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SOCIAL INTERACTION EFFECTS FOLLOWING A TECHNOLOGICAL CHANGE: A LONGITUDINAL INVESTIGATION

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This study was a longitudinal investigation of alternative sources of social influence and the role of interpersonal relationships in spreading beliefs, attitudes, and behaviors in an organization following a technological change. Network analysis techniques were used to test the relationships of belief, attitude, and behavior difference matrixes with structural matrixes depicting interaction distance and similarity in patterns of interaction (structural equivalence). The majority of the findings show that the individuals with whom a person interacts directly influence beliefs about personal mastery, but attitudes and behaviors are more affected by structurally equivalent co-workers. Self-monitoring moderated the extent to which interaction with others influenced individuals.

Technological change has received a wealth of both theoretical and empirical attention. However, longitudinal research examining the processes by which people come to understand the technologies they employ is sparse. Research and theory on social influence may help illuminate these processes. Several authors (Berger & Luckmann, 1967; Festinger, 1954; Salancik & Pfeffer, 1978; Weick, 1969; Zalesny & Ford, 1990) have addressed the impact of social influence on the development of attitudes and behaviors. They have suggested that individuals develop attitudes and behaviors in part as a result of the social information available to them. However, little research has investigated changes in attitudes and behaviors following an organizational change. In addition, although research has established a relationship between attitudes and social influence, there is little evidence to imply causality, or that social context affects attitudes and behaviors. It is just as likely that people with similar attitudes and behaviors come to socialize with one another. Or perhaps the relationship between attitudes and social relations is spurious. Investigating whether social influence processes do indeed occur and determining their role in the development of attitudes and behaviors regarding a technological change requires longitudinal investigation.

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This study addressed the role of social relationships in the development of attitudes and behaviors regarding new technology through a longitudinal investigation. Specifically, I investigated the introduction of a computerized local area network in a government agency. The changes in both formal and informal interaction patterns induced by the technological change were examined to determine their effects on the development of attitudes and behaviors related to the change. What differentiates this study from others that have investigated the effects of social interaction on workplace attitudes is that it was longitudinal. Not only was the investigation conducted over time, but also prior to and following the introduction of a technological change. As such, it provides insight into how people within an organization cope with the uncertainties of change. I analyzed different types of social interaction to determine their efficacy as potential sources for "sense-making" and compared the extent to which individuals are influenced by people with whom they interact directly and individuals with whom they share interaction partners. Further comparisons are made regarding the extent to which these sense-making sources differentially affect attitudes, beliefs, and behaviors.

A SOCIAL INTERACTION PERSPECTIVE

Many theorists have suggested that social context is important in developing attitudes and behaviors. Homans (1950) noted that interaction between individuals and their sharing of organizational position led to similarities in their behavior. Lieberman (1956) addressed the effects of shared interaction on similarity in attitudes. Festinger (1954) developed a theory of social comparison processes to describe how individuals come to share attitudes, proposing that people have an innate drive to evaluate themselves and their attitudes and behaviors and that they select similar others with whom to compare themselves.

Building on the work of Festinger (1954) and others, Salancik and Pfeffer (1978) addressed the role of social influence processes in the development of attitudes and behaviors among co-workers in their social information processing theory. They proposed that co-workers influence an individual's beliefs, attitudes, and behaviors by providing salient, credible, and relevant social information about an object or situation. This theory addresses the effects that individuals have on others who come into contact with them. Thus, within a workplace, co-workers may influence the way people perceive and react to a job (Shaw, 1980).

An alternative explanation is that people who hold similar attitudes interact with one another. In fact, interpersonal attraction theory and much of early psychological attraction-similarity research indicated that people who are similar tend to interact with one another (Byrne [1971] and Berscheid [1985] provide reviews of this literature). For example, in Schneider's (1987) attraction-selection-attrition (ASA) model, organizations become homogeneous over time because individuals become members of the organizations if they perceive existing members to be like themselves. Likewise, organization members seek to hire similar others. Thus, social information

processing theory and interpersonal attraction theory similarly predict that individuals will have attitudes and behaviors similar to those of the individuals with whom they interact. However, these two theories specify opposite causal paths. Consequently, longitudinal examination is necessary to illuminate the causal path between similarity in attitudes, and interaction.

HYPOTHESES

Salancik and Pfeffer (1978) proposed that the most direct way of providing social information is through overt statements about an object or event. People receive information that is biased in the direction of their interlocutor's beliefs (Sprague, 1982) and are rewarded for adopting this biased information into their own beliefs. Within a workplace, these rewards can be tangible, intangible, or both. Money, praise, and social support may reinforce the adoption process. Thus, homogeneity in behaviors and attitudes is both expected and reinforced.

Many researchers and theorists (e.g., Coleman, Katz, & Menzel, 1966; Davis, 1969; Homans, 1950; Newcomb, 1943; Sprague, 1982) have agreed that people tend to adopt the views and actions of those with whom they associate. As Hackman contended "The other people with whom an individual interacts can affect profoundly how that person thinks, feels, and acts" (1976: 1455). Festinger, Schachter, and Back (1950) also suggested that interaction induces common attitudes and behaviors.

According to social information processing theory (Salancik & Pfeffer, 1978), different types of interaction processes may cause this homogeneity of attitudes and behaviors. Contractor and Eisenberg (1990) proposed studying social information processing in communication technologies by applying two network models of social contagion. In the first model, the relational model, people will influence and be influenced by those with whom they have direct interaction (Burt, 1987; Erickson, 1988). Within an organization, this interaction may be formal or informal and may differ from the pattern of interaction prescribed by the organizational structure (Monge & Eisenberg, 1987). Burt (1987) referred to this model as the cohesion model because people are expected to develop attitude similarity with other members of a cohesive group, one whose members interact frequently and directly with each other. The relational or cohesion model is based on the work of Homans (1950) and Festinger, Schachter, and Back (1950), who addressed the effects of direct interaction on the development of attitudes and behaviors, positing that people who interact directly with one another are likely to develop homogeneous attitudes and behaviors. The less direct this interaction, the lower the influence effects (Erickson, 1988; Mintzberg, 1993).

The second network model Contractor and Eisenberg (1990) proposed as a vehicle for studying social information processing is the positional approach, which is also referred to as the structural equivalence model (Burt, 1987). In this model, people are influenced by those with whom they have the same patterns of communication, even though they may not interact directly. Thus, people in the same position within a social structure come to

develop attitudes that are seen as appropriate for that social position. Burt (1982) provided a detailed review of the differences between the positional and relational approaches. In both models, an organization's pattern of social relations is posited to shape attitudes and behaviors in such a way that the latter come to mirror the social interaction. This process ultimately results in homogeneity of attitudes and behaviors among organization members.

Building on the work of Contractor and Eisenberg (1990) and Salancik and Pfeffer (1978), I proposed that social interaction would affect the frequency with which individuals used computers, their attitudes towards computers, and their sense of self-efficacy regarding computer use. Frequency of computer use was selected for investigation because social influence was expected to affect how often individuals used computers. When and how to incorporate such a new technology into everyday work production can be difficult to assess. Therefore, people were expected to do what others around them were doing.

