

*This research examined an organization's change in computer-based communication structures in response to a crisis. All private electronic mail messages were captured in a state extension organization for one year. Month-by-month network analysis revealed that electronic mail patterns changed with the occurrence of a crisis associated with merger, funding changes, and staff positions. Amount of communication increased. Number of communicators increased. Messages became shorter. Individual-level networks became less interlocking. One large user group formed. Finally, communication structures largely returned to baselines without oscillation. Content analysis of messages revealed significant increases in words associated with the organizational changes. This evidence helped rule out rival explanations. The study illustrated some of the advantages of research using computer-based and monitored communication data. Findings from earlier crisis research were testable in a naturalistic, unobtrusive, quantitative case study using network analysis and content analysis.*

## **CRISIS EFFECTS ON INTRAORGANIZATIONAL COMPUTER-BASED COMMUNICATION**

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When organizations experience environmental change, what happens to their intra- and interorganizational communication? This question—one with theoretical significance—has seen considerable investigation. Yet, most studies have treated environment through the variable, “environmental uncertainty.” The ways in which this construct is conceptually and operationally defined tilts attention toward rather long-term and continuous environmental processes. In contrast, abrupt and intense environmental “events” have

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seen little investigation. These kinds of environmental changes are most often referred to as "crises" in the social science literature.

Crisis impacts on human behavior have most frequently been studied in the context of natural disasters. Research has examined individual-level responses to disaster warnings, the impact of the occurring disaster on social and psychological functioning, the effects of relocation, and the return to normalcy (Perry and Mushkatel, 1984). Other research has examined the effects of sociopolitical crisis such as assassinations on mass media content and on individual information-seeking and psychological functioning (Schramm, 1971). Other investigators have given attention to the functioning of mass media during community controversy (Coleman, 1957) and during natural disaster (Rogers and Sood, 1981).

On the whole, little attention has been given to the levels of analysis between the individual and the mass, such as the organizational level. Yet, anecdotal and journalistic evidence suggests that organizations respond to a variety of crises. Related research, however, has largely treated emergency services organizations, such as police, fire, civil defense, Red Cross, and similar organizations as sources of aid to disaster-struck communities.

We know little about organizations as end recipients of crisis effects, rather than mediators of these effects on others. Nevertheless, investigations of organizations impacted by crisis are likely to contribute to theories of organizational communication under different environmental conditions. The present study empirically examines what happens to an organization's internal communication structure as a crisis strikes.

Another theme of this research is the use of computer-based communication data. This investigation extends a recent and growing body of research that automates data capture and analysis more than has been typical in communication research. Studies using this type of data are reviewed by Rice and Borgman (1983). They and Danowski

(1982) point out some major advantages of using computer-based communication data. One can readily accomplish the following:

- study naturally occurring social units
- observe communication processes over time
- automatically capture valid and reliable data
- reduce the number of measurement translations between the behaviors and the data analyzed
- collect data quickly and with little effort
- stay closer to the original character of behavioral processes through relational methods such as network analysis, multidimensional scaling, and content analysis

As the current study illustrates, computer-based communication data also fosters easier and less costly event-centered research. With more traditional kinds of research, an investigator who wishes both to study unplanned actual events and have extensive quantitative information must be poised to leap into the field shortly after the event occurs. Under such hurried conditions, important data are sometimes overlooked and are forever unrecoverable. This "fire house" research strategy usually requires considerably more effort than other kinds of research. In contrast, with computer-based data collection, continuous information gathering is relatively easy and cost-effective. Effects of events can be examined quantitatively with the detailed and long-term records captured on an ongoing basis. Evidence of significant events can be "found" through the data and systematically studied. This is in contrast to first finding an event and then generating data surrounding it.

The research reported here exemplifies this aspect of computer-based communication data use. Prior to conducting this particular study, we were beginning a broader research program studying how change over time in communication networks is linked with change in message content. As a first step, we performed monthly network analyses to see the scope of change in the networks. Our

next planned step was the development of software for relational analysis of the message content that would treat words as nodes and perform network analysis to find groups of words. These word groups would then become the units of analysis for hypothesis-testing about message content change and who-to-whom network structure change.

Serendipitously, though, we observed a major pattern of over-time change in the network; we felt we had to account for it before we could proceed with our original intentions. Had we ignored the change and moved on with our preplanned program, our later results might be misleading. So, we began to consider what might have happened in the organization that could account for the substantial network change we had observed. We recalled that the organization under study had experienced a crisis close in time to the observed network change. Because more than two years had passed, we had forgotten about the event of which the data reminded us. The crisis is described in the methods section that follows.

