally different approach to study leadership processes (e.g., Sashkin and Burke, 1990). In fact, in addition to the new themes, there is a distinct flavor with respect to traditional leadership studies with the inclusion of detailed case studies of charismatic leaders and new dependent variables that incorporate the values and emotions of followers' responses to charismatic leaders (e.g., House, Woycke and Fodor, 1988).

Yet, despite its apparent newness, some authors have argued that the old leadership paradigm is as present as ever in the New Leadership perspective. For instance, Bryman (1992) points out that recent empirical studies still use most of the traditional dependent variables, such as followers' satisfaction. Most important, Meindl (1993) points out that the conceptualization of leadership is still equated to the figure of the leader. In the traditional view, it was the leader's ability (trait theories) and style (behavioral and contingency theories), and in the New Leadership, it is mainly his/her vision and charisma. This almost exclusive focus on the figure of the leader misses other important elements of the leadership phenomenon, such as the followers and the situation. Even when the followers and the context are included in the new models of leadership, they are treated as secondary factors and typically included as mediators, moderators, and outcomes of leader effectiveness. Thus, research that considers the followers and the situation as equal players as leaders in the leadership phenomenon is limited.

Grounded on a social constructionist approach (Berger and Luckman, 1966; Gergen, 1985), the purpose of the present study is to add to the incipient literature on a follower-centered approach (e.g., Mayo, Meindl and Pastor, 1996; Meindl, 1990, 1993, 1995; Pastor, Meindl and Mayo, 1999; Pillai and Meindl, 1993) by examining how leaders are constructed in the minds of followers within the context of business organizations. There are two general principles in social constructionist theory. The first principle states that individuals build models or representations of reality that help them make sense of the events and circumstances around them. These cognitive models act to put order in an otherwise chaotic environment. As such, organizational phenomena have an effect on individuals' behavior once they become assimilated in some form of cognitive structure. It is only when these events are absorbed into a mental map that they acquire meaning and have an effect in subsequent behavior. The second principle is that these mental constructions are acquired through social processes that take place in the context of close interpersonal relationships among followers.

The implication of this view for leadership research is twofold. A social constructionist view first implies that, rather than for what they "are" or "do," leaders are important for what they represent in the mind of the followers, and second, it suggests that these mental constructions around leaders are acquired and transmitted though social processes that take place in the context of close interpersonal relationships among followers. Following this line of thought, the present study focuses on how followers construct their leaders in relation to other organizational issues and how these constructions are transmitted through the organization following informal social networks, or grapevines. I argue that leadership information does not exist in a vacuum, but rather it is integrated

with other organizational concepts into a whole knowledge structure or mental map. In addition, I postulate that these mental maps are social in nature. That is, they can be predicted from the pattern of informal communication networks within the social system.

There are two different but related parts in the present research. The first part is concerned with the description of followers' architecture of leadership cognition. Based on recent advances in Neural Networks (Rumelhardt and McCleland, 1986, McCleland and Rumelhardt, 1986; Woelfel, 1993a, 1993b; Woelfel, Stoyanoff, Danielsen, 1992; Woelfel and Fink, 1980, Barnett and Woelfel, 1988; Woelfel, 1990), leadership cognition is defined as a cognitive structure or architecture composed of basic elements or concepts, that are interconnected based on their similarity of meaning. Based on social influence theory and social network theory, the second part of the research is concerned with the social mechanisms by which individuals acquire these cognitive architectures.

Neural Networks as a Metaphor for Leadership Cognition

The use of cognitive structures or mental models to analyze leadership is not new to the leadership literature (see Lord and Maher, 1993). During the mid 70's and inspired by the structure of the Turing and Von Neuman computing machines, cognitive scholars provided detailed proposals about the nature of knowledge representations that include schemas (Rumelhart, 1984), frames (Minsky, 1975), scripts (Schank and Abelson, 1977), scenarios (Sanford and Garrod, 1981), and schemata (Norman and Bobrow, 1976; Rumelhart, 1975). It was not long before leadership researchers started to apply these concepts to the study of leadership processes (e.g., Lord and Foti, 1986; Lord, Foti and DeVader, 1984; Lord Foti and Phillips, 1982). These models of leadership schemas and implicit theories of leadership have proved to be very useful to analyze the encoding of information about the leader (e.g., Phillips, 1984; Phillips and Lord, 1982, 1981), the formation of leadership perceptions (Fraser and Lord, 1988), and the reconstructive recall of leadership information (Lord, 1985).

However, leadership schema models represent a rather monolithic view of leadership cognition in which the concept of leadership is studied in isolation from other organizational concepts. A more complete and integrated view of leadership cognition ought to take into consideration how leaders are perceived in relation to other organizational concepts. This holistic view of leadership cognition is more consistent with recent neural network models of human cognition known as Connectionism. Connectionism is a theory of information processing that uses the known neurophysiology of the brain to model human cognition (see Rumelhardt and McCleland, 1986, McCleland and Rumelhardt, 1986). Connectionist scholars argue that cognitive systems are networks consistent of large numbers of highly interconnected units or concepts (e.g., Feldman and Ballard, 1982; Hinton, McClelland and Rumelhart, 1986; Woelfel, 1993a, 1993b).

One connectionist model that seems particularly suitable for the study of leadership cognition is the Galileo system (Barnett and Woelfel, 1988; Woelfel, 1993a, 1993b; Woelfel and Barnett, 1982; Woelfel and Fink, 1980; Woelfel, Holmes, Kinkaid and Barnett, 1980). The Galileo approach includes both a theory of cognitive structures and a set of computational methods and techniques that implements the theory. The Galileo system is a spatial network model that has been successfully used in the communication literature to uncover key elements of, for example, patient-physician relations (Hartman, 1991). In this neural network model, the domain of cognition is

represented as a multidimensional space where every point in the space is considered to have a meaning. Points that are close in the space are considered to have similar meaning, and as the distance between points increases so does their difference in meaning.

Based on this framework, mental maps can be conceptualized as neural networks comprising leadership and other organizational concepts, and their semantic relationships. The concepts of the mental map include actors, objects and attributes. Actors refer to individuals who play a significant role in the organization and are salient in the minds of organizational members (e.g., the general manager, my peers). Objects describe organizational elements such as the company itself and relevant organizational practices (e.g., TQM). Finally, attributes describe the qualities of the actors and objects, such as effective and good. The concepts of the mental map are related to one another in terms of their similarity of meaning in the minds of organizational members, and the distance between any two objects in the space represents the degree to which the two points share a similar meaning.

The Galileo approach assumes that the neural network or mental map is a multidimensional structure in which every concept can be described by a set of coordinates (Woelfel and Haller, 1971). Accordingly, any individual's cognitive space can be described in terms of both, its overall configuration and the specific characteristics of each concept. First, the overall configuration of the cognitive space or mental map can be described using the parameters of size and volume. The *size* of the mental map refers to the number of concepts included in the mental map. The more concepts included in the mental map, the greater its size. This parameter is related to the construct of cognitive complexity (Fletcher, Danilovics, Fernández, Peterson, & Reeder, 1986) which indicates individuals' ability to perceive and analyze reality along multiple dimensions or elements. The *volume* of the mental map refers to the extent to which the concepts are located far apart from one another. A high volume indicates that the mental map is composed of a set of concept poorly connected between them. In contrast, a low volume indicates that the mental map is a cohesive set of highly interconnected concepts. In this sense, volume captures the construct of mental map connectiveness; that is, the extent to which the mental map is well established and clearly defined in individuals' minds.

Second, with respect to the specific elements of the mental map, any focal concept can be described in terms of its relative location. Two parameters are particularly useful to describe concept location: concept centrality and concept distance. *Concept centrality* refers to the degree to which a concept is placed at the center of the cognitive space. Concept centrality represents the prominence of a given concept in the mind of the person and is related to the "romance of leadership" notion (Meindl, Ehrlich and Dukerich, 1985). The centrality of the leadership concept may be an indication of the extent to which individuals' romanticize leaders and attribute them central status in the organization. The neural network parameter of concept centrality allows the operationalization and empirical test of these ideas. *Concepts distance* refers to the similarity or dissimilarity between any pair of concepts. Large distances indicate the two concepts are unrelated in the mind of the individual. This parameter can be useful to examine the relationships between the leadership concept and other organizational concepts.

The Social Nature of Leadership Cognition

The social construction of leadership is likely to be more evident during periods of rapid transformation and organizational change, such as start-up operations and leadership successions. As information about the leader begins to spread in the organization, a particular mental map will begin to emerge in people's minds. Concepts that are presented together will converge in the multidimensional space, so that connections among them are established and strengthened. After a certain period of time, a cognitive architecture of leadership in relation to other organizational events will reach a relatively stable configuration in which the more frequently two concepts have been presented together, the closer they are in the space. Thus, communication is the main vehicle by which individuals acquire and transmit leadership information that is thereafter organize in memory. In particular, there is empirical evidence based on the social information processing approach (Salancik and Pfeffer, 1978) that suggests that it is the informal, rather than the formal, communication between organizational members the key source of social influence (e.g., Burkhardt, 1994; Ibarra and Andrews, 1993). Informal communication in the context of close interpersonal relationship has been found to be an important source of information for members to develop their own views about the organization (e.g., Salancik and Pfeffer, 1978; Lord and Smith, 1983). The rationale is that as individuals need to reduce uncertainty, they turn to others to have a normative understanding of their surroundings. Thus, their direct interactions with proximate others in the social structure play an important role in this process. Following this rationale, the acquisition and transmission of mental maps in organizations could be modeled as a social influence process. In what follows, I develop hypotheses that relate social network parameters to the characteristics of individuals' mental maps of the organization.

Individual-Level Hypotheses

This set of hypotheses is concerned with predicting characteristics or properties of individuals' mental maps based on individuals' position in the social network. One structural characteristic that has been extensively documented in the network literature is centrality. Centrality in the social network captures the degree of power, influence, and information that people have in the social system (Astley and Sachdeva, 1984; Bonacich, 1987; Brass, 1984, 1985, Brass and Burkhardt, 1992, 1993; Ibarra, 1993). Central individuals are perceived as being more credible, having more power in the group, being more influential in spreading particular views, and having more accurate perception of organizational issues. Next, I develop hypotheses and the accompany rationale for the links between individuals' centrality in the social network and three characteristics of individuals' mental maps: (1) centrality of the leadership concept, (2) volume of the mental map, and (3) representativeness of the mental map.

Centrality of the Leadership Concept. The degree of centrality of the leadership concept in the mental map represents the degree of psychological importance that the individual attaches to leadership. High centrality of the leadership concept means high psychological commitment to the leadership notion and strong links between the concept of leadership and other concepts in the mental map. The degree of centrality of the concept of leadership is also an indication of the general attitude toward the leadership of the organization. A central position of the concept of leadership in the mental map indicates a positive attitude toward the organization and its leadership. Research on social networks demonstrates that central individuals in the social system express more favorable

attitudes toward the job and the organization (Dean and Brass, 1985; Rice and Mitchell, 1973, Roberts and O'Reilly, 1979; see Shaw, 1964; Hartman and Johnson, 1989). The argument for this relationship is one based on structural opportunities and constraints (Ibarra and Andrews, 1993; Salancik and Pfeffer, 1978). The network of contacts of individuals determines, to a great extent, their access to valued resources. Central actors are in ideal positions to get resources from a greater number of peers. Also, individuals in central positions have a more accurate knowledge of the social system (Krackhardt, 1990) and, therefore, greater access to organizational rewards that will increase their level of satisfaction with the organization. Based on these ideas, it is reasonable to expect that as individuals become more central in the social network, they develop more positive attitudes toward leadership and the organization and attribute a central role to leadership. This rationale leads to the following hypothesis:

> **Hypothesis 1: Individuals' centrality in the social network will be positively related to the centrality of the concept of leadership in the mental map.**

Volume of the Mental Map. Individuals' position in the communication network may affect not only the specific location of the leadership concept in the mental map, but also the overall volume of the cognitive space. The volume of the mental map indicates the extent to which this cognitive structure is firmly connected and integrated. Low volume means that the concepts are closely interrelated. Assuming that organizational reality is a complex system of interrelated elements, individuals with more accurate information about the organization will be more likely to perceive the interconnection among all its elements. Thus, the volume of their mental map will be low, compare to individuals with less and more partial information about the organization. Social network studies have shown that individuals in central positions have a more accurate view of the organization (Krackhardt, 1990). Then, whereas central individuals appreciate the complexities of organizational reality and incorporate them into their mental maps, peripheral individuals have a spotty view of the organization and are more likely to represent organizational information disconnected in their minds. This difference should be reflected in the volume of their mental map as indicated in the following hypothesis:

> **Hypothesis 2: Individuals' centrality in the social network will be negatively related to the volume of their mental map. That is, central individuals will report smaller mental maps.**

Representativeness of the Mental Map. Individuals who are perceived as being more credible or having more power in the group may be more influential in spreading particular views about the leadership of the organization. From a social influence perspective, individuals occupying central positions in their groups are in the best position to influence other members. If individuals' cognitive structures are modified by those proximate in their social networks, then central members are more likely to mold other members' cognitive spaces to reflect their own. Also, central members have more exposure to other members of the social network, and are likely to be influenced by a greater number of people. Accordingly, we would expect centrality to be associated with the dispersion of the group's mental map, so that central individuals will more likely reflect the average mental map of the social system.