Changes in attitudes toward computers and self-efficacy regarding computer use were expected to occur as a function of both individuals' own experience with computers and the opinions about them that co-workers voiced or exhibited (Salancik & Pfeffer, 1978). Allport (1935) defined attitudes as mental states that induce a predisposition to respond consistently to a given object. Such mental states regarding computers may include an assessment of the extent to which they are helpful or harmful, useful or a waste of time. Attitude toward computers has been suggested as the most important aspect of a successful human-computer relationship (Miller, 1971), and many authors (e.g., Bergmark, 1980; Coover & Goldstein, 1980; Pava, 1983; Rafaeli, 1986) have agreed on its importance.

Likewise, a sense of self-efficacy regarding computer use is an important determinant of successful computer adoption (Hill & Smith, 1987). As defined by Bandura (1986), self-efficacy consists of people's beliefs in their ability to organize and execute the courses of action required to attain designated levels of performances. Self-efficacy regarding computer use is an individual's belief regarding his or her ability to successfully master a computer. Bandura showed that self-efficacy judgments influence adaptive human functioning. Thus, self-efficacy regarding computers is thought to be important in regard to adaptive computer use.

To investigate the effects of social interaction on attitudes toward computers, belief in self-efficacy regarding computers, and frequency of computer use, I examined changes in the variances of these variables over time. If the attitudes and behaviors of those around individuals influence the development of their attitudes and behaviors, over time people will have similar attitudes and behaviors (Berger & Luckmann, 1967; Erickson, 1988; Homans, 1950). This homogeneity of attitudes and behaviors develops over time through shared interaction as people try to reduce uncertainty and to understand the world around them (Berger & Luckmann, 1967). If social interaction affects attitudes and behaviors, homogeneity of variance is likely to develop over time among individuals undergoing a technological change.

Therefore,

Hypothesis 1: Following the establishment of a change in technology in an organization, variance in technology-related behaviors and attitudes will decrease across organization members. The frequency of their computer use, their attitudes toward computers, and their self-efficacy beliefs regarding computers will be affected.

Support for the above hypothesis would provide additional evidence for social information processing theory. Investigation of social interaction patterns may help illuminate how social information processing occurs.

The Relational Model

According to Erickson (1988), people compare themselves most often and most importantly to people with whom they are directly connected. Communication that occurs through intermediaries is not as consequential for the development of attitudes and behaviors. Very sophisticated information is difficult to transfer through intermediaries (Mintzberg, 1993). Thus, information appropriate to the development of attitudes and behaviors may be difficult to so transfer. The greater the number of intermediaries, the less significant the social influence effect. Therefore,

Hypothesis 2: Within an organization, the smaller the number of communication steps between two individuals, the greater the similarity in their technology-related attitudes and behaviors, including the frequency of their computer use, their attitudes toward computers, and their self-efficacy beliefs regarding computers.

The Positional Model

In addition to occurring when people adopt the behaviors, attitudes, and beliefs of those with whom they interact, similarity may occur when people interact with the same other people (Burt, 1982, 1987; Coleman et al., 1966; Krackhardt, 1989). The degree to which a focal individual and another person interact with the same others reflects the extent to which the focal and the other are structurally equivalent (Burt, 1982). In the relational model, individuals have to interact directly in order to be similar to one another; but according to the structural equivalence model, they do not. Rather, structural equivalence is a measure of the extent to which individuals communicate with the same other people, not necessarily with one another. Thus, two individuals may be structurally equivalent even if they never talk to one another.

Similarity in interaction defines social boundaries around reference groups. Thus, structurally equivalent actors should develop similar behaviors and attitudes because they are similarly socialized by others (Burt, 1987). Structurally equivalent actors interact with the same others in the

same manner, so structural equivalence has often been equated with role similarity (Burt, 1987).

Katz and Kahn defined organizational role behavior as "the recurring actions of an individual, appropriately interrelated with the repetitive activities of others so as to yield a predictable outcome" (1966: 174). The more similar two individuals are in terms of structural equivalence, the more likely it is they can substitute for each other in organizational role.

The attitudes and actions of those who share people's role positions are used to determine their own attitudes and behaviors (Bandura, 1986; Katz & Kahn, 1966). Burt (1987) proposed that cognitive processes of social comparison are the reason for this "contagion" of attitudes and behaviors, which is particularly likely in organizations, where people learn what behaviors and attitudes are appropriate primarily as a function of their organizational roles (Katz & Kahn, 1966; Lieberman, 1956). The effects of structural equivalence have been demonstrated in studies of behavioral adoption (Burkhardt & Brass, 1990; Burt, 1987), academic perceptions of journal significance (Burt & Doreian, 1982), and software development practices (Walker, 1985).

Hypothesis 3: Structurally equivalent individuals will develop similar technology-related behaviors, attitudes, and beliefs, including the frequency of their computer use, their attitudes toward computers, and their self-efficacy beliefs regarding computers.

As proposed above, social context provides information that may determine attitudes, beliefs, and behaviors. However, some individuals are less apt than others to adjust their behaviors and attitudes to reflect the behaviors and attitudes of those with whom they interact.

Moderators of Social Influence

Certain types of individuals have been found to be especially susceptible to social influence processes. The notion of self-monitoring (Snyder, 1974, 1979) captures the degree to which individuals are likely to adjust their behavior in response to social interaction cues. Self-monitoring is a personality variable that helps determine the extent to which individuals use cues from their social interaction to determine the appropriateness of their attitudes and actions. Specifically, people who are likely to use situational cues to adjust their behaviors and attitudes to be similar to those of others are considered "high self-monitors." In contrast, individuals who remain consistent in their behavior over various situations and are inattentive to social comparison information are considered "low self-monitors." Kilduff (1992) found that high self-monitors were more likely than low self-monitors to rely on friends when deciding on the organizations with which they should interview.

Subcomponents of the self-monitoring variable include an ability to modify self-presentation and sensitivity to the expressive behavior of others

(Lennox & Wolfe, 1984). High self-monitors can detect the subtleties of others in regard to their own behaviors and attitudes as well as their own expectations in regard to the behaviors and attitudes of others. In addition, individuals high on self-monitoring use this information to adjust their attitudes and behaviors to meet the expectations of others. Those low on self-monitoring, in comparison, are either unable to detect expectations or unable or unwilling to adjust their attitudes and behaviors to meet the expectations of others. High self-monitors are thus highly influenced by their social contexts.

Hypothesis 4: Self-monitoring style will moderate the relationships posited in Hypotheses 2 and 3: the behaviors of high self-monitors will exhibit the proposed relationships, and those of low self-monitors will not.

Control Variables

Workers who are at the same level or within the same department of an organization may have similar uses for a specific technology. Within the organization under study, individuals who were in the same department had similar job responsibilities. Likewise, individuals at the same level had similar supervisory responsibilities. Therefore, in order to establish that an individual's behaviors, attitudes, and beliefs were more than a function of a job itself—specifically, that they were influenced by others within the individual's social context—I controlled supervisory level and departmental affiliation by “partialing out” the effects of these variables prior to analyzing the hypothesized relationships.

It is important to note that by removing the effects of department and level, I may have removed the effects of legitimate social interaction processes that occur within department and level. Therefore, my analyses addressed the differential effects of level and department as they pertain to the hypotheses under study.