The opportunity for naturalistic examination of organizational communication dynamics appeared rich and worth pursuing. Even though analysis would be post hoc, we thought we should examine the literature on organizational crisis and observe to what extent actual findings from this quantitative case study were consistent with other research. Opportunities for naturalistic observation of crisis effects with complete records of person-to-person communication acts are rare, to say the least.

Most prior studies using computer-based communication data treat mainly "who-to-whom" network data. Ignored, as a rule, are data about the content of communication messages, despite the fact that most communication models place message content in a central role. In contrast to earlier research, the current study examines both message traffic data and message content data. Our research illustrates how computer-based communication data facil-

itate multimethod treatment of research questions. First, however, we need to consider theoretical aspects of organizations experiencing crisis.

## ORGANIZATIONAL CRISES

### LOCUS OF CRISES

Crisis arise from a variety of sources, natural and human-made. This section inventories these sources.

*Natural.* Most crisis-oriented social science research has been concerned with responses to natural disasters such as floods, earthquakes, tornadoes, and so on. Although such events impact a wide range of social units, this research has been limited to individual responses to these crises. Less is known about organizational effects, except for the behaviors of emergency response organizations. Other organizations involved in crises have essentially gone unstudied.

*Human-made.* Humans stimulate crises in a variety of ways. Some major types include the following:

- (1) *Accidents:* Accidental occurrences with a range of material, organizational, and social processes can stimulate crisis conditions. For example, disasters occur from human mistakes in hazardous materials production or distribution.
- (2) *Intentional acts:* Sometimes humans try to cause crises for organizations through planned action. For example, social activists implement a variety of tactics ranging from nonviolent to violent. At the extreme lies terrorist activity. Military and intelligence operations designed to foment crisis in enemy organizations exemplify other sources of intentional human-initiated crises.

Coleman (1957) describes sources pertaining to disputes arising in communities. From a systems view, the same crisis sources would apply to organizations. Coleman

distinguishes internal and external sources, and issue content. He points to conditions for controversy including differences in economic structure, population shifts and heterogeneous values, and existing cleavages resulting from past controversies. In organizations, as controversies move to the top of the informal and formal communication agendas of the members, crisis exists.

(3) *Indirect effects*: At times crises are a byproduct of other organized human actions not intended to cause a crisis for a particular organization. For example, a terrorist action against a foreign embassy may lead to crisis conditions for a domestic organization physically close to the embassy although not directly related to it.

#### TYPE OF THREAT

Somewhat different, although related to the source of the crisis, is the type of threat that is the focal point of the crisis from the subject organization's perspective. Most crises involve multiple threats, although one tends to dominate public treatment of the crisis.

*Safety and health*. The physical well-being of humans may be threatened or damaged, leading to crisis for organizations.

*Physical property*. The crisis is perceived to center around loss to property, structures, or possessions. Other threats may be directly associated, but the physical threat becomes the defining edge.

*Organizational structure*. Forced changes in organizational structure, such as reorganization, size reduction, merger, or change in ownership can create organizational crisis.

*Economics*. The crisis may be most directly associated with monetary matters. For example, an organization may experience an abrupt loss of funding, or it may have insufficient cash flow to meet creditors' demands.

*Competition*. Other competing organizations may pose a competitive threat to the organization sufficient to cause

crisis conditions. For example, a competitor may suddenly enter a market previously occupied only by the subject organization.

*Supply*. Needed material, energy, or social resources may become quickly restricted and cause crisis.

*Regulation and Law*. Some crises occur most directly as issues of social and organizational control. A change in administrative rule or in statute, either proposed or actual, may stimulate crisis for organizations whose operations are or would be severely curtailed.

*Morale*. Threats to emotional commitment, sense of well-being, support, loyalty, job satisfaction, and other such affective variables may be direct spearhead of crisis.

*Ideology*. Crisis can be associated with ideological conflict. One organization may attack the ideology of another. Or, organizational members alone may abruptly recognize ideological contradiction within their own organization.

*Communication*. Sometimes threats are directly made to communication processes. For example, an organization may suddenly find itself restricted in its ability to communicate internally or externally.