Hypothesis 3: Individuals' centrality in the social network will be negatively related to individuals' deviation from the average configuration of the mental map in the social group. That is, more peripheral individuals will show greater deviation.

Dyadic-Level Hypotheses

This set of hypotheses is concerned with predicting similarity of mental maps between any pair of individuals. Any model of social influence needs to specify the substantive mechanisms through which social influence processes operate. The network influence model of mental maps proposed here is based on the socialization processes between the agent and the target of influence, and therefore, network proximity is considered the basic mechanism of social influence. Frequent and emphatic interpersonal communication would produce similarity of cognitive structures among group members because it provides proximate others with more opportunities to exchange communication messages and converge in similar mental maps.

Several social psychological processes can be used to account for this social influence effect. Social comparison occurs when people are uncertain about the correctness of their perceptions (Festinger, 1954). The leadership qualities of the leader are almost always ambiguous and subject to interpretation, thus, in order to compare the appropriateness of their perceptions, individuals turn to those proximate in their social networks. According to balance theory (Heider, 1958), if individuals are connected by positive relationships, such as friendship ties, they will tend to develop views of third parties that are consistent with this relationship. If two friends have different views of a third person (e.g., the leader), they are said to be in an unbalance state that creates feelings of uncertainty, instability and cognitive dissonance (Festinger and Hutte, 1954; Festinger, 1957). One way for individuals to reduce the psychological discomfort associated with cognitive dissonance and restore balance to their relationships is to change their cognitions (Newcomb, 1961). In the communication literature, Woelfel and Fink (1980) suggest that conversations among subjects can be seen as descriptions of the adequate location of concepts in the cognitive spaces of the communicating parties which creates forces to readjust those locations toward a common mean or equilibrium position. This process will manifest itself in the convergence of individuals' mental maps over time. This rationale leads to the following hypotheses:

Hypothesis 4a: Individuals' network proximity is positively related to similarity of the overall configuration of the mental map.

Hypothesis 4b: Individuals' network proximity is positively related to similarity of the position of the leadership concept.

Method

Research Site

This study was conducted in two different plants of a large manufacturing company with more than 2,000 employees worldwide. The plants, with 400 and 300 employees, are located in New York and New Jersey, respectively. The primary products of the company are disposable plastic and paper medical devices. This organization was chosen for this study because it was experiencing a major organizational change in strategy. The company was recently acquired by a financial institution and it was changing from an entirely industrial organization operating in a mature business and a focus on cost controls and operational efficiency, to an innovative medical company with a strong R&D and marketing orientation. A new top management team, the Corporate Management Group or CMG, led this transition. Since the decisions of the CMG had important implications for the future of the employees and the company as a whole, one could assume that the top management team occupies a prominent role in organizational members' thinking of the organization at that time.

Sample

I collected data from 280 manufacturing employees in 6 production units. Three of the production units were located in the New York plant (N=40, N=44, and N=47), and the other three were located in New Jersey (N=48, N=32, and N=69). The overall response rate was 82% with a response rate of more than 80% in all networks. Each of the six networks was analyzed separately, providing an independent test of the theory. All six networks are free standing production units in which employees have the same supervisor and work together in a common product, or line of products. Thus, each network represents an independent set of workers with a unique social dynamics. Table 1 shows the descriptive statistics for all six networks, including size, average tenure, average age, and social network parameters.

(See Table 1)

New York Plant: The headquarters of the company, exempt and non-exempt employees, are all located in the same building. Employees at this site see the top management team as the "leader" of the company, and the general manager as one more manager. The company is in transition and at the time of the data collection it was 60% industrial and 40% medical (from 100% industrial less than a year ago). Despite reassurances from top management that the company was not going to layoff employees, outsourcing of distribution and the consequent termination of most employees in this department created an atmosphere of mistrust.

> *Network1*: This network corresponds to the night shift in the New York plant. It has the lower average age. The group was relatively young with many unmarried employees. Since the company was downsizing this plant, many members of this group felt that it would be impossible to have a long-term career in this company, but felt confident that they could get another job if needed.

Network 2: This network represents the afternoon shift in the same production lines as network 1, although some members worked on a medical product line that only operated in the afternoon. The supervisor was a young and dynamic person. They were the least satisfied with the current situation. They were very vocal about the new management team not investing in new machinery or bringing new businesses to the plant.

Network 3: This network represented the afternoon shift on a different production line. The supervisor as well as many of the group members were old-timers. They did not fully trust the top management team and had similar questions and complains about the company as network 2.

New Jersey Plant: The plant in New Jersey was expanding at a tremendous rate. They doubled in size in a year, and new business and production lines were coming from other plants. The top management team at headquarters had informed them that they were being rewarded for the successful way in which they had implemented self-managed teams. Because of the new hires, they felt that training and teamwork were critical issues for the success of the plant. The plant was also changing from traditional industrial products to new medical product lines.

Network 4: This is an all-women group and it has the highest age average. They worked in the industrial side of the business and most members were old timers in the company. The female supervisor was retiring the same year the data was collected. They complained that that the medical side of the business was getting all the attention and resources, while their group, which was the most profitable, was used to compensate for the losses of the other two medical groups.

Network 5: This group worked on the medical side of the business. They worked in a "clean" room because their only product is used in invasive procedures during labor and has to be packaged in an antiseptic environment. Their work area is small and crowded. Every time that they had to leave the room, they had to change clothes. Thus, they spent most of their time in the work area. This group had the highest density in the communication networks. They reported that the work was very intense because human lives are at stake if defective or infected products made it to the consumers.

Network 6: This is the largest and newest network. This group was created a few months before the data was collected. A new product line with 42 different products was moved from California to NY. A group of 20 old-timers from the industrial side of the plant went to California to learn how to operate the machines (the core team). The rest of the team included a small group of Latinos brought in from the plant in California, and a majority of new hires who had been with the company for only seven months at the time the data were collected.

Procedure

The following two-stage procedure was used to obtain individuals' mental maps of leadership.

1. Uncovering the Concepts of the Mental Map. The first step in the study was the identification of the relevant concepts, or landmarks, that form the basic elements of the mental map. A common method in the neural network literature to uncover the concepts of the cognitive structure is to conduct interviews with a representative sample of the members of the organization (e.g., Barnett, 1988c). Appendix 1 includes a description of the instructions and questions that I used during the interviews. Open-ended interviews were conducted with a sample of 30 employees (10% of the total sample). Previous research indicates that a small sample within a population can generate the majority of sense-making constructs (c.f., Dunn, Cahill, Dukes, and Ginsberg, 1986; Krackhardt and Kilduff, 1990). Individuals were randomly selected, and were interviewed during normal working hours. The open-ended interviews lasted for more than one hour and employees were asked about the leadership of the organization and about current and relevant organizational issues.

The interviews were transcribed and content analyzed by using computer-aided text analysis methods (CATPAC, Woelfel, 1990). From this analysis, eleven concepts were identified that are considered part of the mental map for all employees in this organization. The concepts identified in the three production units in NY are as follows: Company-Today, Company-Future, World Class (ideal) Company, Medical Company, Industrial Company, Corporate Management Group (CMG), Quality, Teamwork, Profits, Incentives, and Job Security. The concepts identified in the three production units in NJ are as follows: Company-Today, Company-Future, Ideal Company, Medical Company, Industrial Company, General Manager, Quality, Teamwork, Profits, Incentives, and Training. In addition, I included the concepts of Me and My Coworkers. The leadership concepts are Corporate Management Group in NY and the name of the General Manager in NJ. In New York, the employees in the three production networks did not differentiate between the actions of the CEO and his top management team. When asked about "who" made the important decisions affecting the company, the typical answer was 'the CMG.' In contrast, in the plant in NJ, the managers from NY were seen as too distant. These production employees cited the general manager as the most influential decision maker in the plant. Most of them did not know who the CEO of the company was and none of them knew what the letters CMG stood for.

2. Determining the Architecture of the Mental Map. The second step included the application of a paper-and-pencil questionnaire with a pair-comparison methodology to access the internal configuration of the mental map held by each individual (Woelfel and Fink, 1980; Barnett, 1988c). A copy of the Mental Map Questionnaire is included in Appendix 2. I administered this questionnaire to all members of the six production networks. This methodology has been successfully used to uncover elements of organizational culture (Albretch, 1979; Barnett, 1988c). The questionnaire asks respondents to estimate the difference in meaning between each of the k(k-1)/2 possible pairs of concepts. A criterion pair is given for subjects to use as a unit measure when making comparisons. Subjects estimated the differences among concepts by answering the following type of questions: If the concepts of MEDICAL COMPANY and INDUSTRIAL COMPANY are 5 units apart, how far apart are the following pairs of concepts: INDUSTRIAL COMPANY vs. MEDICAL COMPANY. There is evidence that this scaling procedure produces

more reliable estimates of differences in meaning among concepts than the use of typical rating and categorical scales (Barnett, Hamlin and Danowski, 1981; Gillham and Woelfel, 1977). I reassured participants that their answers to the surveys were strictly confidential, and that no individual or firm names would be identified in published reports. I coded the questionnaires so that individual responses could be identified by the researcher in order to match cognitive data with the social network data. The answers to the pair-comparison part of the survey were used to obtain individuals' mental maps.

Individuals' estimations of the distances between pairs of concepts are put into a square matrix of concepts-by-concepts D_k(NxN) whose cells D_k(i,j) represent the distances between concepts i and j as perceived by subject k. Because the cell D_k(i,i) describes the dissimilarity of concept i with itself, by definition the diagonal contains zeros. The concept-dissimilarity matrix D_k(NxN) was converted into a multidimensional space so that each concept is located on a number of dimensions. This procedure is done by using a metric multidimensional scaling (MDS) procedure that transform the dissimilarity matrix into Cartesian coordinates. The coordinates of the concepts in the first three dimensions can be used to provide a three-dimensional graphic of the cognitive structure, although we may need more than three dimensions to fully describe the entire cognitive space. Appendix 3 includes a more detailed description of the computations used to transform pair-comparison data into neural network data, and Appendix 4 shows the mean distances for each pair comparison in each network.

Dependent Variables

Consistent with the individual-level hypotheses, I first define three dependent variables that describe individual's mental maps: -centrality of the leadership concept, volume of the mental map, and representativeness of the mental map. Second, consistent with the dyadic-level hypotheses, I define two relational dependent variables: similarity of mental maps and similarity of the centrality of the leadership concept.

Centrality of the leadership concept. It refers to the degree to which the leadership concept is placed at the center of the cognitive space. High centrality means that the leadership concept is close to other concepts in meaning and that it is connected to a large number of concepts. Centrality is taken here as a measure of the prominence of the leadership concepts in the mind of the individual. The centrality of the leadership concept is operationalized by the length of the leadership vector. Since the Multidimensional Scaling procedure places the centroid of the nodes at the origin, the centrality of any concept can be determined by its distance to the origin as determined by a vector. The shorter the vector associated with the concept of leadership, the higher its centrality. A measure of the vector can be obtained from the adjusted scalar product matrix whose diagonal cells, bii, represent the square distance of each node i from the center of the network. From the scalar product matrix, a vector containing the centrality of the focal concept in each individual's representation was obtained CT_j(Nx1).

Volume of the mental map. The measure of volume describes the semantic connectivity of the mental map. The volume of the space is a function of the distances among the elements of the representation. A low volume indicates that the mental map is a cohesive subset of highly interconnected concepts with similar meaning. The volume of the cognitive space can be obtained

from the trace of the scalar products matrix. The trace represents the total sum of the square lengths of the position vectors of any point in the cognitive space. The length of these position vectors is a measure of the volume of the cognitive space.

Representativeness of the mental map. The representativeness of the mental map refers to the degree to which an individual's mental map is similar to the average mental map of the group. I obtained an average mental map of the group by aggregating the individual mental maps of all members of the group. Since all individuals' mental maps include the same concepts, individuals' mental maps can be aggregated into a group mental map that represents the shared system of cognition. Then, I computed an individual dissimilarity measure that results from comparing each individual's mental map against the group' mental map. Values close to zero indicate mental maps that are close to the groups' average mental map, while larger values indicate great dissimilarity with the group's mental map.

Dyadic similarity of mental maps. Since all members of the network have the same concepts included in their cognitive space, a procedure for assessing the overall degree of similarity can be developed by comparing the overall degree of similarity among cognitive spaces (Barnett, 1988a 1988b, Barnett and Rice, 1985a; Serota, Cody, Barnett, and Taylor, 1977). To obtain a measure of similarity between two cognitive spaces, the spaces are first translated to a common origin and rotated following a least squares fit that minimizes the differences among the spaces. The individual spaces are not standardized so that dilation or contraction of the cognitive structure can be measured. After the cognitive spaces have been rotated, differences in the position of the concepts are obtained by subtracting the coordinates of the concepts between the two spaces. Galileo provides the eigenvectors or dimensions for each matrix of concepts, the location of the concepts on these dimensions, and the differences in the location of these concepts between any two spaces. Therefore, we can obtain the distances for each pair of concepts, and the overall grand mean of these distances is an overall measure of similarity between the cognitive spaces of these two individuals.