Although distinct theoretically, the dependent variables under study (attitudes toward computers, self-efficacy regarding computers, and frequency of use) are highly correlated with one another. Thus, I examined each as a control variable to differentiate effects. This study is also exploratory in that I examined the differential effects of interaction distance and structural equivalence on each dependent variable, using the former as control variables. Although both structural equivalence and interaction predict that people develop similarity in attitudes, behaviors, and beliefs in order to reduce uncertainty, the two theories imply different mechanisms. Similarity that occurs as a function of structural equivalence implies a social comparison of role equivalents (Burt, 1987; Lieberman, 1956). However, similarity that occurs via direct interaction may occur through direct persuasion or social comparison (Bandura, 1986; Berger & Luckmann, 1967; Erickson, 1988; Homans, 1954; Salancik & Pfeffer, 1978). In addition, influence via direct interaction may occur as a result of trusting relationships that entail

individuals' receiving social support from those who interact directly with them (Bandura, 1986).

METHODS

Research Setting

The research was conducted in a federal agency, located near Washington, DC, that was responsible for the collection, analysis, and dissemination of information about nutrition. The organization employed approximately 100 people over the time period studied, most of whom were researchers trained in nutrient data analysis. The organization was structured into five branches, each responsible for analyzing data and reporting information on one or more of the following: food consumption, foods' nutritive content, dieting, and nutrition education. Although the branches performed similar functions, each worked on different research projects and analyzed separate survey data.

Prior to the technological change studied here, computer analyses of nutrient data were contracted out to another agency. The prohibitive costs of such services were described as a reason to install an in-house local area network with distributive data processing capabilities covering all employees. The transition to a local area network was tantamount to changing the technology of the organization. Rather than farming out computer analyses, researchers became responsible for their own analyses. Furthermore, the network added capabilities previously unavailable to agency workers, including electronic mail, graphics, database management, spreadsheet analyses, and word processing. These new functions afforded new opportunities for workers to adjust not only how their work was accomplished, but also what activities their jobs entailed. Top management gave workers in all the agency's branches equal opportunity and encouragement to adapt this new technology to existing work procedures.

Procedures

All employees were asked to participate in a longitudinal research project requiring that they complete a questionnaire at several points in time. Respondents were asked to include their names on the instruments so their reactions over time could be traced. Data were collected prior to and following the implementation of the computer information system.

This research analyzed three waves of data. The first wave (time 1) was collected approximately three months prior to the introduction of the computerized information system. Time 2 data were collected three months after training was completed, approximately nine months after time 1. I considered time 2 to be equivalent to the final installation of the system because it assessed the organization after equipment and software were in place and an agency-wide training program had been completed. The time 3 data, collected one year after time 2, were considered an assessment of the agency after the new technology had become established as a normal part of day-to-day organizational life. I chose a year following installation as an appro-

priate point at which to measure post-system implementation because within that year the agency had undergone all of its seasonal analyses at least once.

At time 1, 75 out of 99 employees completed the questionnaire. There were 65 completed questionnaires from 96 possible respondents at time 2, and 75 out of a possible 100 at time 3. Although close to 100 employees were available all three times, because of turnover only 75 employees were available at all three data collection points. Of that 75, 40 completed all three questionnaires, yielding a 53 percent response rate for the longitudinal analysis.

Measures

Network measures. At each measurement time, respondents were provided with a list of all agency employees and asked to circle the names of people with whom they communicated as part of their jobs during a typical week. These data were used to construct an adjacency matrix, a binary matrix in which a 1 stood for communication between actor i and actor j and a 0 stood for a lack of communication. I analyzed these data to determine the following network measures:

Interaction distance, measuring the communication distance between two actors, was calculated as the number of links, or individuals, in a communication chain. A distance of 1 implies direct contact between two people; 2 is contact through one other individual; 3 implies that it takes three links to transmit information between the two, and so forth.

Structural equivalence measured the similarity of the interaction patterns of two actors. The aggregate dissimilarity, or distance, between i 's and j 's relations in a network was measured as:

$$d_{ij} = \frac{\sqrt{\sum_{k=1}^N (x_{ik} - x_{jk})^2}}{N},$$

where x_{ik} and x_{jk} are the i th row and k th column and j th row and k th column entries, respectively, of the symmetric adjacency matrix (MacEvoy & Freeman, 1987).

Frequency of computer use. Employees were asked to respond to the question "During an average work week, how much time do you spend using this computer? (_____ hours)."

Attitudes toward computers. This variable measured the extent to which a worker had positive or negative feelings about computers. The Computer Attitude Scale (Shaft, 1986), which was used to measure this construct, is an eight-item scale that prompts respondents to consider eight pairs of adjectives, each pair anchoring the ends of a seven-point Likert-type scale. Examples of the polar adjectives presented are helpful/harmful, easy to use/difficult to use, threatening/nonthreatening, boring/intriguing, and enjoyable to use/frustrating to use. I formed an index by averaging choices on the eight items (α s = .84, .92, and .85, times 1, 2, and 3).

Self-efficacy beliefs regarding computers. This variable, reflecting the degree to which individuals felt they could competently use computers in the workplace, was self-rated on a three-item scale with a seven-point (1 = disagree strongly, 7 = agree strongly) Likert-type response format. A sample item is, "I am confident that I can use the AGENCY X computer system effectively." An index was formed by averaging the ratings on the three items (α s = .92, .79, and .88, times 1, 2, and 3).

Self-monitoring. This variable measured the extent to which individuals altered their actions on the basis of contextual cues. The Revised Self-Monitoring Scale, a 13-item scale developed by Lennox and Wolfe (1984) and composed of six-point Likert-type items, was used to assess this variable at time 3. I averaged the 13 items to form a self-monitoring index (α = .85) and used the mean, 2.95, to differentiate high and low self-monitors, thus dichotomizing the variable (0 = low, 1 = high). There were 38 high self-monitors and 37 low self-monitors.

Control Variables

Demographic characteristics. Four demographic characteristics were measured. Respondents were asked to indicate their age in years, their education level (1 = high school, 2 = some college, 3 = bachelor's degree, 4 = master's degree, 5 = doctoral degree), their gender (1 = man, 2 = woman), and the length of their agency tenure in years.

Branch. The five agency units, referred to as branches, were coded 1 through 5.

Level. There were five supervisory levels within the organization (1 = does not supervise, 2 = supervisor of a work unit, 3 = supervisor of a branch, 4 = a department supervisor, 5 = agency director).

ANALYSES

Standard *F*-tests based on analysis of variance (ANOVA) and correlation coefficients were respectively used to test Hypotheses 1 and 2. To test the remaining hypotheses, I correlated matrixes representing the independent and dependent variables with one another. The dependent variables are represented by dissimilarity matrixes. Specifically, I assessed whether the degree of similarity in the behaviors and attitudes of two people was related to their interaction distance and to their sharing interaction partners. Such assessments were conducted by first creating dissimilarity matrixes comparing the difference in each person's attitudes and behaviors with those of every other person. I created these matrixes by transforming each column vector composed of individual ratings on the scales measuring attitudes toward computers, self-efficacy beliefs, and hours of use into square matrixes composed of absolute difference scores ($|i - j|$), where the absolute value of each *i* minus each *j* refers to the difference in their individual ratings.

Matrixes representing independent variables were derived from an ad-

jacency matrix, which describes who talked to whom in the organization. If *i* reported talking to *j*, a 1 was entered in the matrix cell. If there was no record of communication, a 0 was entered. Because network measures do not always accurately measure actual communication, I calculated the reciprocation rate to determine the agreement between each *i* and *j*. The reciprocation rates for the three consecutive measurements were 61, 55, and 47 percent. Because memories of communication behavior have been demonstrated to be faulty (Bernard & Kilworth, 1977), I made the matrixes symmetric through the union method (MacEvoy & Freeman, 1987), placing a 1 in the intersecting cells of *i* and *j* if either reported communication with the other.