*Image*. Imminent or actual image alterations that have a negative impact on public opinion about the organization can cause crisis. These are most directly "public relations" crises. For example, Proctor & Gamble suffered such a crisis when religious community members spread rumors that the corporate logo was designed to convey a Satanic message.

#### TYPE OF RESPONSE

Organizations' attempts to address a crisis situation may vary on a number of factors: (1) how internal or external the target of action is, (2) how directly or indirectly the action is targeted, (3) the degree of correspondence in kind between the nature of the threat and the response, (4) the intensity of response, (5) the response duration, (6) persistence in the face of obstacles, and (7) effectiveness.

### FACTORS AFFECTING ORGANIZATIONAL RESPONSE

Given that the organization perceives a threat sufficient to trigger a crisis state, different variables mediate its response. Detailed treatment is beyond the scope of this article, but some of the major classes of variables may be: (1) organizational size, (2) economic structure, (3) authority structure, (4) communication structure, (5) technological structure, (6) membership structure, and (7) organizational culture. These classes of variables may alter the content, speed, and direction of response to a crisis.

### COMMUNICATION IN CRISIS

Our primary concern here, however, is not with the aspects of response so far discussed. Rather, we are most interested in the immediate impact of crisis on the structure of organizational communication. For theory building purposes, we assume that the changes in communication patterns are largely independent of the type of crisis and type of organization. This would lead to more parsimonious theory. Parsimony would be further enhanced if such communication processes were cross-level in nature, pertaining not only to the organizational level but to others. Starting with the most parsimonious theory first is generally a good theory-construction strategy. Subsequent evidence reveals whether one needs to reject the more parsimonious explanation and add qualifications to it.

Schramm (1971) offers concepts originally posed in the context of mass crisis due to political assassination that have value in this regard. In the first stage of crisis communication response, individuals become aware of the possibility of crisis by recognizing a warning sign or signal (Perry and Mushkatel, 1984). If crisis is perceived to be sufficiently likely, then a confirmation stage occurs. Additional information is sought to determine whether a crisis is imminent or actual. In this confirmation stage, individuals increase their amount of communication with others. Typically,

contact is made with diverse individuals with whom they normally do not communicate (Schramm, 1971). If sufficiently credible supportive information is found, then a crisis belief develops (Perry and Mushkatel, 1984).

After confirmation, if it is perceived that some behavior can mitigate the crisis for self or others, these actions are taken. The next major communication stage, however, is the interpretation stage. Individuals turn to established sources for their views of the meaning and significance of events and their effects. These are interpreted with respect to knowledge, norms, and values. Through this process meaning is given to aspects of the crisis. The final stage is reintegration, in which there is a return to normal communication patterns.

### METHODS

The organization studied was a Midwestern state extension agency. As do most such organizations, this one had offices in each county of the state and central offices on a large public university campus. The organization maintained an electronic mail system for use by all personnel. It contained both private messaging and "broadcast" software. These communication services were part of the more extensive computer system developed mainly to provide county offices with software to aid decision making by residents. Numerous programs for agricultural management and consumer services were maintained.

### THE OCTOBER CRISIS

In October 1981 it was announced that the organization would merge with another organization and would have changes in its funding and operational aspects. A freeze started on all hiring and spending. A letter-writing campaign got underway to protest a budget cut from the state. Much discussion occurred (outside electronic mail) about

reallocation of resources and position reallocation from retiring faculty.

Observers noted that the organization was experiencing a significant crisis. Given the theoretical information about crisis, this particular one could be categorized as human-made, intentional, economic, and organizational. Nevertheless, our theoretical premise is that regardless of the type of crisis and organization, a particular kind of communication response occurs. The quantitative information presented in the results section shows a response pattern. Whether this pattern is generalizable cannot be addressed within this research design, but this research can point the way toward future research that can determine whether cross-level crisis response patterns do in fact occur, and what the specific contour of response is.

#### DATA COLLECTION

The research team captured the full content of all messages exchanged on this system from May 1981 to April 1982 (except for January, for which data were lost). Only the private messages, numbering 2592, were analyzed. Excluded were the "broadcasts," memo-like messages sent from one to many users. This was because our interest was in the more informal, emergent, dyadic-level interactions, and not in the formal, administrative communication represented by general-audience messages.