Dyadic similarity of the centrality of the leadership concept. I conducted pair comparisons among all individuals in the network to produce a similarity matrix $CT_i(NxN)$ whose cells $CT_i(a,b)$ contain the absolute value of the difference between the centrality of the leadership concepts for subjects a and b. A value of zero means that both individuals ascribe the same level of centrality to the leadership concept and higher values mean greater dissimilarity on this measure.

Independent Variables

Consistent with the hypotheses and the definition of the dependent variables, I define an individual-level independent variable - individuals' centrality in the social network, and a dyadic-level independent variable - network proximity between two individuals. Both variables come from the analysis of two communication networks in the organization, namely the task and friendship networks. To uncover the pattern of social ties, I asked participants to complete a Network Analysis Questionnaire (NAQ) which is included in Appendix 5. First, to obtain information about the *task network*, participants are asked, "how many times do you find yourself discussing job-related matters with other members of this organization in a typical week -- last week for instance?." Second, to uncover the *friendship network*, respondents are asked, "how many times do you find

yourself socializing and discussing job-unrelated matters with other members of this organization in a typical week -- last week for instance?" Participants were given a list with the names of all members of their production group. Two square matrices, T(NxN) and F(NxN), are then created for each social network. Based on these matrices, I computed the independent variables.

Individuals' Centrality. The two most common measures of centrality are degree and closeness centrality (see Freeman, 1979; Borgatti, Everett and Freeman. 1992). *Degree centrality* refers to the number of links that a person has with other members of the group. The more links, the more central a person is in the group. Degree centrality includes out-degree links (i.e., those links reported by the focal person), and in-degree links (i.e., those reported by other group members about the focal person). When using reciprocated links, both in-degree and out-degree centrality are equivalent. *Closeness* is a measure of centrality that accounts for both direct and indirect links. Conceptually, it represents ease of access to others. For instance, one individual with five ties to central individuals is "closer" to other members of the group than an individual with five ties to five peripheral members of the group. A measure of "farness" is calculated by adding the number of steps it takes for one individual to reach any other member of the group following the shortest paths or geodesics. This measure of farness is then normalized by dividing it by the minimum possible farness. The reciprocal of that amount expressed as a percentage is the measure of closeness. This procedure provides a measure of closeness in which higher values indicate greater centrality. In this study, the correlations between the two measures are relatively high for all networks (mean of the six correlations is .67), and both measures yielded the same results. Thus, I am reporting the results for closeness centrality, since this measure captures the idea of being at the center of the flow of information better than degree centrality.

Dyadic network Proximity. Network proximity is defined as the presence of reciprocated links. Two individuals are proximate in the social network if they both agree that there is a link between them. Reciprocation as a criterion for relational proximity is a standard practice in network analysis, since it increases the face validity of the network. Two adjacency matrices were created for the task and friendship networks T(NxN) and F(NxN), whose cells, (i,j), consist of 1's indicating the presence of reciprocal ties between pairs of members, and 0's indicating the absence of ties. The density in the task network, measured as the ratio of present links over the total number of possible links was .24, .12, .22, .13, .78, and .18 for the six production units, respectively. The density in the friendship network for the six production units was .34, .10, .09, .13, .53, and .11, respectively.

Control Variables

Several individual characteristics and formal positions are used as control variables in this study, as they represent alternative explanations to network-derived sources of social influence. First, **age** could be an important factor affecting participants' perception of leadership. Age differences may reflect differences in values and attitudes with respect to what is expected from leaders. That is, the representation of leadership may vary across different age groups what will result in different interpretations of leaders' actions. Second, there is some evidence that **gender** has an impact on leadership perceptions. For instance, women have been found to give higher ratings of leadership to their leaders (e.g., Adams, Rice, and Instone, 1984; Bass and Avolio, 1991; Butterfield and Powell, 1981; Rice, Instone, and Adams, 1984). Gender was coded as follows: 1-Male and 2-

Female. Third, individuals' **level** in the production unit may also have an effect in individuals' perceptions of their leaders. The higher in the organizational ladder, the more positive attitudes toward management. Level was coded as follows: 1- lowest rank/temporaries, 2- journey, 3- masters, 4-team leaders. Fourth, **ethnic background** is usually associated with different cultural values and attitudes. Since the leadership of the organization is predominantly white male, members of different ethnic backgrounds may have differing perceptions and interpretations of top management actions. This variable was coded as 1-white 2-minorities. Finally, **tenure** may also affect perceptions of leadership because higher tenured employees may have had previous experiences with the top management team that could affect their perception of the leadership of the organization.

Data Analysis

I used OLS regression analysis to test the individual-level hypotheses. However, the dyadic-level hypotheses that required analysis of dyadic data can not be tested with OLS regression analysis because independence of observations cannot be assumed. Observations are autocorrelated since each subject reports more than one observation, or link, and each observation is reported twice by the two members of the link. Additionally, the General Least Squares (GLS) procedure used in econometrics to deal with autocorrelated samples is also troublesome with network data because a theory to estimate rows, columns and diagonals autocorrelation parameters has not yet been developed, and, as Engel (1974) has shown, assuming incorrect values for the autocorrelation parameters produces far worse estimates than using the normal OLS procedure. There are, however, several techniques that handle this problem and still provide exact tests of the statistical significance of the effect of the variables in the equation.

One of the most frequently used techniques for handling network autocorrelation is the Quadratic Assignment Procedure (QAP, Hubert and Schultz, 1976; Krackhardt, 1988). QAP compares whether or not dyadic links in the social network are statistically related to dyadic similarities in individuals characteristics, or in other words, whether or not two matrices are statistically the same (Krackhardt, 1988; Tutzauer, 1993). The QAP procedure uses a non-parametric solution to the problem of network autocorrelation. It proceeds in two steps. First, it calculates a Person's correlation between paired entries of the network, or dyadic data. In the second step, instead of comparing the value of this correlation with an F or t test, it builds a correlations distribution by generating all correlations that result from permuting the rows and columns of one of the structural matrices. The original correlation is then compared with the hundreds of correlations computed. Similar to the .05 cutting point of statistical significance of parametric approaches, the original correlation is considered statistically significant if less than 5% of the randomly computed correlations are as large. Krackhardt's (1988) extension of this procedure to the multiple regression case (MRQAP) allows for the introduction in the regression equation of multiple similarity matrices. All variables in the equations are square matrices of NxN, where N is the number of individuals in the network. Cells in these matrices include the absolute values of the differences between pairs of individuals in each variable with the exception of the social network matrices that were defined above.

Results

Descriptive Statistics

Table 2 shows the means, standard deviations, and intercorrelations among all variables at the individual level. Table 3 shows a partial matrix of intercorrelations at the dyadic level between social network proximity and similarity of mental map characteristics. In this table, all indices are Pearson product-moment correlations resulting from the Quadratic Assignment Procedure based on 1000 random permutations.

(See Tables 2 and 3)

Description of the Mental Maps by Manufacturing Operations

Each production unit represents a subsystem within the organization with a unique pattern of interactions and social dynamics. I aggregated individuals' mental map to obtain a group-level mental map that represents the shared cognition for that particular group. Next, I describe these group-level mental maps by location– three networks in New York, and three networks in New Jersey.

Production New York (Networks 1, 2 and 3). The three production networks from NY present several common characteristics. First, the three mental maps of leadership have large volumes, indicating that individuals see the concepts are largely unrelated and disconnected. Second, the concept of ME, which represents employees' organizational identity, is in the periphery of the cognitive space, indicating that individuals see themselves as very different from the other elements. It is also significant to note that the concept of ME is opposite to the leadership concept, CMG, in all three mental maps. Similarly, the mental maps of the three groups show a similar dimensions from MDS analysis In the three configurations, the main two dimensions go from "company-today/Industrial" to "company-future/medical," and from "me/my-peers" to "CMG." Finally, in all three configurations, the center of the space is defined by the concepts of "quality" "teamwork" "ideal-company". The configurations of the three mental maps are consistent with the reports from the interviews. Production employees voiced their dissatisfaction with the current transition of the organization into a medical company, and pointed out their belief that management wanted to use the industrial resources to develop the medical business, while at the same time let the industrial wither away. The three production networks are predominantly industrial. The first group (Network 1) represents the night shift and they rarely see their managers, other than their supervisor. This can help explain the substantially larger distance between the concepts of "me" and "CMG" in this network.

Production New Jersey (Networks 4, 5 and 6). In the three networks, the main dimension goes from "company-today" to "company-future." On this dimension most concepts lie closer to "company-future" than "company-today," indicating that for most members, both the industrial and medical areas play an important role in the future of the plant. The first network is 100% industrial with long-tenured employees. As expected, the concept of "medical" is located far away from the center of the representation, while the concept of "industrial" is at the center of the cognitive space. In general, the volumes of the three

mental maps are smaller than those of the NY networks, which is consistent with the expansion of the NJ plant and the downsizing of the NY plant.

Hypotheses

Table 4 shows the results from the OLS on the individual-level variables. The overall characteristics of the social networks may have an effect on the relationship between individuals' network centrality and the properties of their mental maps. For instance, high density in the communication network reduces the variability of the individuals' centrality measure, resulting in lower correlation with mental maps' characteristics. Accordingly, five dummy variables were created to control for the six social networks. Table 5 shows the results from the Multiple Regression Quadratic Assignment Procedure (MRQAP) on the dyadic-level variables.

(See Tables 4 and 5)

Hypothesis 1: Individuals' centrality in the social network and centrality of the leadership concept. Hypothesis 1 states that centrality in the network is positively related to the centrality of the concept of leadership in the cognitive space. In addition to the normal controls, a statistical control for volume was included since this variable is related to the centrality of the leadership concept. Results from the OLS show that individuals' centrality in the social network is marginally and negatively associated with the length of the leadership vector (B=-.31, p<.066), providing support for hypothesis 1. Since the shorter the leadership vector, the greater the centrality of the leadership concept in the neural map, the results modestly support the notion that central individuals place the leadership concept at the center of their organizational mental map. Furthermore, this relationship is supported for the friendship network, but not for the task network

.

Hypothesis 2: Individuals' centrality in the social network and volume of the mental map. Hypothesis 2 states that centrality in the network will increase the access to important information about the organizational leadership and will result in smaller volumes of the cognitive space. After controlling for individuals characteristics and networks, centrality in the friendship network shows a statistically and negative significant coefficient predicting the volume of the cognitive space (B=-.45, p <.05). As expected, the greater the centrality of the individual in the social network, the lower the volume of his/her mental map. In other words, compared to more peripheral individuals, the mental maps of central individuals show greater semantic connectivity. That is, their concepts are more highly related to one another. Again, this relationship is supported for the friendship network, but not for the task network.

Hypothesis 3: Individuals' centrality in the social network and deviation from the group's average mental map. To test this notion, I examined the relationship between individuals' centrality in their networks and the deviation between their mental map with respect to the groups' average mental map. Statistical controls for sex, age, marital status, and tenure were included in the regression equations. The beta coefficients revealed a statistically significant unique effect for friendship network centrality on individuals' dissimilarity of mental maps (*B*=-.476 p<.04). As expected, central individuals show the least dissimilarity. In other words, central individuals, rather than more peripheral individuals, better represent or reflect the mental map of

the group as a whole. As in the above hypotheses, the results here are supported for the friendship network, but not for the task network.

Hypothesis 4: Dyadic network proximity and similarity of mental maps. To test the notion that social network proximity predicts similarity of mental maps, I used Krackhardt's (1988) extension of QAP to the multiple regression model (MRQAP). To control for age, gender, tenure, level, and race at the dyadic level, four matrices were created A(NxN), G(NxN), T(NxN), L (NxN), R(NxN) whose cells contain the absolute value of the difference between each pair of individuals. Table 5 summarizes the meta-analysis on the six networks. As expected, the results show that proximity in the friendship network has a statistically significant beta coefficient predicting similarity of mental maps of leadership (b=.161, p<.000), the volume of the cognitive space (b=15.00, p<.032), and similarity of the length of the leadership vector (b=2.287, p<.023). In contrast, none of the coefficients for proximity in the task-related network was statistically significant, even though they all are in the expected direction. Thus, these results support hypothesis 4 for the friendship network. Figure 1 depicts a summary of the overall results.

(See Figure 1)

Discussion

Taking a social constructionist approach to leadership, the empirical results from this study provide a first positive test to the notion that leadership information is not just stored in memory into independent leadership schemas, but rather leadership information is organized into semantic cognitive structures including leadership and other organizational concepts as well as their relationships. This theory asserts that leadership information together with other organizational concepts are represented in the minds of the people in the form of mental maps, and particularly in the form of semantic neural maps. Thus, what gives meaning to leadership is the set of concepts that are close to it in the thought system of organizational members. Since verbal reports are a window to individuals' thought systems, inductive and content-free analyses of participants' verbal reports ought to be able uncover the concepts that are related to leadership. A qualitative analysis of participants' verbal reports revealed that leadership information was closely related to the concepts of "quality," "teamwork," and "ideal company." Leadership information was also related to a temporal dimension that described the company "today" and in the "future." In addition, consistent with the strategy of the top management team, employees reported leadership information related with the change of strategy, from "industrial" to "medical" company.