Next, to test whether similarity was a function of the interaction distance between individuals (Hypothesis 2), I correlated a matrix composed of the path distance of each individual from every other individual with each absolute difference matrix. Finally, a structural equivalence matrix (composed of the value of the structural equivalence of each individual with every other individual) was correlated with absolute difference matrixes to assess Hypothesis 3, concerning the extent to which individuals' similarity in attitudes and behaviors is a function of their having similar interaction partners.

Dissimilarity and structural equivalence matrixes were formed for all individuals at each measurement time ($N_s = 75, 65$, and 75). I then deleted data on those who had not completed all three questionnaires, leaving data from 40 people. The full time 3 matrix ($N = 75$) was used to test Hypothesis 4 and to partial out the effects of the control variables.

Dissimilarity matrixes were correlated with interaction and structural equivalence matrixes via the quadratic assignment procedure (QAP) in Borgatti's (1989) network program Anthropac and MacEvoy and Freeman's (1987) UCINET package. QAP, a nonparametric test of whether two matrixes are significantly and nonspuriously related (e.g., Baker & Hubert, 1981; Hubert & Schultz, 1976; Krackhardt, 1987, 1988), involves randomly permuting the rows and columns of one matrix while holding the other matrix constant and calculating the correlation between the two after each permutation. A distribution produced from each of these correlations determines its significance. This procedure has been found to be superior to ordinary-least-squares regression analysis for testing hypotheses based on dyadic data, like the data in network analysis (Krackhardt, 1988), because it is more accurate than ordinary-least-squares procedures in dealing with autocorrelated social network data. I used a special partialing routine in the UCINET package to remove level and departmental affiliation from the interaction and structural equivalence matrixes, enabling independent assessments of the effects of interaction and structural equivalence and of each dependent variable.

To determine the extent to which self-monitoring moderated the proposed relationships (Hypothesis 4), individuals who completed the time 3 survey were dichotomized into low and high groups on the basis of the median split (3.08) and mean split (2.95) of the self-monitoring ratings. I

conducted separate analyses for each group (high, $N = 38$; low, $N = 37$). A significant, positive relationship between the interaction distance matrix and the attitude and behavior difference matrixes for high self-monitors but not for low self-monitors would support Hypothesis 4.

To control for the effects of level and departmental affiliation, similarity matrixes were constructed in which a 1 indicated that two people were at the same supervisory level or had the same departmental affiliation. I separately partialled the branch similarity and level dissimilarity matrixes out of both interaction and structural equivalence matrixes at time 3 to control for the effects of job function on similarity in the dependent variables. These controls also had the effect of controlling for spatial proximity, as department members were located next to one another in the same area of the agency. The results with the control variables were compared to the results prior to partialing.

To assess the temporal ordering of the relationships between the matrixes under analysis, I compared the significance of the matrix correlations over time. Whether interaction patterns cause attitude changes or attitudes cause interaction pattern changes was assessed by comparing the results of the quadratic assignment procedure in a manner similar to that in which cross-lagged correlation analyses are conducted. For example, first I correlated time 1 interaction patterns with time 3 behaviors and attitudes. Second, time 3 interaction patterns were correlated with time 1 behaviors and attitudes. If the first z-score, or standard score, is significant but the second is not, there is support for the belief that interaction patterns cause changes in behaviors and attitudes. In other words, network structure can be said to act as a diffusion device for the contagion of attitudes and behaviors. However, if the second z is significant rather than the first, it can be said that individuals change their structural locations by communicating with others with whom they share attitudes or by becoming structurally equivalent to individuals with whom they are similar. It may also be that managers assign people who share values to similar structural positions or group individuals who share similar values together. For example, individuals who have a positive attitude toward computers may be assigned as their departments' liaisons for computer activities. In the event that both zs are significant, Goodman-Kruskal's (1963) gamma is calculated to allow for a comparison of the levels of association.

RESULTS

Descriptive Statistics

A majority ($N = 65$) of the 75 potential respondents for longitudinal analysis responded to the survey instrument at least once. Table 1 displays the demographic makeup of that group of 65 and of the 40 respondents who completed all three questionnaires. A comparison of the two groups demonstrated their relative demographic similarity. None of the differences between full respondents and partial respondents are significant; for age and

TABLE 1
Demographic Profile of Respondent Groups

Characteristics	Three-Time Respondents ^a			One-Time Respondents ^b		
	Means	s.d.	Frequency	Means	s.d.	Frequency
Age	42.08	9.25		42.13	10.31	
Organizational tenure	10.18	5.80		9.41	7.07	
Men			25.0%			22.2%
Education						
High school			7.5			7.7
Some college			12.5			7.7
B.A.			35.0			35.4
M.A.			30.0			29.2
Ph.D.			15.0			20.0

^a N = 40.

^b N = 65.

tenure, *zs* are $-.004$ and $.11$, respectively. The chi-squares resulting from comparing respondents and nonrespondents on gender and education are $.06$ and 1.7 , respectively.

Table 2 presents means, standard deviations, and correlations for the variables. Spearman rank-order correlation coefficients were calculated for level and education and Pearson correlation coefficients were calculated for the other variables.

With one exception, early measurements of each dependent variable were significantly related to later measurements of the same variable. The exception was that individuals' attitudes toward computers prior to the technological change were not related to their long-term, post-implementation attitudes. The high correlation between times 2 and 3 computer use ($.72$) provides a form of test-retest reliability for this variable.

Table 2 also shows that attitude toward computers, self-efficacy regarding computers, and hours of use are highly intercorrelated. Attitude and self-efficacy are significantly correlated ($p < .001$) at each time. Earlier measurements of each variable are generally correlated with later measurements of the other variable ($p < .05$), but time 1 attitude is not significantly related to time 3 self-efficacy. Although correlations were higher when these variables were measured at the same point in time, it is interesting to note that correlations of earlier measurements of self-efficacy with later measurements of attitudes are more highly correlated than the reverse (later measurements of self-efficacy with earlier measurements of attitude). Thus, it is likely that a sense of self-efficacy regarding computers may affect the development of attitudes toward computers. In addition, however, some other variable may be affecting the two variables similarly over time. Hours of use at both times 2 and 3 was significantly correlated with all three measurements of computer self-efficacy ($p < .05$). Time 2 hours of computer use was significantly related to time 2 computer attitude ($p < .05$) and time 3 computer attitude ($p < .001$), but not to time 1 computer attitude. This pattern