Users were not aware that their messages were captured. This creates ethical problems, so care was taken to insure confidentiality of data at the individual level. User numbers rather than names were used in the network analysis, to preserve anonymity. Furthermore, the researchers did not examine actual message content in raw form. Computer software performed word frequency counts across all messages for each month. Only the aggregated frequency lists were observed by the researchers. These steps protected user privacy.

The total user pool numbered approximately 300 during the time of the study. (Users come and go in the short-term,

and in no single month did the number of users reach the total pool level.) The actual number of communicators per month appears in Figure 1.

For each month, a network analysis of who sends messages to whom was performed using the NEGOPY (Rice and Richards, 1981) computer program. Parameter settings were at the default levels for all group detection and other algorithmic functions. The following variables were extracted from the network analysis results and plotted on a monthly basis: number of users, number of links (messages), the degree of interlocking among each user's contacts (triangles metric), percentage of reciprocity among pairs of users, and the number of group members identified.

Message content analysis was performed at the word level of analysis. Messages for each month were input to Oasis WORDFREQ software running on a personal computer. This program returns the number of times each word occurs. Word frequencies were made relative, by computing the number of occurrences per 1000 words.

## RESULTS

Figures 1 to 3 show monthly structural changes across the one-year time frame. One month—October 1981—showed significant changes (using Chi-square tests) compared to adjacent months. The shifts included the following features:

*Amount of communication increased.* Figure 1 shows the 340% increase in number of messages exchanged for October compared to September ( $p < .001$ ). Across the time series, except for the October spike, there was a linear increase in the number of messages.

*Number of communicators increased.* Figure 1 also reveals a similar October spike for the number of users on the system. There was more than a 240% increase, from 84 users in September to 205 in October ( $p < .001$ ). Again,

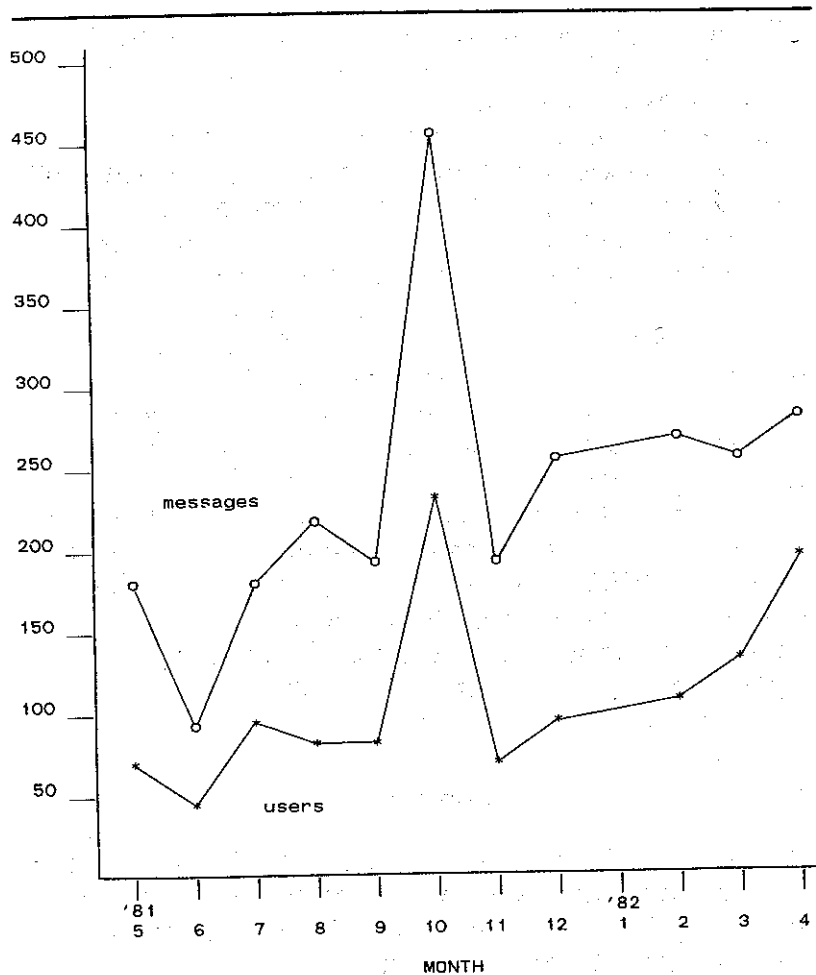


Figure 1: Number of Users and Messages per Month

other than for the October spike, there was nearly a linear increase in the number of users over the larger time series.