Furthermore, this model looks at the social nature of these neural maps and claims that these cognitive architectures are acquired, in part, through a social process as individuals communicate with one another. Based on the social information processing approach (e.g., Salancik and Pfeffer, 1978), we know that individuals' attitudes can be predicted from their social environments. Thus, significant findings can be expected when predicting individuals' mental maps from their relative position in the social network. Confirming this general notion, I found that individuals' centrality in the friendship network was significantly related to the location of the leadership concept in the mental map, the semantic connectivity of the mental map, and the representativeness of the mental map. In particular, central individuals in the friendship network tend to ascribe the concept of leadership a central stature in their minds relative to other

organizational concepts. That is, the leadership concept is psychologically prominent in their minds. Furthermore, individuals who are central in the friendship network report highly connected mental maps. The organizational reality, including leadership information, of central members is organized and represented in memory in a rather cohesive way in which all concepts are highly interrelated. In addition, when compared against the group's average mental map of leadership, central individuals more highly represent the groups' mental map. At the dyadic level, the results of this study show that the more frequently two people communicate, the more similar their mental maps of the organization and its leadership.

It is interesting to note that all the effects relating network parameters and mental maps occur for the friendship network but not for the task network. A potential explanation for this unique effect in the friendship network has to do with the notion that friendship ties are stronger, more intimate links, and tend to connect people who are similar in other personal characteristics, such as sex, race, age, and religion (Ibarra, 1992, Marsden, 1988). In contrast, task links are usually instrumental, weaker, and link people who more dissimilar in other personal characteristics (Laumann, Galaskiewicz, and Marsden, 1978, Lincoln, 1982, Lin, 1982). Thus, individuals use others as valid referent points for comparison only when they are similar to them or have similar interests. As a consequence, friendship, rather than task-related ties, may be used for comparison and influence processes. Also, because of their strength and pressures for conformity, friendship relationships may have a greater potential for persuasion.

Overall, the results of this study provide additional empirical evidence that supports a follower-centered approach to leadership using a social constructionist theory. Figure 2 graphically summarizes the focus of the leadership literature into three areas: leader, followers, and context. Traditional studies on leadership have typically focused on the figure of the leader. Even when looking at the followers, most studies treat followers as social hermits who perceive, interpret and evaluate organizational stimuli in isolation rather than in context. These studies have left largely unexplored those social processes which are not directly traceable to the personal characteristics of the leader, but which instead have their origins in, and derive their impact from, the social context that individuals create for one another. Thus, virtually no attention has been paid to those aspects of the wider social environment, which embed and potentially influence the development of individuals' perceptions of leadership. The result is an under-socialized account of how individuals experience leadership and their organizational worlds. The present study compensates this bias by offering a more socialized account that highlights the inter-subjective nature of individuals' experiences in organizations. This study presents direct evidence that followers actively construct their leaders and that these constructions are created in a social process as individuals interact with their close friends.

(See Figure 2)

Future research

The conceptualization of leadership cognition as a neural network composed of the concept of leadership and other relevant organizational concepts and their relationships introduces a new set of dependent variables. As such, it opens several new research avenues that fall into three broad categories.

First, one conceptual problem with neural networks has to do with logical inconsistencies among neural paths. Neural network theory includes a parameter that measures inconsistencies in meaning. This parameter is called *Warp*. Warp is a measure of the extent to which the multidimensional space of the mental map deviates from Euclidean geometry into Riemannian geometry (Barnet and Rice, 1985). In a Euclidean space, distances among concepts are transitive, that is, if two concepts are close to a third concept, they should also be close to each other. This idea of inconsistency among concepts captures the well-established construct of cognitive dissonance or cognitive imbalance (Festinger, 1957; Heider, 1958). Bougon, Weick, and Binkhorst (1977) found that individuals' cognitive structures are in a state of dissonance when individuals are trying to make new sense. Innovative thinking requires inconsistencies. If we want to learn more about how individuals make sense of organizational reality in a non-logical but innovative way, then we need to know about logical inconsistencies in their thought system and whether or not they are ever resolved. That is, is individuals' thought system permanently in a state of dissonance? or are there periods of integrativeness and balance?

Another area of research has to do with issues of causality. The present study has shown a strong relationship between network-derived parameters and similarity of cognitive structures. However, the cross-sectional nature of the study does not lend itself to examine questions of causality. I have argued that proximity, defined here as reciprocity of interactions, in the social network leads to homogeneity of cognitive structures. However, it could also be argued that individuals might find it more rewarding to interact with other members of the network with similar cognitive structures. That is, pre-existing similarity among friends could be an alternative explanation for the proximity-homogeneity effect. I have attempted to eliminate these effects by controlling for similarity of a number of personal characteristics (e.g., sex, age). To the extent that similarity on these personal characteristics is related to, but does not totally explain, similarity of cognitive structures, we can argue that this residual variance can be explained by individuals' position in the social structure. Still, future research should examine this question by using longitudinal methodologies.

The third area of research brings together two particularly interesting issues: dyadic influence process and the group-level context or whole network. One factor that might affect dyadic influence processes may be the density of the whole network. The density of the social network has been found to play a role in the diffusion of innovations. For instance, Valente (1995) analyzed the relationship between network density and the rate of diffusion of innovations in three studies: the diffusion of medical innovations (Coleman, et al., 1966), the diffusion of farm practices in Brazil (Rogers, Ascroft, and Roling, 1970), and the diffusion of family planning in Korean villages (Rogers and Kincaid, 1981). He reports that the correlations between network density and the speed of diffusion are r=.97, r=.61, r=.49, respectively. These results suggest that social systems in which the communication network does not reach a certain level of connectedness may not provide an adequate environment for network influence processes to take place. Thus, one could expect that the density of the network would moderate the relationship between dyadic proximity and similarity of mental maps. In high-density networks, the relationship would greater than in low-density networks.

To summarize, the four key ideas that appear throughout this research are: (1) individuals' store leadership information in their minds in a structure of meaning in which the leadership concept is related to other organizational relevant concepts, (2) neural networks are a useful and valid metaphor to study how individuals represent the organizational world in their minds including leadership, (3) the psychological importance of leadership relative to other organizational issues is positively related to the individuals' central position in the social network, and (4) the translation from the world of reality to the world of thought is performed via close social interactions, so that close organizational friends shape the meaning that individuals ascribe to the external world.

Finally, this line of work will help us improve our understanding of how individuals perceive and process organizational information and the role that the social environment plays in shaping their views of the organization. Knowledge in this area will be very useful in designing effective communication strategies that ensure that the intended message is adequately perceived and stored in memory by all members of the organization. This is even more relevant nowadays when globalization pressures have the potential for creating distant and fragmented organizational units with the corresponding risk of misalignments among them.

Table 1. Descriptive data for all six social networks

	NETWORKS					
	New York			New Jersey		
	1	**2**	**3**	**4**	**5**	**6**
Size	40	44	47	48	32	69
Valid Surveys (%)	33 (83)	36 (82)	37 (82)	39 (81)	28 (93)	60 (87)
Tenure (average years)	7.81	12.63	17.54	12.45	5.96	2.63
Age (average years)	35	41	43	49	42	39
Number of links reported						
Task	682	528	1,292	1,040	3,392	3,628
Friendship	1,464	584	442	1,254	2,358	1,046
Number of reciprocated links						
Task	250	146	288	188	590	632
Friendship	354	128	122	196	404	372
Density of the Networks						
Task	.24	.12	.22	.13	.78	.18
Friendship	.34	.10	.09	.13	.53	.11

Table 2. Correlation matrix for all dependent variables at the individual level.

	1	2	3	4	5	6	7	8	9	10
Control Variables										
1. Age										
2. Sex	0.12									
3. Tenure	0.44**	-0.18**								
4. Level	0.24**	-0.10	0.31**							
5. Marital	0.32**	-0.12	0.19*	0.04						
Network Centrality										
6. Task	0.03	0.24**	-0.13	0.20**	-0.03					
7. Friendship	-0.05	0.15*	-0.14*	0.12	-0.07	0.78**				
Leadership Variables										
8. Representativenes	-0.05	-0.11	-0.09	-0.16*	0.12	-0.03	-0.09			
9. Volume of SRL	-0.09	0.00	-0.04	-0.16*	0.09	-0.14*	-0.17**	0.80**		
10. Centrality-Leadership	-0.01	0.01	0.03	-0.10	0.05	-0.06	-0.08	0.53**	0.67**	
Mean	41.56	1.53	9.44	2.04	1.55	31.20	12.79	2.21	246.72	20.46
SD	10.81	0.50	8.39	0.91	0.50	21.77	11.52	0.62	133.91	17.12

N=263. * p < .05; ** p < .01.

Table 3. Partial correlation matrix at the dyadic level. Results from the Quadratic Assignment Procedure (QAP) on the similarity of leadership representations and the length of the leadership vector.

	OVERALL SIMILARITY OF MENTAL REPRESENTATIONS OF LEADERSHIP			**SIMILARITY OF LENGTH OF LEADERSHIP VECTOR**		
TASK PROXIMITY						
	r	p	z	r	P	z
Network 1	0.048	0.305	0.510	0.061	0.238	0.713
Network 2	0.050	0.150	1.036	0.040	0.180	0.915
Network 3	0.010	0.466	0.085	0.030	0.276	0.595
Network 4	-0.050	0.254	-0.662	-0.010	0.480	-0.050
Network 5	0.107	0.140	1.080	0.040	0.272	0.607
Network 6	-0.017	0.320	-0.468	-0.011	0.410	-0.228
Meta-analysis	***0.025***	***Zc=.646,p=.259***		***0.025***	***Zc=1.04,p=.149***	
FRIENDSHIP PROXIMITY						
	r	p	z	r	p	z
Network 1	0.078	0.217	0.782	0.128	0.100	1.282
Network 2	0.130	0.008	2.409	0.100	0.022	2.014
Network 3	0.090	0.050	1.645	0.065	0.107	1.243
Network 4	-0.040	0.286	-0.565	-0.010	0.418	-0.207
Network 5	0.217	0.013	2.226	0.095	0.136	1.098
Network 6	0.012	0.388	0.285	0.007	0.406	0.238
	0.081	***Zc=2.77,p=.003***		***0.064***	***Zc=2.31,p=.010***	

Table 4. Results from the Multiple Regression Quadratic Assignment Procedure (MRQAP) on the similarity of leadership representations and the length of the leadership vector, showing unstandardized betas. Statistical controls were established for similarity of age, sex, level, race, and tenure.

	OVERALL SIMILARITY OF MENTAL REPRESENTATIONS OF LEADERSHIP			**SIMILARITY OF LENGTH OF LEADERSHIP VECTOR**		
TASK PROXIMITY						
	b	p	z	*b*	p	z
Network 1	0.110	0.270	0.613	3.350	0.286	0.565
Network 2	0.090	0.167	0.966	0.715	0.328	0.445
Network 3	-0.016	0.432	-0.171	0.632	0.342	0.407
Network 4	0.020	0.430	0.176	0.050	0.482	0.045
Network 5	0.232	0.116	1.195	1.430	0.312	0.490
Network 6	-0.017	0.370	-0.332	-0.011	0.358	-0.364
Meta-analysis	***0.070***	***Zc= 1.00,p = .159***		***1.028***	***Zc = .649, p = .258***	
FRIENDSHIP PROXIMITY						
	b	p	z	*b*	p	z
Network 1	0.165	0.110	1.227	6.430	0.050	1.645
Network 2	0.214	0.007	2.457	2.560	0.096	1.305
Network 3	0.179	0.050	1.645	2.060	0.184	0.900
Network 4	0.080	0.228	0.745	0.320	0.434	0.166
Network 5	0.318	0.020	2.054	2.350	0.230	0.739
Network 6	0.012	0.310	0.496	0.004	0.448	0.131
Meta-analysis	***0.161***	***Zc= 3.52,p = .000***		***2.287***	***Zc = 2.00, p = .023***	

Table 5. Results from the OLS multiple regression analysis on the dispersion of social representations of leadership, showing standardized beta coefficients.