TABLE 2
Descriptive Statistics and Correlations^a

Variables	Means	s.d.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Attitudes, time 1	5.45	0.79														
2. Attitudes, time 2	5.11	1.13	.47**													
3. Attitudes, time 3	3.93	0.27	.14	.53***												
4. Self-efficacy, time 1	5.60	1.25	.56***	.32*	.39**											
5. Self-efficacy, time 2	5.48	1.50	.35*	.69***	.55***	.59***										
6. Self-efficacy, time 3	4.65	0.64	.13	.34*	.55***	.42**	.58***									
7. Hours of use, time 2	11.12	10.20	.22	.26*	.52***	.62***	.58***	.59***								
8. Hours of use, time 3	14.42	12.55	.11	.33*	.34*	.31*	.47***	.46**	.72***							
9. Low self-monitoring	55%		.19	.29*	.27*	.21	.13	-.02	-.01	.16						
10. Age	42.08	9.25	-.19	-.19	.09	-.17	-.39**	-.13	-.10	-.24	-.06					
11. Men	25%		-.10	-.26*	.21	-.05	-.27*	-.03	-.39**	-.15	.29*	-.10				
12. Organizational tenure	10.18	5.80	-.10	-.04	-.03	-.09	-.03	.03	-.28*	-.12	-.19	.31*	-.29*			
13. Graduate degrees	45%		.53***	.16	.11	.26	.25	-.02	.18	.16	-.07	-.12	.06	-.06		
14. Nonsupervisors	87%		.09	.15	.05	.09	.11	.20	-.09	.24	.32*	.55***	-.13	.29	.35*	
15. Branch	5-9		.09	-.02	-.06	.26	.22	.19	.17	.16	-.04	-.20	.07	-.15	-.27*	-.08

^a Statistics are for the 40 respondents who took the questionnaire three times.

* $p < .05$, one-tailed test.

** $p < .01$, one-tailed test.

*** $p < .001$, one-tailed test.

implies, albeit weakly, that computer use may shape computer attitude. Time 3 computer use was moderately related to attitude toward computers at times 2 and 3. Because of the high correlations between the dependent variables in analyses using time 3 data, I partialled out the dissimilarity matrix for each variable from other dissimilarity matrixes prior to analyzing their relationships to the structural equivalence and interaction matrixes.

As expected, both job tenure and organizational level were significantly related to age ($p < .05$ and $p < .001$, respectively). Tenure was also negatively related to time 2 hours of use ($p < .05$). Level was related to education ($p < .05$). Education was significantly related to computer attitude at time 1 ($p < .001$) but not at time 2 or time 3. Self-monitoring was related to gender, level, and times 2 and 3 attitudes toward computers ($p < .05$). High self-monitors tended to be women at relatively high levels in the organization and to have more positive computer attitudes at times 2 and 3 than at time 1. However, the relationship between gender and level was negative, although insignificant. Being a woman, rather than self-monitoring, accounts for similarity in computer self-efficacy.

There was a significant, negative relationship between job tenure and hours of use at time 2 ($r = -.28$, $p < .05$). At time 3, this relationship was no longer significant ($r = -.12$). At time 2, there was a significant, negative relationship between age and self-efficacy regarding computers ($r = -.39$, $p < .01$). At time 3, this relationship was no longer significant ($r = -.13$). Gender was significantly related to hours of use ($r = -.39$, $p < .01$), attitude ($r = -.26$, $p < .05$), and self-efficacy ($r = -.27$, $p < .05$) at time 2. Men used the computers more and had more positive attitudes toward them and higher senses of self-efficacy. At time 3, however, these relationships were no longer significant (hours, $r = -.15$, attitude, $r = .21$, self-efficacy, $r = -.03$). Overall, these findings indicate that the relationship between gender, the interaction and structural equivalence matrixes, and the dependent variables need to be examined further.

Chi-square statistics were also generated to determine the significance of the relationship between categorical variables. The chi-squares were not significant except for the one for the relationship between self-monitoring, when measured dichotomously, and gender ($\chi^2_5 = 12.77$, $p < .05$). As the results of the correlational analyses using continuous self-monitoring data indicated, women were more likely to be high on self-monitoring than men.

The means for attitudes toward computers and self-efficacy decreased over time. Multivariate analyses of variance (MANOVAs) of the times 1, 2, and 3 computer attitude data indicated a significant main effect for time ($F = 64.56$, $p < .001$). Likewise, MANOVAs of the self-efficacy data over time showed a significant decrease ($F = 20.99$, $p < .001$). Thus, the trend was toward more negative computer attitudes and beliefs.

Analysis of Variance

To the extent that changes in attitudes, beliefs, and behaviors are a function of an individual's social context, variance was expected to decrease

over time (Hypothesis 1). Because everyone in the organization studied had adopted the new technology, it can be said that there was some evidence of homogeneity following its introduction. However, when I measured computer use in terms of hours, there was no support for an increase in homogeneity between times 2 and 3; variance was actually higher at the third measurement. The standard deviation for hours of use at time 2 was 10.20, but at time 3 it was 12.55. Visual observation of the hours-of-use data revealed that if two individuals were eliminated from the data set, variance decreased. These two individuals inflated the variance by reporting more than 40 hours per week (the upper limit for reportable federal employment work hours) of computer use.

The variance in attitudes toward computers and self-efficacy regarding them decreased significantly from time 2 to time 3, lending support for two of the Hypothesis 1 predictions (attitude, time 2 = 1.284, time 3 = .071, $F = 18.08$, $p < .001$; self-efficacy, time 2 = 2.247, time 3 = .416, $F = 5.40$, $p < .001$).

Interaction Influence Processes: Testing the Relational Model

Table 3 reports the results of quadratic assignment procedure analyses correlating time 3 interaction data with time 3 data on attitude, self-efficacy, and hours of use (75×75 matrixes). If individuals who interact directly with one another are more similar in their computer-related behavior and attitudes than individuals who interact through intermediaries, as Hypothesis 2 predicts, there should be significant z s for the relationship of the computer behavior and attitude difference matrixes with the interaction matrix. Hypothesis 4 proposes that an individual's self-monitoring style will moderate this relationship. No significant correlations emerged from the computer attitude or computer use difference matrixes using time 3 respondents. A significant z corresponded to the self-efficacy difference matrix and the interaction matrix for all 75 individuals ($p < .01$, Goodman-Kruskal's gamma = .16). As predicted, this relationship was significant for high self-monitors but not for low self-monitors. I used a hypothesis test about the difference between two proportions in which z is equal to $[(\hat{p}_1 - \hat{p}_2) - D_0]/\sigma_{(\hat{p}_1 - \hat{p}_2)}$, where \hat{p}_1 and \hat{p}_2 are the proportion of times that a random gamma is larger than or equal to the observed gamma calculated in the QAP procedure; D_0 equals $p_1 - p_2$ (0 in this case because the null hypothesis is that there is no difference between high and low self-monitors); $\sigma_{(\hat{p}_1 - \hat{p}_2)}$ is nearly equal to $(\hat{p}_1\hat{q}_1/n_1 + \hat{p}_2\hat{q}_2/n_2)^{1/2}$; and n_1 and n_2 are sample sizes (Sincich, 1982). There was a significant difference between the results for high and low self-monitors ($z = 2.20$, $p < .01$, one-tailed test).

Because women tended to be higher on self-monitoring than men, I also analyzed the relationship between gender and self-efficacy, finding it insignificant ($z = .86$). Therefore, the relationship between self-monitoring and interaction is not spurious.

When structural equivalence was partialled out of interaction distance, the relationship between the latter and computer self-efficacy remained sig-

TABLE 3
Results of Quadratic Assignment Procedure for Interaction Distance at Time 3^a

Variables	All Respondents	High Self-Monitors	Low Self-Monitors	Partialled Out					Self-Efficacy	Hours of Use
				Structural Equivalence	Branch	Level	Attitudes			
Computer attitudes	-0.245	-0.818	0.424	0.366	-0.364	-0.584			-0.588	-0.194
Computer self-efficacy	2.629**	1.975*	1.013	3.022**	2.627**	2.767**	2.749**			2.729***
Hours of computer use	0.226	0.026	0.292	0.240	-0.276	-0.211	-0.194		-0.584	

^a Values are zs for Hubert's quadratic assignment gamma measure of association. *N* = 75.