**Messages became shorter.** Across the series, there were on average 25,493 words per month. (Of these, 12% were unique words, and 46% of these appeared only once per month. On average, a word appeared 5.5 times.) October had 27,671 words. This was close to the numbers for the adjacent months of September with 26,878 words and of

November with 21,856. October was not significantly different from the average of the words in the adjacent months. With the significant increases observed in the number of messages in October, this meant that the average message was shorter. At the word level of analysis, then, there was "conservation of information." It was at the message level that the changes occurred.

**Individual-level networks became less interlocking.** Figure 2 shows the time series for the "triangles" metric of individual networks (Richards, 1974). This index accounts for the degree of interlocking among a node's contactees. Represented is the extent to which the persons with whom a focal person communicates also communicate with one another. The triangles metric is a relative measure of the number of complete triangles (A links B, B links C, A links C) among sets of nodes, controlling for the number of complete triangles expected by chance. Results show that individual networks became somewhat less interlocking ( $p < .10$ ). In other words, individuals developed more radial networks. They communicated more with individuals who did not themselves communicate.

**The macro-level network became more grouped.** Figure 3 shows a large spike occurred in October for the number of group members. In September, there were no groups, but in October a single large group with 85 members emerged. In the following month there were two groups but their combined membership totaled only 32. This was followed in December by a single group of 37 members. Then, there were no groups. At the next time point a single group of 52 members emerged, followed by no groups at the next time point.

**Structural changes returned to a baseline without oscillation.** The data for amount of communication, number of communicators, network interlocking, and to some extent number of group members, showed that the structural variables returned to a baseline after October. An oscillation pattern, that is a dampening swing above and below the baseline, did not occur. The structure apparently "snapped back" into its normal long-term fluctuation pattern. This is

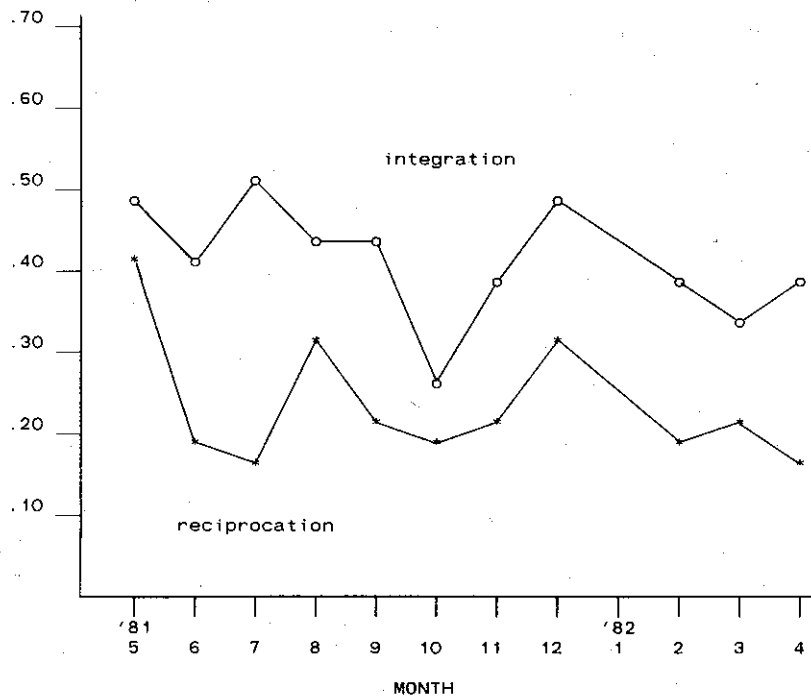


Figure 2: Reciprocation and Individual Network Interlock per Month

similar to what happens when a heavily damped spring is moved. Consider a car spring with a strong shock absorber. Upon hitting a bump, the spring quickly returns to its original position without much oscillation. Interestingly, such a pattern of over-time change has been identified for cognitive structures in response to messages from the environment (Woelfel and Fink, 1980). The current findings suggest that similar kinds of patterns may occur with organizational communication structures in response to information surges.