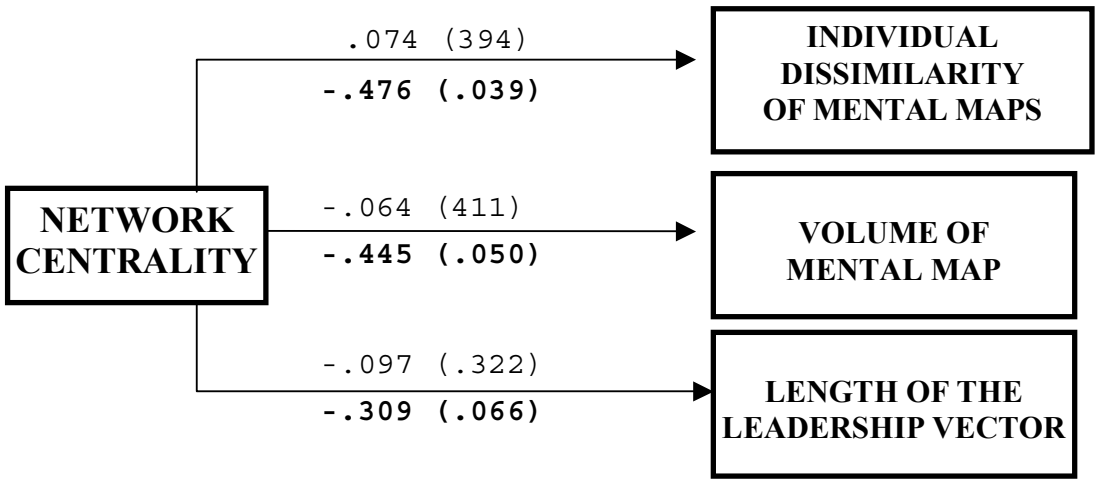
	Representativeness of the mental map		**Connectivity of the Mental Map**		**Centrality of the Leadership Concept**	
	Beta	p	Beta	p	Beta	p
Controls						
Sex	-.051	*(.287)*	.010	*(.458)*	.050	*(.234)*
Age	.036	*(.330)*	-.121†	*(.074)*	.056	*(.185)*
Marital	.100†	*(.072)*	.098†	*(.078)*	-.004	*(.470)*
Level	-.184**	*(.006)*	-.113†	*(.063)*	-.041	*(.232)*
Tenure	-.028	*(.391)*	.045	*(.333)*	.090	*(.122)*
Network 1	-.090	*(.208)*	.034	*(.380)*	-.204**	*(.008)*
Network 2	-.191	*(.125)*	-.073	*(.333)*	-.164	*(.096)*
Network 3	-.304**	*(.006)*	-.010	*(.467)*	-.250	*(.003)*
Network 4	.231	*(.206)*	.353	*(.109)*	.286	*(.092)*
Network 5	-.168	*(.195)*	-.026	*(.448)*	-.196	*(.094)*
Volume					.683**	*(.000)*
Network centrality						
Friendship	-.476*	*(.039)*	-.445*	*(.050)*	-.309†	*(.066)*
Task	.074	*(.394)*	-.064	*(.411)*	-.097	*(.322)*
Rsq	.106		.076		.488	
Adj Rsq	.057		.026		.457	
F	2.16 *(.01)*		1.51*(.12)*		16.04*(.00)*	

N=263. † p,.1; * p < .05; ** p < .01.

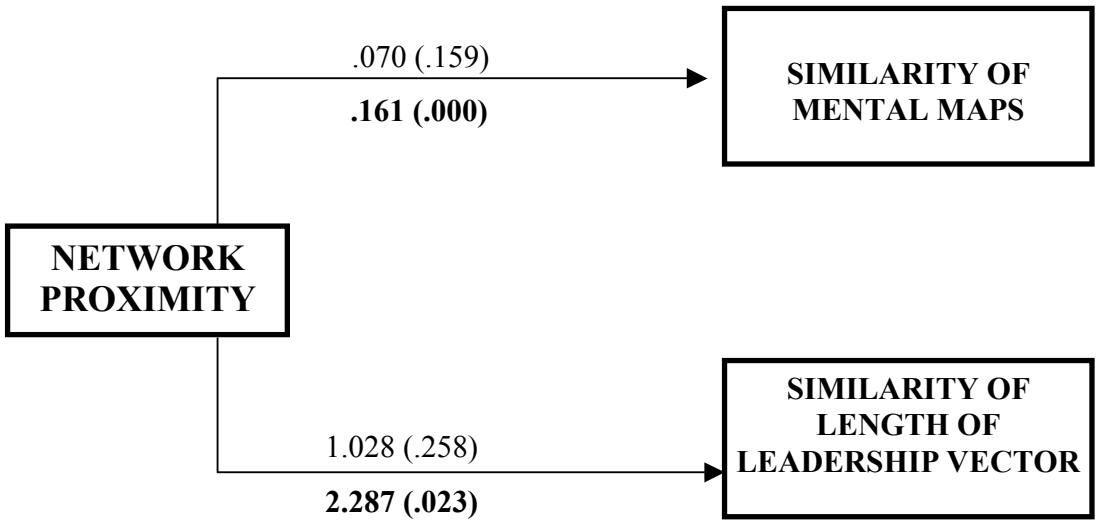
Figure 1

Overall results linking social network parameters to individuals' mental maps. Beta coefficients from OLS regression analysis for network centrality, and unstandardized coefficients from meta-analysis for network proximity are presented. Their associated probabilities are included in parenthesis.

Individual-Level Results

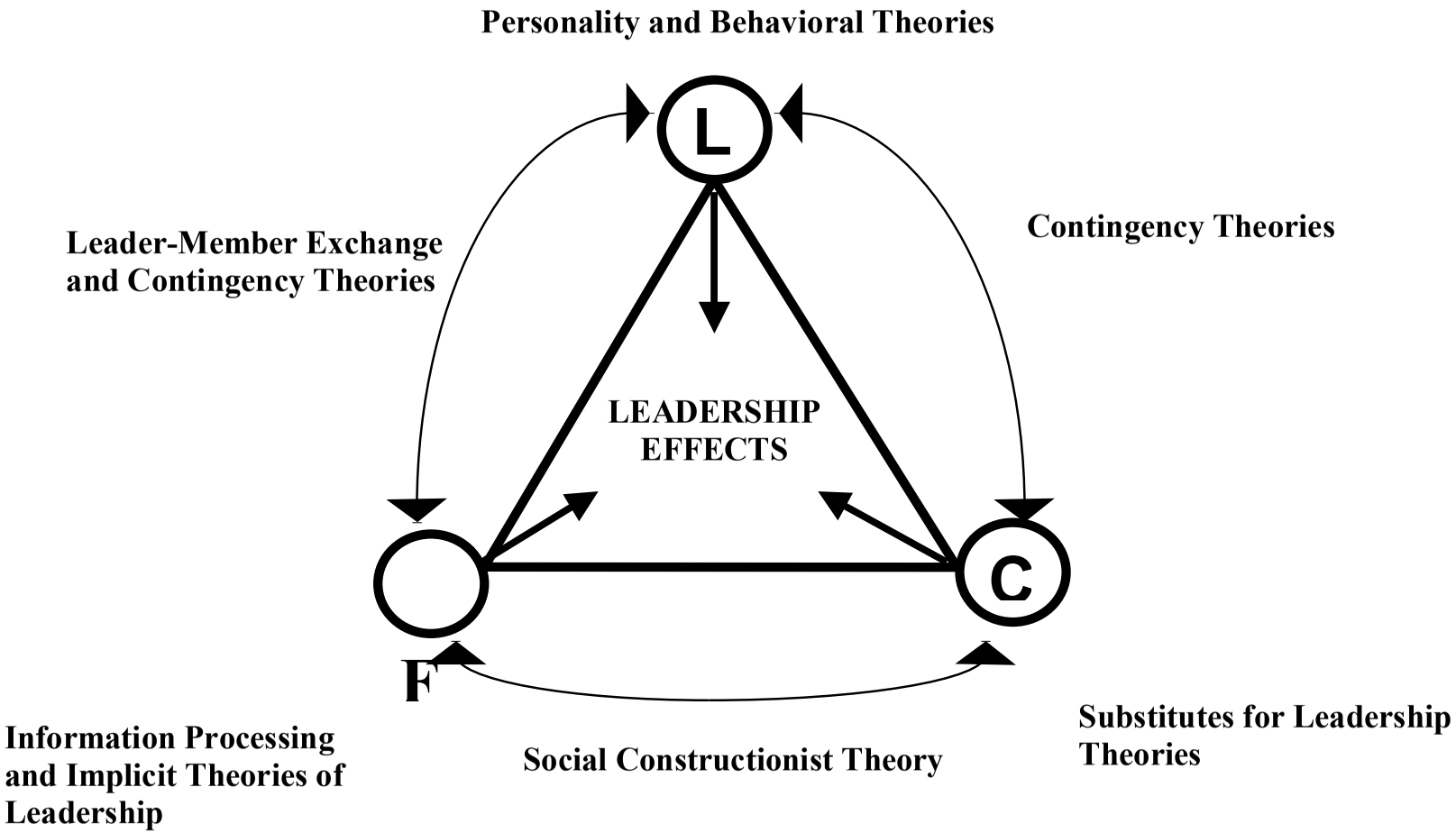


Dyadic-Level Results



Task network above the line
Friendship network below the line

Figure 2. The Study Leadership in Organizations



L=Leaders, F=Followers, C=Context

Appendix 1. Semi-structured Interviews

Instructions: My name is [name of researcher] and I am a researcher from [name of university]. I am conducting a study on employees' views of their organizations. In this study, I am interested in how you perceive your organization and its leadership. In a few days, you will receive a questionnaire. However, before distributing the questionnaires, I need to know more about what issues are important for you and your peers so that we can incorporate them in the survey. This week, I am interviewing a small sample of employees (30 people) to determine what those issues are and how people think about them. Your name was drawn randomly from a pool of 300 people and your answers during the interview are absolutely confidential. No one from this company will have access to them. Also, your name will not be recorded during this interview. Do you have any questions so far?

Initial Interview Questions

1. How long have you been employed at [name of company]

2. What type of work do you do?, Please, describe a typical day for you at work (include breaks, lunch).

Perceptions of the Company and the Corporate Management Group (CMG)

3. What are the major issues or topics relating to the company and its employees that you discuss more often with other members of the organization?

4. About top management? How would you describe the leadership of this company to a newcomer? Is this the general feeling among employees here?

5. How do others feel about top management and their policies in general?

If they mention quality and teamwork, I followed up with the following question:

6. What would you say quality and teamwork mean to top management in this organization?

Appendix 2. Mental Map Questionnaire

Please, read the instructions carefully

INSTRUCTIONS: Please, evaluate **how different** each pair of items are in your opinion by filling in the appropriate space. If you think that two items are very different, you would use a large number. If you think that the two items are very similar, then you would use a small number. To help you make comparisons, here is an example: **Think of the difference between GRAPHIC CONTROLS-TODAY AND GRAPHIC CONTROLS-FUTURE as 50 units.** Keep this in mind when you make the other comparisons. You can use numbers larger numbers than 100.

How different are...?

VERY SIMILAR 0....10....20....30....40...50 ....60....70....80....90....100... VERY DIFFERENT

GRAPHIC CONTROLS - TODAY	AND	GRAPHIC CONTROLS - FUTURE	_____
GRAPHIC CONTROLS - TODAY	AND	WORLD CLASS COMPANY	_____
GRAPHIC CONTROLS - TODAY	AND	MEDICAL COMPANY	_____
GRAPHIC CONTROLS - TODAY	AND	INDUSTRIAL COMPANY	_____
GRAPHIC CONTROLS - TODAY	AND	ME	_____
GRAPHIC CONTROLS - TODAY	AND	MY COWORKERS	_____
GRAPHIC CONTROLS - TODAY	AND	TOP MANAGEMENT - CMG	_____
GRAPHIC CONTROLS - TODAY	AND	QUALITY	_____
GRAPHIC CONTROLS - TODAY	AND	TEAMWORK	_____
GRAPHIC CONTROLS - TODAY	AND	PROFITS	_____
GRAPHIC CONTROLS - TODAY	AND	INCENTIVES	_____
GRAPHIC CONTROLS - TODAY	AND	JOB SECURITY	_____
GRAPHIC CONTROLS - FUTURE	AND	WORLD CLASS COMPANY	_____
GRAPHIC CONTROLS - FUTURE	AND	MEDICAL COMPANY	_____
GRAPHIC CONTROLS - FUTURE	AND	INDUSTRIAL COMPANY	_____
GRAPHIC CONTROLS - FUTURE	AND	ME	_____
GRAPHIC CONTROLS - FUTURE	AND	MY COWORKERS	_____
GRAPHIC CONTROLS - FUTURE	AND	TOP MANAGEMENT - CMG	_____
GRAPHIC CONTROLS - FUTURE	AND	QUALITY	_____
GRAPHIC CONTROLS - FUTURE	AND	TEAMWORK	_____
GRAPHIC CONTROLS - FUTURE	AND	PROFITS	_____
GRAPHIC CONTROLS - FUTURE	AND	INCENTIVES	_____
GRAPHIC CONTROLS - FUTURE	AND	JOB SECURITY	_____
WORLD CLASS COMPANY	AND	MEDICAL COMPANY	_____
WORLD CLASS COMPANY	AND	INDUSTRIAL COMPANY	_____
WORLD CLASS COMPANY	AND	ME	_____
WORLD CLASS COMPANY	AND	MY COWORKERS	_____
WORLD CLASS COMPANY	AND	TOP MANAGEMENT - CMG	_____
WORLD CLASS COMPANY	AND	QUALITY	_____