* *p* < .05, one-tailed test.

** *p* < .01, one-tailed test.

nificant ($p < .01$); however, Goodman-Kruskal's gamma dropped to .042. The z changed from negative to positive for attitudes toward computers after structural equivalence was partialled out of interaction distance; however, neither of the z s was significant. When the effects of attitude and hours of use were individually removed from self-efficacy, the relationship between self-efficacy and interaction distance remained significant. Because gender and age had significant relationships with some of the dependent variables, I also partialled those two variables out of computer efficacy. The relationship remained significant when age ($z = 2.34$, $p < .01$, one-tailed test) and gender ($z = 2.72$, $p < .01$, one-tailed test) were each partialled out of self-efficacy prior to correlating the latter with interaction distance. It is also interesting to note that similarity in gender was not related to interaction distance ($z = .11$); however, similarity in age was positively related to interaction distance ($z = 2.78$, $p < .01$). Individuals tended to interact with others of the same age. Likewise, those who were similar in age tended to have similar beliefs about their self-efficacy regarding computers ($z = 2.58$, $p < .01$). Age and interaction distance provided both common and independent sources of variance for self-efficacy. Even when individuals didn't talk directly to one another, they tended to have similar senses of self-efficacy about computers if they were similar in age, and individuals who talked to one another were similar in self-efficacy even if they were not similar in age.

The relationship between the branch similarity matrix and the interaction matrix yielded a z of -3.28 ($p < .001$, Goodman-Kruskal's gamma = $-.61$). Most people interacted with individuals from their own branch. The relationship between level similarity and interaction yielded a z of $-.63$ (n.s.). Individually partialing level and branch out of the interaction matrix did not change the overall patterns of significance. The interaction distance and computer efficacy matrixes remained significantly related with branch ($p < .01$, Goodman-Kruskal's gamma = .144) and level ($p < .01$, Goodman-Kruskal's gamma = .144) removed. The z s corresponding to correlations between the interaction and dependent variable matrixes also displayed the same patterns of significance after I partialled attitude, self-efficacy, and computer use from each other prior to using the quadratic assignment procedure with the interaction matrix.

Table 4 reports the results for causal analyses of the self-efficacy and computer attitude data with interaction data. Because of the reduced number of respondents, levels of significance at $p < .10$ are reported. There were significant relationships ($p < .10$) between the time 1 interaction matrix and the time 2 computer self-efficacy difference matrix (Goodman-Kruskal's gamma = .12). However, after structural equivalence is partialled out, the relationship between the time 2 interaction matrix and time 3 computer self-efficacy is no longer significant. Overall, findings support the notion that those with whom individuals interact influence their senses of self-efficacy regarding computers. Thus, results supported Hypothesis 2 for self-efficacy.

There was a significant ($p < .10$, Goodman-Kruskal's gamma = .082)

TABLE 4
Results of Quadratic Assignment Procedure for Interaction Distance at
Times 1, 2, and 3^a

Variables	Interaction Distance		
	Time 1	Time 2	Time 3
Computer self-efficacy, time 1	.752 (.623)	.472 (.226)	-.700 (-.830)
Computer self-efficacy, time 2	1.537† (1.439†)	1.122 (.924)	-.393 (-.264)
Computer self-efficacy, time 3	1.210 (.913)	1.502† (1.191)	.916 (.946)
Computer attitudes, time 1	.599 (.642)	1.584† (1.435†)	.526 (.621)
Computer attitudes, time 2	-.622 (-.680)	-.658 (-.876)	-1.359 (-1.177)
Computer attitudes, time 3	-.454 (-.626)	-1.097 (-1.486)	-.609 (-.206)

^a Values are zs for Hubert's quadratic assignment gamma measure of association; values in parentheses are zs calculated after partialing structural equivalence from interaction.

† $p < .10$, one-tailed test.

relationship between the time 1 computer attitude difference matrix and the time 2 interaction matrix. This relationship remained significant ($p < .10$) even when the effects of structural equivalence were removed from the interaction matrix. In terms of causality, this relationship implies that employees interact with those whose attitudes toward computers are similar. It is also important to note the negative correlations for the computer attitude data reported in Table 4. When using only time 3 data (Table 3, $N = 75$), the negative relationship between computer attitude and interaction disappears when the effects of structural equivalence are removed from the interaction (thereby testing the effects of the interaction independent of structural equivalence). However, these negative correlations remain when structural equivalence is partialled out of interaction matrixes using data from all three measurement times. The negative correlation is strongest when time 3 computer attitude data and time 2 interaction data are used. The time 3 data suggest that, rather than developing attitudes similar to those with whom they interact, people develop computer attitudes dissimilar to those of their time 2 interaction partners. Overall, Hypotheses 2 and 4 were supported for self-efficacy but not for attitudes or hours of use. It appears that the use of computers and attitudes toward them have different origins than the sense of self-efficacy about using computers.

Structural Equivalence Influence Processes: Testing the Positional Model

Hypothesis 3 addresses the relationship between similarity in interaction patterns and similarity in computer-related attitudes and behaviors.

Table 5 reports the results of QAP analyses using the time 3 structural equivalence matrix with the time 3 attitude, self-efficacy, and hours of use difference matrixes. There were significant correlations between the time 3 structural equivalence matrix and both the attitude ($p < .05$, Goodman-Kruskal's gamma = .076) and hours of use ($p < .10$, Goodman-Kruskal's gamma = .069) matrixes. Results did not support Hypothesis 4 for structural equivalence. In fact, separate analysis for high and low self-monitors show a relationship for the low but not for the high group, when the prediction was for the reverse pattern. For low self-monitors, there was evidence for an association between the structural equivalence matrix and the computer attitude difference matrix ($p < .10$) and between the structural equivalence matrix and the hours-of-use difference matrix ($p < .01$).

Overall patterns of significance remained similar when branch, level, and interaction were separately removed from the structural equivalence matrixes and when the dependent variables were separated from each other. Exceptions were that the z s for the relationship of hours of use with structural equivalence were no longer significant when attitude was partialled from hours and likewise when branch was partialled from structural equivalence. The z s corresponding to the relationship between the hours-of-use matrix and the computer attitude matrix was 1.79 ($p < .10$), and the z for hours of use and branch was $-.97$ (n.s.). Likewise, the relationship between similarity in hours of use and structural equivalence was no longer significant when I removed gender from computer use prior to correlating the matrix with structural equivalence ($z = 1.26$). The relationship between hours of use and structural equivalence remained significant when similarity in age was removed ($z = 1.4$, $p < .01$). The relationship between computer attitude and structural equivalence remained significant when gender ($z = 1.64$, $p < .05$) and age ($z = 1.57$, $p < .10$) were partialled out.