#### RIVAL EXPLANATIONS

The data show that the communication structure changed in October. This change was consistent with our separate knowledge that a crisis had occurred for the organization at

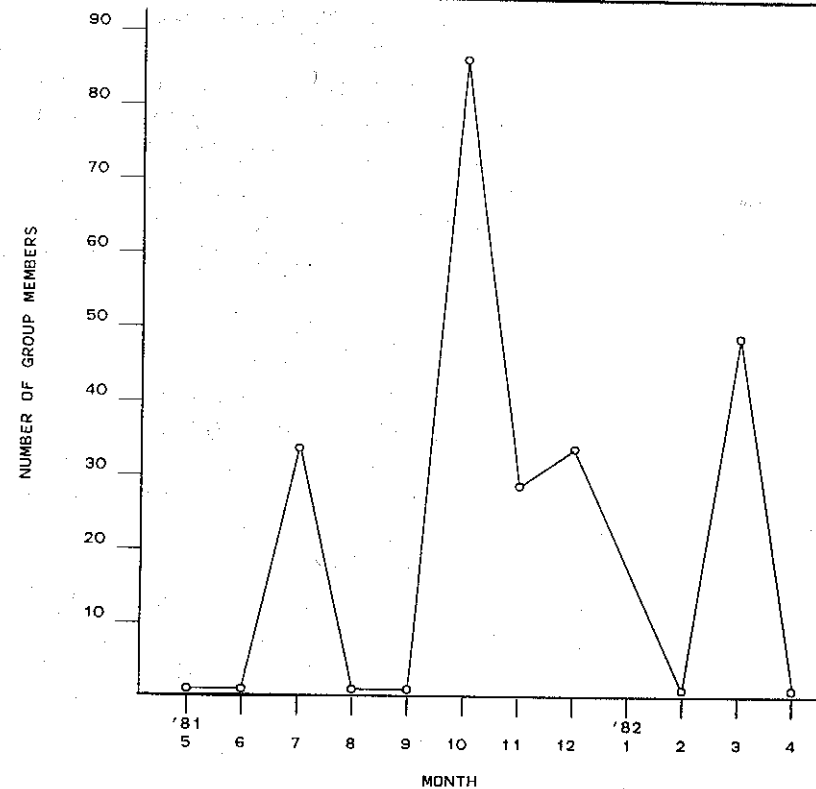


Figure 3: Number of Group Members per Month

that time. Many observers would be satisfied that the crisis "caused" the changes in communication. Nevertheless, other explanations are possible. One rival explanation is seasonality. Because we have examined only one year of monthly data, we cannot rule out the rival explanation that there is normal seasonality in the organization, such that similar changes occur each October. It is not possible here, however, to test directly for this rival explanation, because data from only one year were available. Nevertheless, the message content could provide an indirect means of examining the validity of the crisis explanation. To the extent that what people talked about changed in ways



consistent with the explanation, we can be more confident in it.

Accordingly, results of the monthly word frequency counts were examined. Chi-square tests on the changes in relative word frequency from September to October were performed. Number of word occurrences per thousand words was the variable used. Root words were used to represent categories of similar words, such as plurals, case differences, misspellings, and so on.

This analysis showed that there were about 5 times as many words that increased in frequency as decreased. Of the 27 increasing words shown in Table 1, the 10 increasing the most were extension, federal, cooperative, increase, cost, function, decision, recommendation, give, and legislature. Decreasing words included agenda, concern, content, description, determine, file, and person.

Many of the increasing words are concerned with the organization itself, its funding, and its structure. This is consistent with the crisis explanation. Although this content analysis adds a sense of validity, it still does not, of course, definitively rule out the seasonality or other possible rival explanations.

## DISCUSSION

This naturalistic, quantitative case study has shown that the structure of an organization's computer-based communication response to a crisis is consistent with communication responses identified earlier for mass-level crisis. There was an increase in the number of people communicating. They sent more messages, but their messages were shorter. Other findings were based on network variables not examined in prior crisis research. Yet, these findings are not incompatible with the thrust of earlier findings. Organizational members communicated more with others who did not themselves communicate. In other words, the networks became more radical rather than interlocking. A