WORLD CLASS COMPANY	AND	TEAMWORK	_____
WORLD CLASS COMPANY	AND	PROFITS	_____
WORLD CLASS COMPANY	AND	INCENTIVES	_____
WORLD CLASS COMPANY	AND	JOB SECURITY	_____

very similar 0....10....20....30....40...50 ....60....70....80....90....100... very different

MEDICAL COMPANY	AND	INDUSTRIAL COMPANY	_____
MEDICAL COMPANY	AND	ME	_____
MEDICAL COMPANY	AND	MY COWORKERS	_____
MEDICAL COMPANY	AND	TOP MANAGEMENT - CMG	_____
MEDICAL COMPANY	AND	QUALITY	_____
MEDICAL COMPANY	AND	TEAMWORK	_____
MEDICAL COMPANY	AND	PROFITS	_____
MEDICAL COMPANY	AND	INCENTIVES	_____
MEDICAL COMPANY	AND	JOB SECURITY	_____
INDUSTRIAL COMPANY	AND	ME	_____
INDUSTRIAL COMPANY	AND	MY COWORKERS	_____
INDUSTRIAL COMPANY	AND	TOP MANAGEMENT - CMG	_____
INDUSTRIAL COMPANY	AND	QUALITY	_____
INDUSTRIAL COMPANY	AND	TEAMWORK	_____
INDUSTRIAL COMPANY	AND	PROFITS	_____
INDUSTRIAL COMPANY	AND	INCENTIVES	_____
INDUSTRIAL COMPANY	AND	JOB SECURITY	_____
ME	AND	MY COWORKERS	_____
ME	AND	TOP MANAGEMENT - CMG	_____
ME	AND	QUALITY	_____
ME	AND	TEAMWORK	_____
ME	AND	PROFITS	_____
ME	AND	INCENTIVES	_____
ME	AND	JOB SECURITY	_____
MY COWORKERS	AND	TOP MANAGEMENT - CMG	_____
MY COWORKERS	AND	QUALITY	_____
MY COWORKERS	AND	TEAMWORK	_____
MY COWORKERS	AND	PROFITS	_____
MY COWORKERS	AND	INCENTIVES	_____
MY COWORKERS	AND	JOB SECURITY	_____
TOP MANAGEMENT - CMG	AND	QUALITY	_____
TOP MANAGEMENT - CMG	AND	TEAMWORK	_____
TOP MANAGEMENT - CMG	AND	PROFITS	_____
TOP MANAGEMENT - CMG	AND	INCENTIVES	_____
TOP MANAGEMENT - CMG	AND	JOB SECURITY	_____
QUALITY	AND	TEAMWORK	_____
QUALITY	AND	PROFITS	_____
QUALITY	AND	INCENTIVES	_____

QUALITY	AND	JOB SECURITY	_____
TEAMWORK	AND	PROFITS	_____
TEAMWORK	AND	INCENTIVES	_____
TEAMWORK	AND	JOB SECURITY	_____
PROFITS	AND	INCENTIVES	_____
PROFITS	AND	JOB SECURITY	_____
INCENTIVES	AND	JOB SECURITY	_____

Appendix 3. Transforming pair-comparison data to neural network data

The algorithms used to transform the dissimilarity matrix into a multidimensional space are described by Woelfel and Fink (1980) and are part of the Galileo computer program. Technically, Galileo operates as follows. The dissimilarity matrix is transformed into a similarity matrix S, so that larger values indicate similar meaning and small values indicate dissimilar meaning, or larger distances in the cognitive space. This transformation is accomplished by using an inverse function S = (K-F). Next, the similarity matrix is centered around the grand mean and multiplied by its transpose to create a scalar product matrix B* following Torgerson (1958):

$$b_{ij}^{*} = \frac{1}{2}\left(\frac{1}{k}\sum_{i}^{k} d_{ij}^{2} + \frac{1}{k}\sum_{j}^{k} d_{ij}^{2} - \frac{1}{k^{2}}\sum_{i}^{k}\sum_{j}^{k} d_{ij}^{2} - d_{ij}^{2} \right)$$

This matrix *B** is then factored to extract all the eigenvectors which constitute the set of Cartesian coordinates axes onto which the concepts are projected. This process results in a matrix R(NxR) of N (concepts) x R (orthogonal dimensions) whose cells R(i,j) represent the values, or coordinates, of concept i on the j dimension, or reference axes. The lengths of the coordinate axes are determined by the square root of their corresponding eigenvalues. The eigenvalues are the sum of squares of the coordinates of the concepts on their corresponding eigenvector. The eigenvectors are normalized and the sum of their eigenvalues is equal to the trace of the scalar products matrix. The trace then represents the total sum of the square lengths of the position vectors of any point in the cognitive space and it is also a measure of the total variance of these points. Accordingly, the standardized eigenvalues represent the amount of variance, or square distance in the cognitive space, explain by the corresponding eigenvector. The coordinates of the concepts in the first three dimensions can be used to provide a three-dimensional graphic of the cognitive structure, although we may need more than three dimensions to fully describe the entire cognitive space.

Appendix 4. Mean distances and standard deviations among all concepts of the aggregated mental maps of the six production units

Network (NY-1)	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Company-Today		2.08	1.97	2.63	2.46	2.23	2.19	3.17	2.63	2.56	3.23	3.08	3.14
2. Company-Future	6.94		2.51	2.91	2.93	2.68	2.44	3.13	3.03	2.87	3.22	2.74	5.16
3. Ideal	5.46	4.55		2.69	3.02	2.55	2.64	3.13	3.09	2.95	3.11	2.94	3.14
4. Medical	5.00	4.15	4.13		3.11	2.94	2.64	2.84	3.06	3.01	3.33	3.04	3.06
5. Industrial	5.18	5.58	4.97	6.67		4.08	2.73	3.14	2.92	2.72	3.24	3.19	3.36
6. Me	6.36	5.33	4.52	5.44	4.81		3.47	3.79	3.02	2.93	3.58	3.42	3.37
7. My Coworkers	6.30	4.91	5.36	5.50	4.59	5.31		3.42	3.27	3.85	3.13	3.43	3.79
8. Leader	5.33	4.88	4.55	4.82	4.94	6.41	6.22		3.41	3.39	3.88	6.15	4.27
9. Quality	4.76	3.97	4.03	3.97	4.25	2.66	4.00	4.70		2.74	3.21	3.39	4.09
10. Teamwork	5.33	4.46	4.09	4.28	4.59	2.84	4.44	5.47	3.24		3.03	3.66	4.82
11. Profits	5.21	5.18	4.27	5.09	5.69	4.78	4.50	4.06	3.75	4.03		5.63	4.27
12. Incentives	5.61	5.73	4.06	5.16	5.28	4.63	4.88	6.44	4.66	4.88	5.94		6.13
13. Job Security	5.94	6.67	4.52	5.44	5.75	5.16	6.34	5.34	4.88	5.72	5.25	5.97	

N=33. Means are below the diagonal and standard deviations above the diagonal.

Network (NY-2)	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Company-Today		1.91	2.33	2.59	2.99	2.75	2.76	3.46	2.91	2.84	3.63	4.00	3.73
2. Company-Future	8.08		2.85	3.79	3.11	3.36	7.81	3.69	3.39	3.30	3.44	3.29	3.10
3. Ideal	6.51	6.08		3.23	3.20	3.47	3.18	3.47	3.18	3.09	3.43	3.47	3.37
4. Medical	6.38	4.87	5.46		2.74	3.24	2.67	3.01	3.16	3.29	3.68	3.62	3.48
5. Industrial	5.43	6.62	6.36	7.78		3.54	3.31	3.17	3.51	3.62	3.65	3.58	3.63
6. Me	6.42	6.94	4.89	5.11	6.53		3.31	3.49	3.26	2.95	3.70	3.74	3.10
7. My Coworkers	6.24	7.60	5.50	5.19	6.14	3.60		2.68	3.19	3.17	3.26	3.40	2.92
8. Leader	6.70	5.14	5.79	4.72	6.86	6.81	7.56		3.38	3.19	3.62	3.63	3.71
9. Quality	6.38	5.62	4.37	4.49	5.35	2.81	3.64	5.61		3.26	3.17	3.65	3.87
10. Teamwork	6.03	5.32	5.08	4.60	5.00	2.49	3.69	5.94	4.19		3.05	3.02	3.61
11. Profits	5.87	6.36	5.50	5.42	5.22	5.11	6.03	3.81	3.60	3.73		3.65	3.62
12. Incentives	6.95	7.08	6.06	5.67	6.16	5.84	6.81	5.25	4.87	4.14	4.76		3.66
13. Job Security	7.89	7.08	6.64	6.46	6.65	7.24	7.50	5.58	5.30	5.54	5.38	5.57	

N=36. Means are below the diagonal and standard deviations above the diagonal.

Appendix 4 (Contd.)

Network (NY-3)	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Company-Today		2.31	2.86	3.08	3.13	2.80	2.52	3.37	3.21	2.98	3.20	3.18	3.16
2. Company-Future	7.49		3.14	3.82	3.16	2.95	3.09	3.43	3.55	3.23	3.21	3.06	3.42
3. Ideal	5.32	5.11		3.70	3.49	3.02	2.77	3.29	3.53	3.20	3.33	3.37	3.34
4. Medical	4.97	4.68	4.69		2.52	2.78	2.57	3.45	3.49	3.33	3.35	3.36	3.42
5. Industrial	5.58	7.17	6.26	7.32		3.14	2.99	2.84	3.30	3.14	2.87	2.91	2.84
6. Me	5.03	6.44	5.86	6.19	4.31		3.03	2.96	3.37	3.09	3.43	3.44	2.93
7. My Coworkers	5.38	5.73	5.60	6.05	4.41	4.52		2.64	2.99	3.08	2.97	3.00	3.32
8. Leader	6.06	5.80	5.97	5.61	6.68	6.12	5.79		3.36	3.10	3.49	3.30	3.38
9. Quality	3.95	5.16	4.32	4.39	4.09	3.15	4.09	5.24		3.45	3.32	3.23	3.49
10. Teamwork	4.68	5.25	4.50	4.57	4.16	2.85	4.49	5.21	4.15		3.52	3.31	3.25
11. Profits	4.57	4.80	4.85	4.46	6.09	5.07	5.34	4.97	4.24	4.31		3.12	3.52
12. Incentives	6.11	5.69	5.41	5.62	6.09	5.65	5.34	5.13	5.00	4.91	5.09		3.14
13. Job Security	6.21	6.00	6.09	5.66	6.56	6.28	5.59	5.13	4.91	5.39	5.50	5.22	

N=37. Means are below the diagonal and standard deviations above the diagonal.

Network (NJ-1)	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Company-Today		2.55	2.40	2.63	2.71	2.98	2.65	3.29	2.97	2.60	2.57	2.38	2.68
2. Company-Future	7.98		2.60	2.48	2.25	3.05	2.88	3.32	2.70	2.67	2.55	2.55	2.36
3. Ideal	6.31	6.32		2.22	2.54	2.88	2.35	3.25	2.70	2.70	2.85	2.55	2.84
4. Medical	7.36	7.24	6.89		2.66	3.12	2.81	3.26	3.35	2.83	2.58	2.36	2.50
5. Industrial	6.24	6.30	6.11	7.24		2.82	2.62	3.30	2.89	2.69	2.73	2.65	2.77
6. Me	6.37	6.60	6.21	5.71	5.24		2.84	3.02	3.18	3.09	2.84	2.82	3.09
7. My Coworkers	6.32	6.16	5.88	5.74	5.89	4.71		3.10	2.94	2.69	2.70	2.47	2.70
8. Leader(GM)	5.43	5.75	5.11	5.71	5.47	4.57	4.97		3.73	3.52	3.58	3.44	3.44
9. Quality	5.74	6.16	4.95	5.49	5.17	5.11	5.49	4.86		2.85	3.05	2.94	3.12
10. Teamwork	4.87	5.37	5.08	5.40	5.00	4.51	4.92	4.77	4.97		3.13	2.69	3.04
11. Profits	7.05	6.44	6.41	6.60	6.28	5.76	5.51	5.20	5.83	5.49		2.67	2.81
12. Incentives	5.95	6.16	5.19	5.83	5.89	5.54	5.57	5.29	5.54	5.47	5.34		2.69
13. Training	6.08	6.46	5.92	6.97	6.00	5.72	5.42	5.56	5.28	5.43	5.74	5.53	

N=39. Means are below the diagonal and standard deviations above the diagonal.

Appendix 4 (contd.)