To assess the causal direction implied in Hypothesis 3, I compared 40-by-40 structural equivalence matrixes for times 1, 2, and 3 with 40-by-40 attitude difference matrixes for the three times. Table 6 reports the results of the QAP analyses. There was a significant relationship between the time 1 self-efficacy matrix and the time 3 structural equivalence matrix ($p < .01$, Goodman-Kruskal's gamma = .069). This finding implies that individuals with similar views on computer efficacy at time 1 became structurally equivalent at time 3. However, there was also a significant relationship ($p < .10$, Goodman-Kruskal's gamma = .087) between the time 1 structural equivalence matrix and the time 3 computer efficacy matrix. Comparing the values of Goodman-Kruskal's gamma for the previous relationships shows a slightly stronger relationship when the earlier structural equivalence matrixes are compared to a later computer efficacy matrix.

All possible comparisons of the time 2 and time 3 matrixes were significant for computer attitude data. The values of Goodman-Kruskal's gamma were higher when earlier structural equivalence matrixes were paired with later computer attitude matrixes (Goodman-Kruskal's gamma ranged from .138 to .143) than when the comparison had the reverse temporal pattern:

TABLE 5
Results of Quadratic Assignment Procedure for Structural Equivalence at Time 3^a

Variables	All Respondents	High Self-Monitors		Low Self-Monitors		Partialed Out					Hours of Use
						Interaction Distance	Branch	Level	Attitudes	Self-Efficacy	
Computer attitudes	1.646*	0.840		1.422†		1.859**	1.565†	1.698*		1.856*	1.498†
Computer self-efficacy	-1.473	-1.355		0.570		-1.228	-1.536	-1.536	-1.704		-1.649
Hours of computer use	1.313†	0.459		1.889**		1.478†	1.276	1.309†	1.142	1.492†	

^a Values are zs for Hubert's quadratic assignment gamma measure of association.
† $p < .10$, one-tailed test.
* $p < .05$, one-tailed test.
** $p < .01$, one-tailed test.

TABLE 6
Results of Quadratic Assignment Procedure for Structural Equivalence at Times 1, 2, and 3^a

Variables	Structural Equivalence		
	Time 1	Time 2	Time 3
Computer self-efficacy, time 1	.246 (.300)	.989 (.779)	2.407** (2.298**)
Computer self-efficacy, time 2	-.643 (-.730)	.237 (.026)	1.156 (-.0374)
Computer self-efficacy, time 3	1.308† (1.159)	.431 (.162)	1.762* (-1.421)
Computer attitudes, time 1	-.794 (-.777)	-.283 (-.450)	-.068 (-.061)
Computer attitudes, time 2	1.087 (1.221)	1.981* (1.846*)	1.661* (1.630*)
Computer attitudes, time 3	2.370* (2.305**)	2.816** (2.694**)	2.160* (2.285**)

^a Values are zs for Hubert's quadratic assignment gamma measure of association. Values in parentheses are zs calculated after partialing interaction distance from structural equivalence.

† $p < .10$, one-tailed test.

* $p < .05$, one-tailed test.

** $p < .01$, one-tailed test.

Goodman-Kruskal's gamma comparing time 2 computer attitude with time 3 structural equivalence was .074, and other comparisons were nonsignificant. The time 1 structural equivalence matrix was also significantly related to the time 3 computer attitude matrix ($p < .01$). These findings suggest that structural equivalence leads to similarity in computer attitudes. Thus, results supported Hypothesis 3 for attitudes toward computers for data from individuals who completed questionnaires all three times.

DISCUSSION

In this research, I found that social context affected the development of attitudes and behaviors following a change in technology. Individuals developed their attitudes and behaviors in part through their patterns of interaction. Basically, as individuals changed their work processes, they came to depend on others around them to inform their own behaviors, attitudes, and beliefs.

Analyses over time lent support for social information processing theory; however, some findings were mixed. Apparently bearing out interpersonal attraction theory (Berscheid, 1985), results sometimes suggested that individuals with similar attitudes began to interact with one another. Perhaps people who were adept at using computers or who had positive computer attitudes formed an informal support group to help co-workers. Discussions with individuals in the organization supported this explanation. Those who understood how to use the computers became the informal lead-

ers of those who did not understand the new technology. Thus, individuals may change who they communicate with as their attitudes and capabilities change and may also develop attitudes and capabilities that are based on their social contexts. This interpretation of the findings supports Giddens's (1976, 1977) statement that social structure and meaning may be created in such a way that each is a necessary part of the other. In other words, relationship between social structure and attitudes and behaviors is reciprocal. Individuals may reposition themselves (or perhaps managers reposition them) in a way that redefines organizational realities. In essence, these individuals may be able to initiate changes in the attitudes and behaviors of others by virtue of their new organizational positions.

Although this study investigated the relative values of attitudes and behaviors, it is important to note the decrease over time in the mean values the measures of attitudes toward computers and self-efficacy regarding computers. To investigate possible explanations for these decreases, I interviewed several employees following data collection at times 2 and 3. Individuals reported that they were angry about not being involved in the decision or implementation process for the new computer system. For the most part, their initial involvement did not occur until after the equipment arrived. Some people did not get involved until they were told that they had to take training classes on the new system. There was also very little information disseminated on the new computer network.

Other individuals reported that their expectations regarding the ease of computer use and the capabilities of the new system were much too high. Disappointed expectations may have accounted for some of the decrease in the positivity of individuals' attitudes toward computers and their senses of self-efficacy regarding computer use.

The variance in attitudes and self-efficacy decreased over time as hypothesized (Hypothesis 1). If it were not for two outliers, even hours of use would have become more homogeneous over time. Perhaps hours of use is less subject to social context effects than attitudes and beliefs because job requirements have a major effect on the former. In fact, people were forced to use the new attitude system—adoption was mandatory, not voluntary. Thus, it is possible that individuals' need to use the technology overshadowed socialization effects in determining how much time they spent using their computers. The finding that computer use was no longer related to structural equivalence when the effects of computer attitude were removed in part supports this explanation. Attitudes and beliefs, however, may be less influenced by job requirements than hours of use. Lieberman's (1956) arguments regarding changes in attitudes, beliefs, and behaviors support this rationale. According to Lieberman, behaviors are overt and readily enforceable in a job role; however, attitudes and beliefs are more easily influenced by reference groups. This idea is supported in part by the lack of significant findings when the effects of branch similarity are removed from structural equivalence prior to correlating structural equivalence with hours of use.

When people were in the same branch (a surrogate for having similar job functions), structural equivalence no longer correlated with similarity in computer use.

Sense-making sources may also vary depending on whether an attitude concerns a person's self or an inanimate object like a computer. Attitudes toward objects and attitudes toward the self have generally been separate areas of inquiry (Kiecolt, 1988). This research combined the two areas and found differential effects. A person's sense of efficacy, a measure of personal mastery, apparently develops in a different manner than the person's attitude toward computers. This is one explanation for the results' failure to support all parts of the hypotheses about social information processing. In particular, attitudes toward computers were more closely related to structural equivalence than to direct interaction. In fact, there was a negative rather than a positive relationship between computer attitude and direct interaction. However, this negative relationship may have been a function of the negative relationship between structural equivalence and interaction at time 3 (for $N = 40$, $p < .01$; for $N = 75$, $p < .001$), which contrasted to their positive relationship ($p < .01$) at times 2 and 3. At time 3, people no longer interacted directly with those with whom they shared interaction partners. Specific assignments of individuals might account for that result. For example, a computer expert might have been assigned to work with the members of a group but might not have had any contact with the group's leader. Discussions with respondents verified at least one instance of such a scenario.