TABLE 1  
Word Occurrence Change for October

	RATIO	SEPT.	OCT.	NOV.
<b>INCREASING WORDS</b>				
cooperative	56.0	.7	33.6	.5
relevant	43.4	.7	15.2	.0
increase	38.5	1.1	23.1	.0
forced	38.0	.4	7.6	.0
decision	29.0	3.4	11.6	1.4
funds	24.0	2.2	48.0	1.8
federal	22.2	2.2	40.0	1.4
legislature	14.5	.7	8.7	.5
function	11.9	1.5	11.9	.5
finance	11.5	.7	6.9	.5
potential	10.3	.4	4.7	.5
various	9.7	.7	5.8	.5
recommendation	7.7	1.9	10.8	.9
explanation	7.2	.4	4.3	1.8
description	6.8	3.4	22.7	3.2
detail	6.5	.4	5.8	1.4
eliminate	5.5	.7	3.3	.5
directly	5.1	.4	3.3	.9
joint	4.9	.4	7.6	2.7
authorize	4.8	.4	3.2	.9
strong	4.7	2.6	6.1	.0
where	4.5	2.2	6.9	.9
consequence	4.2	.7	2.5	.5
never	4.2	.7	2.5	.5
extension	4.1	7.1	45.1	15.1
today	4.0	2.2	9.0	2.3
salary	3.8	1.5	7.6	.5
support	3.0	.7	7.2	4.1
further	2.8	1.5	5.4	2.3
because	2.7	1.9	6.1	2.7
purpose	2.6	1.9	4.7	1.8
statement	2.6	.4	4.7	3.2
separate	2.2	1.5	3.6	1.8
these	2.0	5.6	17.3	12.3
cost	1.9	6.0	15.2	9.6
give	1.5	2.6	10.1	10.5
different	.7	1.1	4.0	11.4
<b>DECREASING WORDS</b>				
content	-.1	4.1	.4	1.8
person	-.2	13.8	1.8	6.4
agenda	-.3	7.4	1.8	3.2
determine	-.3	6.7	1.4	1.8
file	-.3	9.3	2.9	14.2
concern	-.5	10.4	4.3	6.4

NOTE: Values for September, October, and November were the number of word occurrences per 1000 words. Words listed had a significant Chi-square test difference ( $p < .05$ ) in occurrence from September to October. Ratios were computed by dividing the October value by the average of the September and November values.

single large group of communicators, numbering 85, emerged. Subsequently, structural variables largely "bounced back" to their baseline without oscillation. This is consistent with the "reintegration" stage described in earlier research (Schramm, 1971). It also parallels a pattern of change observed for cognitive structure and messages from the environment (Woelfel and Fink, 1980). This suggests there may even be cross-level generality to the findings. A different theoretical implication of the findings is the "conservation of information" observed at the word level. If this finding is replicated in future studies, the theoretical links between "conservation of energy" and "conservation of information" should be explored.

A notable methodological aspect of this research was the content analysis of actual message texts, to examine whether observed network changes had any substantive linkage to a crisis that had occurred at about the time of the changes. Significant differences in word occurrences in the month of peak change and in the adjacent months added confidence to our crisis interpretation. Words increasing most appeared to be associated with the nature of the crisis that occurred.

Some obvious limitations of the study should be noted. Although the content analysis results argue against seasonality as an explanation for the other findings, it is still not conclusive evidence. Data from a number of years would be necessary to rule out seasonality fully. Another limitation is that although we have complete records of computer-based communication, we do not have information about other kinds of organizational communication. Hence, we have an incomplete view of communication in crisis. All we can safely describe is computer-based communication responses to the crisis. Although we suspect that similar patterns occurred across other modes of organizational communication, we have no evidence of it.

An additional limitation is the kind of content analysis performed. Words were the unit of analysis and were treated in an atomistic way, word-by-word. A relational

approach to content analysis would be more informative, examining sets of words in relation to one another. Multi-dimensional scaling has been used for this purpose (Danowski, 1982), although network analysis appears promising for large numbers of words and for operational consistency across the domains of: (1) who communicates with whom, and (2) what they communicate about. Such analysis requires further software development.

The case study method used in this research also has limitations. Generalizability is clearly low, but other methodological features balance this limitation. The computer-captured communication data provided a low-cost means of recording interactions within the medium over time. This enabled detailed quantitative analysis of communication responses to a crisis facing the organization. The researchers did not have to wait with bated breath for the unexpected to occur before they unleashed an intrusive data collection effort. Rather, they "found" evidence of the crisis while examining a set of data that had been unobtrusively gathered by computer software for a year. Because of the nature of these information-gathering techniques, useful views of the dynamics of organizational response to a crisis were recoverable. Without such techniques, one would be left with largely qualitative, anecdotal, and retrospective accounts of what had happened. As it was, the researchers were able to use the data to extend the research on organizational communication in crisis. Future research should expand use of the enhanced data gathering tools that computer-based and monitored communication systems offer.

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