Network (NJ-2)	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Company-Today		2.45	2.75	2.48	2.65	2.68	2.48	3.11	2.96	2.69	2.98	3.06	2.80
2. Company-Future	7.07		3.17	3.38	3.03	3.35	2.68	4.00	3.30	3.16	3.57	2.94	2.85
3. Ideal	5.29	5.54		3.39	2.88	3.27	2.95	3.82	3.40	2.69	3.63	2.74	2.77
4. Medical	6.10	6.00	5.14		2.01	2.90	2.59	3.31	2.54	2.64	2.81	2.58	2.63
5. Industrial	5.46	5.25	4.69	5.45		2.44	2.55	2.82	2.42	2.65	2.96	2.80	2.46
6. Me	5.10	5.21	4.07	3.76	5.31		3.14	3.54	3.10	2.95	3.22	3.13	2.71
7. My Coworkers	4.69	4.79	4.45	3.86	4.86	4.10		3.54	2.81	2.84	2.70	2.64	2.69
8. Leader (GM)	5.64	5.54	5.23	4.07	4.66	5.14	5.50		3.73	3.46	2.86	2.69	2.96
9. Quality	5.24	5.41	4.48	3.36	4.31	3.52	4.21	4.00		2.43	2.46	2.89	2.75
10. Teamwork	4.28	4.79	4.52	3.48	4.00	3.48	4.17	3.37	3.33		2.88	2.98	2.65
11. Profits	6.21	6.14	5.18	4.54	4.07	4.72	4.86	4.74	3.89	4.33		3.12	2.95
12. Incentives	5.35	5.35	4.35	4.03	4.00	4.59	4.55	4.70	3.78	4.19	4.15		3.19
13. Training	4.48	4.84	4.17	3.57	3.50	3.59	4.21	3.15	3.56	3.56	4.41	4.41	

N=28. Means are below the diagonal and standard deviations above the diagonal.

Network (NJ-3)	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Company-Today		2.47	2.82	2.84	2.75	3.48	2.89	3.28	3.47	3.06	3.21	2.94	3.33
2. Company-Future	7.05		3.56	3.45	3.29	3.65	3.15	3.61	3.88	3.49	3.68	3.59	3.71
3. Ideal	6.19	5.74		3.33	3.03	3.44	3.09	3.40	3.59	3.44	3.62	3.66	3.75
4. Medical	6.29	5.48	5.52		2.85	3.40	2.89	3.30	3.44	3.12	3.36	3.42	3.50
5. Industrial	5.87	5.53	5.44	6.21		3.30	3.03	3.34	3.32	3.26	3.48	3.43	3.50
6. Me	6.02	5.98	5.79	5.50	6.12		3.41	3.58	3.91	3.80	3.81	3.76	3.85
7. My Coworkers	5.69	5.36	5.48	5.71	5.63	5.61		3.07	3.03	3.07	3.13	3.22	3.30
8. Leader	5.13	5.27	5.61	5.32	5.64	5.59	6.03		3.77	3.72	3.77	3.79	3.76
9. Quality	5.95	5.39	5.37	5.13	5.53	5.39	5.57	5.60		3.54	3.72	3.59	3.77
10. Teamwork	5.68	5.44	5.43	5.54	5.31	5.21	5.48	5.56	4.71		3.54	3.63	3.70
11. Profits	5.71	5.66	5.71	5.56	5.44	5.39	5.66	5.39	4.82	4.65		3.75	3.50
12. Incentives	5.57	5.71	5.41	5.16	5.34	5.16	5.05	5.35	4.43	4.50	4.74		3.62
13. Training	5.32	5.77	5.47	5.11	5.42	5.29	5.51	5.58	4.90	4.71	4.98	5.36	

N=60. Means are below the diagonal and standard deviations above the diagonal.

Appendix 5. Network Analysis Questionnaire

Instructions: Please, answer the following questions by filling in the appropriate number of interactions on the line next to each person's name (e.g., 1, 2, 3, etc.). If you rarely interact or do not interact at all with some members, please leave the appropriate space blank

1. How many times in a typical week do you find yourself discussing JOB-RELATED issues with other members of the organization?

2. How many times in a typical week do you discuss JOB-UNRELATED issues with other members of the organization?

QUESTIONS	**Question #1 JOB-RELATED**	**Question #2 JOB-UNRELATED**
1. Name	_____	_____
2. Name	_____	_____
3. Name	_____	_____
4. Name	_____	_____
5. Name	_____	_____
6. Name	_____	_____
7. Name	_____	_____
8. Name	_____	_____
9. Name	_____	_____
10. Name	_____	_____
11. Name	_____	_____
12. Name	_____	_____
13. Name	_____	_____
14. Name	_____	_____
15. Name	_____	_____
16. Name	_____	_____

References

Adams, Jerome; Robert W. Rice, Robert W; and Debra Instone. 1984. Follower attitudes toward women and judgments concerning performance by female and male leaders. Academy of Management Journal, 27(3): 636-643.

Albrecht, Terrance L. 1979. The role of communication in perceptions of organizational climate. Communication Yearbook, 3: 343-357. New Brunswick, NJ: Transaction.

Albrecht, Terrance L. 1984. Managerial communication and work perception. In R. Bostrom (Ed.), Communication Yearbook 8: 343-357. Beverly Hills, CA: Sage.

Anderson J. R. 1983. The Architecture of Cognition. Cambridge, MA: Harvard University Press.

Asch, Solomon**.** 1952. Social Psychology. New York. Prentice-Hall.

Astley, W. Graham, and Paramjit S. Sachdeva. 1984. Structural sources of intra-organizational power: A theoretical synthesis. Academy of Management Review, 9: 104-113.

Astley, W. Graham, and Paramjit S. Sachdeva. 1984. Structural sources of intra-organizational power: A theoretical synthesis. Academy of Management Review, 9: 104-113.

Back, Kurt. 1951. Influence through social communication. Journal of Abnormal Social Psychology, 46: 9-23

Barnett, George A**.** 1988a. Precise procedures for longitudinal network analysis. In George Barnett and Joseph Woelfel (Eds.), Readings in the Galileo System: Theory, Methods and Applications. Dubuque, IA: Kendall/Hunt.

1988b An association model for the diffusion of innovations. In George Barnett and Joseph Woelfel (Eds.), Readings in the Galileo System: Theory, Methods and Applications. Dubuque, IA: Kendall/Hunt.

1988c Communication and organizational culture. In G.M. Goldhaber and G.A. Barnett (Eds.), Handbook of Organizational Communication, 101-130.

Barnett, George A. and Ronald E. Rice. 1985a. Longitudinal non-euclidean networks applying Galileo. Social Networks, 7: 287-322.

1985b Network analysis in Riemann space: Applications of the Galileo system to social networks. Social Networks, 7: 287-322.

Barnett, George A., D. M. Hamlin and J. A. Danowski. 1981. The use of fractionation scales in communication scales. In M. Burgoon (Ed.), Communication Yearbook 5. New Brunswick, NJ: Transaction.

Barnett, George, K.B. Serota and J.A. Taylor. 1976. Campaign communication and attitude change: A multidimensional analysis. Human Communication Research, 2,227-244.

Barnett, George and Joseph Woelfel. 1988. Readings in the Galileo System: Theory, Methods and Applications. Dubuque, IA: Kendall/Hunt.

Berger, Peter L. and T. Luckman. 1967. The Social Construction of Reality. Garden City, NY: Anchor Books.

Bonacich, P. 1987. Power and centrality: A family of measures. American Journal of Sociology, 92: 1170-1182.

Borgatti, Stephen P., M G. Everett, and L. C. Freeman**.** 1992. UCINET IV Version 1.0. Columbia: Analytic Technologies.

Bougon, Michel, Karl Weick, and Dan Binkhorst. 1978. Cognition in Organizations: An Analysis of the Utrecht Jazz Orchestra. Administrative Science Quarterly, 22: 606-639.

Brass, Daniel J. 1985. Men's and women's networks: A study of interaction patterns and influence in an organization. Academy of Management Journal, 28: 327-343.
1984. Being in the right place: A structural analysis of individual influence in an organization. Administrative Science Quarterly, 29: 518-539.

Brass, Daniel, and Marlene E. Burkhardt. 1992. Centrality and power in organizations. In Nitin Nohria and Robert Eccles (Eds.), Networks in organizations: Structure, Form, and Action: 191-215. Boston, MA: Harvard Business School Press.
1993. Potential power and power use: An investigation of structure and behavior. Academy of Management Journal, 36: 441-470.

Bass, Bernard M., and Bruce J. Avolio. 1991. The transformational and transactional leadership behavior of management women and men as described by the men and women who directly report to them. Report Series 91-3, Center for Leadership Studies. SUNY Binghamton.

Bryman, Alan. 1995. Qualitative methods in leadership research. Leadership Quarterly, 6(4), 491-493.
1992. Charisma and Leadership in Organizations. London: Sage.
1988. Quantity and Quality in social research. London: Rouledge.

Butterfield, Anthony D., and Gary N. Powell. 1981. Effect of group performance, leader sex, and rater sex on ratings of leader behavior. Organizational Behavior and Human Performance, 28: 129-141.

Burt, Ronald S. 1987. Social contagion and innovation: Cohesion versus structural equivalence. American Journal of Sociology, 92: 1287-1335.

Coleman, James S., E. Katz, and H. Menzel. 1966. Medical innovation. New York: Bobbs-Merrill.

Danowski, James A. 1993. Network Analysis of message content. George Barnett and Joseph Woelfel (Eds.), Readings in the Galileo System: Theory, Methods and Applications. Dubuque, IA: Kendall/Hunt.

Dean, James, Jr., and Daniel Brass. 1985. Social interaction and the perception of the job characteristics in an organization. Human Relations, 38: 571-582.

Dunn, William N., Anthony G. Cahill, Mary J. Dukes, and Ari Ginsberg. 1986. The Policy grid: A cognitive methodology for assessing policy dynamics." In William Dunn (Ed.), Policy Analysis: Perspectives, Concepts, and Methods (pp. 355-375). Greenwich, CT: JAI Press.

Engle, Robert F. 1974. Specifications of the disturbance term for efficient stimulation. Econometrica, 42: 135-146.

Erickson, Bonnie. 1988. The relational basis of attitudes." In B. Wellman and S. Berkowitz (eds.). Social Structures: A network Approach, pp. 99-121. New York: Cambridge University Press.

Feldman, J. A. and D. H. Ballard. 1982. Connectionist models and their properties. Cognitive Science, 6: 205-254

Festinger, Leon. 1957. A Theory of Cognitive Dissonance. New York: Row, Peterson.
1954. A theory of social comparison processes. Human Relations, 7: 117-140.
1950. Informal social communication. Psychological Review, 57: 157-166.

Festinger, Leon, and Herman A. Hutte. 1954. An Experimental investigation of the effects of unstable interpersonal relations in a group. Journal of Abnormal and Social Psychology, 49: 513-523.

Festinger, Leon, S. Schacter, and K. Back. 1950. Social Pressures in Informal Groups: A Study of Human Factors in Housing. Palo Alto, CA: Stanford University Press.

Fink, Edward and Shih-Shin Chen. 1995. A Galileo Analysis of Organizational Climate. Human Communication Research, Vol. 21(4): 494-521

Fink, Edward L., and Stan Kaplowitz. 1993. Oscillation beliefs and cognitive networks. In William D. Richards and George A. Barnett (Eds.), Progress in Communication Sciences, Vol. XII (pp.218-273).

Fletcher, Danilovics, Fernandez, Peterson, & Reeder. 1986.

Fraser, S. L. and Robert G. Lord. 1988. Stimulus prototypicality and general leadership impressions: their role in leadership and behavioral ratings." Journal of Psychology, 122: 291-303.

Freeman, Linton C. 1979. Centrality in social networks: Conceptual clarification. Social Networks, 1: 215-239.

Friedkin, Noah E. 1993. Structural bases of interpersonal influence in groups: A longitudinal case study. American Sociological Review, xx: 861-872.

Gergen, Kenneth. 1985. The Social Construction of the Person. New York: Springer-Verlag.

Gillham, James and Joseph Woelfel. 1977. The Galileo system of measurement: Preliminary evidence for precision, stability, and equivalence to traditional measures. Human Communication Research,

3(3), 243-263.

Graen, G.B. and Mary Uhl-Bien. 1995. Relationship-based approach to leadership: Development of leader-member exchange (LMX) theory of leadership over 25 years: Applying a multi-level multi-domain perspective. Leadership Quarterly, 6, 219-247.

Hartman, Roseanne. 1991. Self-concept and culture: A comparison of black Americans, Hispanics, and whites in the context of patient/physician relations. Unpublished doctoral dissertation. State University of New York at Buffalo.

Hartman, Rossane, and David J. Johnson. 1989. Social contagion and multiplexity: Communication networks as predictors of commitment and role ambiguity. Human Communication Research, 15(4): 523-548.

Heider, Fritz. 1958. The Psychology of Interpersonal Relations. New York: Wiley.

Hinton, G.E., James, L. McClelland and David E. Rumelhart. 1986. Distributed representations. In David E. Rumelhart, James, L. McClelland; and the PDP Research Group (Eds.), Parallel Distributed Processing: Exploration in the Microstructure of Cognition." Cambridge, MA: The MIT Press.

Hollander, Edwin. 1978. Leadership Dynamics. New York: Free Press.

House, Robert, James Woycke and E. M. Fodor. 1988. Charismatic and non-charismatic leaders: Differences in behavior and effectiveness. In J.A. Conger and R.N. Kanungo (Eds.), Charismatic Leadership: The elusive factor in organizational effectiveness. San Francisco: Jossey-Bass.