Computer self-efficacy was related to direct interaction but not to structural equivalence for all employees at time 3. These findings remained similar when all the control variables were partialled out. Thus, attitudes about the self are apparently more strongly influenced by interaction partners than by social location. In fact, Mead (1934) and Cooley (1902) noted long ago that people's self-images are shaped by others' reactions to them. More recently, Bandura (1986) proposed that direct persuasion affects self-efficacy. Furthermore, Turner (1976) and Meyer (1986) noted that at the time of their studies people no longer described themselves in terms of institutionalized roles and that such disassociation may be responsible for the low association between self-concept and social location. Another explanation may be that the development of perceptions of personal ability are more complicated than the development of attitudes about other objects and as such, the former require direct interaction for formation (Bandura, 1986; Erickson, 1982). Thus, those close to people, their frequent interaction partners, may be more likely to influence their computer self-efficacy because direct contact involves both verbal and nonverbal cues that may aid in the development process (Bandura, 1986). Therefore, it is likely that influencing beliefs relies on direct contact rather than on social comparisons made at a distance. Through direct contact, the self-efficacy, attitudes, and actions of those close to an individual may shape his or her sense of self-efficacy.

However, attitudes about work-related tools like computers may be

more heavily influenced by organizational role (Lieberman, 1956). Burt's (1987) tests of social contagion as an explanation of physicians' adoption of a drug are consistent with these results: a structural equivalence model was a better predictor of drug adoption than was a cohesion model. Such findings are consistent with theory elaborating the effects of roles on attitude development. According to Bogardus (1927) and Lieberman (1956), individuals will adopt attitudes about work-related phenomena that are defined through role enactment. In fact, individuals use their organizational roles to help determine how they should act and what attitudes to adopt within a workplace (Katz & Kahn, 1976). Turner (1978) referred to this process as the role-person merger. Thus, in comparison to interaction, structural equivalence highlights social comparison processes of role equivalents (Burt, 1987), not social support or direct persuasion. Therefore, computer attitude and computer use may be more susceptible to role analyses than are personal mastery beliefs, such as computer self-efficacy. When analyses partialled out the effects of structural equivalence from interaction and vice versa, these differences remained the same or became stronger. Basically, when people evaluate their own personal skills or self-images, they rely on those close to them; when they determine job-related attitudes, they are more likely to rely on role equivalents.

Self-Monitoring

Direct interaction partners influenced high self-monitors more than low self-monitors; however, structural equivalent others influenced low self-monitors more than high self-monitors. These findings support the notion that individuals, particularly high self-monitors, adjust their beliefs to be similar to the beliefs of those around them (Kilduff, 1992; Snyder, 1974, 1979). Low self-monitors may not be concerned with what their interaction partners think but rather with developing organizational roles that are consistent with their attitudes and behaviors. According to self-monitoring theory (Snyder & Gangestad, 1982), low self-monitors will choose work compatible with the values and beliefs that are consistent with their self-identities. In contrast to interaction distance, structural equivalence was related to similarity for low self-monitors but was not for high self-monitors (see Table 5). Thus, it may be that low self-monitors change their structural positions. Structural equivalence may not be a cause of similarity in self-efficacy, but rather a consequence. Some results were consistent with this explanation. Findings (Table 6) analyzing the relationship between structural equivalence and computer self-efficacy over time indicated that there was a significant relationship between structural equivalence and similarity in self-efficacy for earlier efficacy data used with later structural equivalence data. I did not have a large enough number of respondents to contrast these findings for low and high self-monitors. Future research might investigate whether the two react differently to social influence mechanisms. High self-monitors may be changed by their organizational positions, whereas low

self-monitors may attempt to change their work roles than adapt to role requirements.

Limitations and Generalizations

During the first several months of the implementation of any major technological change, people are learning how to use the system. As they use it, their behaviors and attitudes change and will likely coalesce. Therefore, similarity in attitudes and behaviors may be a function of experience with a new system. This study cannot rule out the effect of experience on the development of homogeneity. However, patterns of similarity were found to follow patterns of interaction, thereby supporting the theory that interaction affects the development of attitudes and behaviors.

The type of technology implemented within the organization under study may limit the generalization of findings to other technologies or other types of organizational change. Implementing a computer information system may be very different from making incremental work changes. Because the new technology differed greatly from that employed previously, the process studied was an example of a discontinuous shift in technology. A discontinuous shift in technology is one in which the transformation process of inputs into outputs is adjusted significantly in such a way that previous technological expertise is not an asset in dealing with the new technology (Tushman & Anderson, 1986). Individuals may be especially easily influenced by their social context when a discontinuous shift in technology occurs because the uncertainty involved in adopting new work processes is high.

Perhaps even more important than the type of technology adopted here was the manner in which it was implemented. Although there was no public punishment for not adopting the new technology, doing so was mandatory rather than voluntary. Thus, generalizations from these findings may be limited to mandatory change situations.

Additional limitations involve the study's reliance on self-report data. Data on communication interaction are often subject to human frailties of recall and may not necessarily accurately depict reality.

Contributions and Future Research

O'Reilly (1991) addressed two themes that need increasing attention in organizational behavior research. The first theme is the influence of context upon individuals in organizations, and the second is the need to blend psychology and sociology. The current research addressed both of these themes and broke from the traditional separation of micro and macro analyses. This study is an example of cross-level (Rousseau, 1985) research in that I recognized the influence of macro sociological phenomena on the attitudes and behaviors of individuals. The study thus synthesizes psychological and sociological theories of social interaction. Although previous research has addressed similar issues, few longitudinal investigations adequately address the causality underlying theory.

Despite limitations, this study helps to describe how organizationally induced changes in social context can affect the development of attitudes, beliefs, and behaviors. Social influence was shown to imitate a contagion or diffusion process, with organizational interaction patterns affecting the behaviors and attitudes of individuals. To determine the generalizability of this study to additional types of organizational change, future research could examine the effects of interaction prior to and following other organizational changes such as downsizing, relocation, and organizational mergers. Perhaps the type of change influences the way social interaction affects attitudes and behaviors.

It may also be valuable to ferret out the influence of demographic characteristics. Age, gender, and other demographic characteristics may moderate the relationships hypothesized in this study. Several researchers have posited that individuals with similar demographic characteristics develop similar attitudes and behaviors (e.g., Lawrence, 1987; Pfeffer, 1983). This similarity in part results from the sharing of experiences and life events, such as coming of age during the Vietnam War. In addition, demographic characteristics may partially determine with whom people interact. For example, Zenger and Lawrence (1989) found a relationship between age and tenure distributions and the frequency of technical communication.

This study supports the proposition that social interaction over time affects individuals. Additional studies analyzing change as a multilevel phenomenon may add to these findings. The interaction of organizations and individuals in the influence process needs to be further clarified. Research investigating interlocking directorates (cf. Burt, 1982) begins to examine how interaction processes affect interorganizational changes. Such research may help create a multilevel theory on organizational learning. Such theory development might also benefit from a network analysis approach.

Overall, this study points to the value of using network analysis techniques to integrate individual attributes and structural phenomena. Network methods have been criticized in the past for being atheoretical. This study points to the value of network analysis in theory development when, as Aldrich and Whetten noted, "an investigator describes processes that brought the network to its current state" (1981: 376). By describing these processes, researchers can understand a little more about how individuals develop attitudes and behaviors as a function of their social contexts.

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