Hubert, Lawrence, and James Schultz. 1976. Quadratic assignment as a general data analysis strategy. British Journal of Mathematical and Statistical Psychology, 23: 2214-2226.

Ibarra, Herminia. 1992. Homophily and differential returns: Sex differences in network structure and access in an advertising firm. Administrative Science Quarterly, 37: 422-447
1993. Network centrality, power and innovation involvement: Determinants of technical and administrative roles. Academy of Management Journal, 36: 471-501

Ibarra, Herminia, and Steven B. Andrews. 1993. Power, social influence, and sense making: Effects of network centrality and proximity on employee perceptions. Administrative Science Quarterly, 38: 277-303.

Klein, Katherine J., and Robert House. 1995. On fire: Charismatic leadership and levels of analysis. Leadership Quarterly, 6(2): 183-198.

Krackhardt, David. 1990. Assessing the political landscape: Structure, cognition, and power in organizations. Administrative Science Quarterly, 35: 342-369.
1988. Predicting with networks: Non-parametric multiple regression analysis of dyadic data. Social Networks, 10: 359-381.

Krackhardt, David and Daniel J. Brass. 1994. Intraorganizational networks: The micro side. In Stanley Wasserman and Joseph Galaskiewicz (Ed.), Advances in \social Network Analysis (pp. 3-25). Thousand Oaks, CA: Sage.

Krackhardt, David and Martin Kilduff. 1990. Friendship Patterns and culture: The control of organizational diversity. American Anthropologist, 92: 142-154.

Laumann, Edward O, Joseph Galaskiewicz and Peter V. Marsden. 1978. Community structure as interorganizational linkages. In Ralph H. Turner, James Coleman. And Renee C. Fox (eds), Annual Review of Sociology, 4: 455-484. Palo Alto, CA: Annual Reviews.

Lin, Nan. 1982. Social Resources and instrumental action. In Peter V. Marsden and Nan Lin (eds.), Social Structure and Network Analysis: 131-145. Beverly Hills, CA: Sage.

Lincoln. James R. 1982. Intra- (and inter-) organizational networks. In Samuel B. Bacharach (ed.), Research in the Sociology of Organizations, 1: 1-38. Greenwich, CT: JAI Press.

Lord, Robert. 1985. An information processing approach to social perceptions, leadership, and behavioral measurement in organizations. In B.M. Staw and L.L. Cummings (Eds.), Research in Organizational Behavior, 7: 87-128. Greenwich, Conn.: JAI Press.

Lord, Robert and Roseanne J. Foti. 1986. Schema theories, information processing, and organizational behavior. In H.P. Sims and D.A. Gioia (Eds.), The thinking Organization. San Francisco: Jossey-Bass.

Lord, Robert and Karen J. Maher. 1993. Leadership and Information Processing. Cambridge, MA: Unwin Hyman.

Lord, Robert G., and Jonathan E. Smith. 1983. Theoretical information processing, and situational factors affecting attribution theory models of organizational behavior. Academy of Management Review, 8: 50-60.

Lord, Robert, Roseanne J. Foti and Christy L. DeVader. 1984. A test of leadership categorization theory: internal structure, information processing, and leadership perceptions. Organizational Behavior and Human Performance, 34: 343-378.

Lord, Robert, R. J. Foti and J.S. Phillips. 1982. A theory of leadership categorization. In J.G Hunt, U.Sekaran, C. Schriesheim (Eds.), Leadership: Beyond establishment views (pp. 104-121), Carbondale: Southern Illinois University Press.

Marsden, Peter V. 1988. Homogeneity in confiding relations. Journal of Social Networks, 10: 57-76.

Mayo, Margarita, James R. Meindl and Juan-Carlos Pastor. 1996. Diversity as a context for the emergence of charismatic leadership. Unpublished manuscript, SUNY Buffalo.

McClelland, James, L.; David E. Rumelhart and the PDP Research Group. 1986. Parallel Distributed Processing: Exploration in the Microstructure of Cognition. Cambridge, MA: The MIT

Press.

Meindl, James R. 1995. The romance of leadership as a follower-centric theory: a social construction approach. Leadership Quarterly, 6(3): 329-341
1993. Reinventing Leadership: A radical Social Psychological Approach. In Keith Murnighan (Ed.), Social Psychology in Organizations: Advances in Theory and Research, 12: 159-203. Englewoods Cliffs, NJ: Prentice Hall.
1990. On leadership: An alternative to the conventional wisdom. In Barry M. Staw, and L.L. Cummings (Eds.), Research in Organizational Behavior, 12: 159-203. Greenwich, CT: JAI Press Inc.

Meidl, James R., Sanford B. Erlich and Janet M. Dukerich. 1985. The Romance of Leadership. Administrative Science Quarterly, 30: 78-102

Minsky, M. L. 1975. A framework for representing knowledge. In P. H. Winston (Ed.), The Psychology of Computer Vision (pp. 211-277). New York: McGraw-Hill.

Monge, Peter R. and Eric M. Eisenberg. 1987. Emergent networks. In Jablin, Putman, Roberts, and Porter (Eds.), Handbook of Organizational Behavior (pp. 304-342). Beverly Hills, CA: Sage.

Newcomb, Theodore. 1961. The Acquaintance Process. New York: Free Press.

Pastor, Juan-Carlos, James R. Meindl and Margarita C. Mayo. 1996. A social network analysis of attributions of charisma. Unpublished manuscript. SUNY Buffalo.

Phillips, James S. 1984. The accuracy of leadership ratings: A cognitive categorization perspective. Organizational Behavior and Human Performance, 33: 72-83.

Phillips, James S., and Robert G. Lord. 1986. Causal attributions and perceptions of leadership. Organizational Behavior and Human Performance, 29: 72-83.
1982. Schematic information processing and perception of leadership in problem-solving teams. Journal of Applied Psychology, 67: 486-492.
1981. Causal attributions and perceptions of leadership. Organizational Behavior and Human Performance, 28: 143-168.

Pillai, Rajnandini, and James R. Meindl. 1991. The effect of a crisis on the emergence of charismatic leadership: A laboratory study. Best Paper Proceedings of the Academy of Management Meetings, Miami.

Rice, Ronald E. 1991. Using network concepts to clarify sources and mechanisms of social influence. In William D. Richards and George A. Barnett Eds), Progress in Communication Sciences, Vol. XII, Norwood, NJ: Ablex Publishing Co.

Rice, Ronald E. and C. Aydin. 1991. Attitudes toward new organizational technology: Network Proximity as a mechanism for social information processing. Administrative Science Quarterly, 9: 219-244.

Rice, Robert W; Debra Instone; and Jerome Adams. 1984. Leader sex, leader success, and leadership process: Two field studies. Journal of Applied Psychology, 69(1): 12-31.

Rice, Ronald E., and George A. Barnett. 1985. Group Communication Networking in an information environment: Applying metric multidimensional scaling. In M. McLaughin (Ed.), Communication Yearbook. Beverly Hills, CA: Sage.

Roberts Karlene H., and Charles A. O'Reilly. 1979. Some correlations of communication roles in organizations. Academy of Management Journal, 22, 42-57.

Rogers, Everett, M., Joseph R. Ascroft, and Niels G. Roling. 1970. Diffusion of Innovation in Brazil, Nigeria, and India. East Lansing, Michigan State University, Department of Communication, Diffusion of Innovations Research Report 24.

Rogers, Everett M. and D. Lawrence Kinkaid. 1981. Communication Networks. New York: The Free Press.

Ruhmelhart, David E. 1984. Schemas and the cognitive system. In R.S. Wyer and T.K. Srull (eds.), Handbook of Social Cognition (Vol 1) Hillsdale, NJ: Lawrence earlbaum, 161-188.

Ruhmelhart, David E. 1975. Notes on a Schema for Stories. In D.G. Bobrow and A. Collins (Eds.), Representation and Understanding: 211-236. New York: Academic Press.

Rumelhart, David E.; James, L. McClelland; and the PDP Research Group. 1986. Parallel Distributed Processing: Exploration in the Microstructure of Cognition. Cambridge, MA: The MIT Press.

Salancik, Gerald R. 1995. WANTED: A good network theory of organization. Administrative Science Quarterly, 40: 345-349.

Salancik, Gerald, and Jeffrey Pfeffer. 1978. A social information processing approach to job attitudes and task design. Administrative Science Quarterly, 23: 224-252.

Sanford, A. J. and Garrod, S. C. 1981. Understanding written language. Chichester: Wiley.

Sashkin, M and Burke, W.W. 1990. Understanding and assessing organizational leadership. In K.E.Clark and M.B. Clark (eds.) Measures of Leadership. West Orange, NJ: Leadership Library of America.

Schacter, Stanley. 1959. The Psychology of Affiliation. Stanford, CA: Stanford University Press.

Schank, R. and Abelson, R. 1977. Scripts, plans, goals, and understanding. Hilldale, NJ: Erlbaum.

Serota, K.B., M. J. Cody, George A. Barnett, and J. A. Taylor. 1977. Precise procedures for optimizing campaign communication. In B. Ruben (Ed.), Communication Yearbook 1. New Brunswick, N.J.: Transaction Books.

Sherif, Muzafer. 1969. Formation of social norms: The experimental paradigm. In H. Prohansky, and B. Seidenberg (Eds.), Basic Studies in Social Psychology. New York: Holt, Rinehart, and Winston.
1965. Formation of social norms: The experimental paradigm. In Harold Proshansky, and Bernard Seidenberg (Eds.), Basic Studies in Social Psychology: 461-470. New York: Holt, Rinehart, and

Winston.1936. The Psychology of Social Norms. New York: Harper.

Shaw, M. E. 1964. Communication Networks. In L. Berkowick (Ed.), Advances in Experimental Social Psychology (pp. 11-147). NY: Academic press.

Thomas, Joe G., and Ricky W. Griffin. 1983. The social information processing model of task design: A critical review. Academy of Management Review, 8: 672-682.

Tichy, Noel M., M. L. Tuschman, and C. Fombrun. 1987. Social network analysis for organizations. Academy of Management Review, 4(4): 507-519.

Torgerson, W. S. 1958. Theory and methods of Scaling. New York: Wiley.

Tutzauer, Frank E. 1993. Statistical comparisons of Communication Networks. In William D. Richards and George A. Barnett (Eds), Progress in Communication Sciences, Vol. XII. Norwood, NJ: Ablex Publishing Co.

Valente, Thomas H. 1995. Network Models of the diffusion of innovations. Cresskill, NJ: Hampton Press Inc.

Wasserman, Stanley and Joseph Galaskiewicz. 1994. Advances in Social Network Analysis. Thousands Oaks, CA: Sage Publications.

Vygotski, Lev. 1934/1986. Thought and Language. Cambridge. The MIT Press.

Woelfel, Joseph. 1993a. Artificial neural networks in policy research: A current assessment. Journal of Communication, 43(1).
1993b. Cognitive processes and communication networks: A general theory. In William D. Richards and George A. Barnett Eds), Progress in Communication Sciences, Vol. XII, Norwood, NJ: Ablex Publishing Co.
1990. Galileo 3.0: System Manual. Troy, NY: Terra Research and Computing Co.
1988. A theory of linear force aggregation in attitude formation and change. In George Barnett and Joseph Woelfel (Eds.), Readings in the Galileo System: Theory, Methods and Applications. Dubuque, IA: Kendall/Hunt.

Woelfel, Joseph and George Barnett. 1982. Multidimensional scaling in Riemann space. Quality and Quantity, 16, 469-491.

Woelfel, Joseph and Edward L. Fink. 1980. The Measurement of Communication Processes: Galileo Theory and Method. New York: Academic Press.

Woelfe, Joseph, and A. O. Haller. 1971. Significant others, the self-reflexive act, and the attitude formation process. American Sociological Review, 36(1).

Woelfel, Joseph , Richard A. Holmes, and D. Lawrence Kincaid. 1988. Rotation to congruence for general Riemann surfaces. In George Barnett and Joseph Woelfel (Eds.), Readings in the Galileo System: Theory, Methods and Applications. Dubuque, IA: Kendall/Hunt.

Woelfel, Joseph and J. Saltiel. 1978. Cognitive processes as motions in a multidimensional space. In George Barnett and Joseph Woelfel (Eds.), Readings in the Galileo System: Theory, Methods and Applications. Dubuque, IA: Kendall/Hunt.

Woelfel, Joseph, N. Stoyanoff, and S. Danielsen. 1992. CATPAC user manual. Troy, NY: Terra Research and Computing Co.

Woelfel, Joseph, Richard A. Holmes, D. Lawrence Kinkaid and George A. Barnett. 1980. How to do a Galileo study. Troy, NY: Good Books.

Footnotes

1. The use of dyads to examine social contagion models is often used in social network research (e.g., Friedkin, 1993). Because actors' influences on others are heterogeneous, Friedkin argues, the dyad is the proper unit of analysis to assess relational outcomes. One advantage of using dyads as the unit of analysis is that they are the basic unit of social interaction and social contagion (Burt, 1987), and provide a basic test of whether social influence processes have taken place in a social system.